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काशी हिन्दू विश्वविद्यालय Banaras Hindu University
शताब्दी वर्ष 2015 - 2016 Centenary Year

International Conference
on
Recent Advances in Food Processing and Biotechnology

APRIL 05-06, 2016

Organized by :

Centre of Food Science and Technology
Institute of Agricultural Sciences
Banaras Hindu University, Varanasi, India

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SASNET (FF) | International College of Nutrition

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Department of Science and Technology (DST)

Pandit Madan Mohan Malaviya

Founder of Banaras Hindu University

Message

"Nothing great can be achieved without collective efforts of a group of people. People work in harmony only when they have sense of mutual trust. The mutual trust infests when every single individual follows the footsteps of the truth"

"It is earnest hope and prayer that this centre of life and light which is coming into existence, will produce students who will not only be intellectually equal to the best of their fellow students in other parts of the world, but will also live a noble life, love their country and be loyal to the supreme ruler"

कुल-गीत

मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।
यह तीनों लोकों से न्यारी काशी।
सुज्ञान धर्म और सत्यराशी।।
बसी है गङ्गा के रम्य तट पर, यह सर्वविद्या की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

नये नहीं हैं ये ईंट पत्थर।
है विश्वकर्मा का कार्य सुन्दर।।
रचे हैं विद्या के भव्य मन्दिर, यह सर्वसृष्टि की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

यहाँ की है यह पवित्र शिक्षा।
कि सत्य पहले फिर आत्म-रक्षा।।
बिके हरिश्चन्द्र थे यहीं पर, यह सत्यशिक्षा की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

वह वेद ईश्वर की सत्यवाणी।
बनें जिन्हें पढ़ के ब्रह्मज्ञानी।।
थे व्यास जी ने रचे यहीं पर, यह ब्रह्म-विद्या की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

वह मुक्तिपद को दिलाने वाले।
सुधर्म पथ पर चलाने वाले।।
यहीं फले-फूले बुद्ध शंकर, यह राज-ऋषियों की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

सुरम्य धाराएँ वरूणा अस्सी।
नहायें जिनमें कबीर तुलसी।।
भला हो कविता का क्यों न आकर, यह वाग्विद्या की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

विविध कला अर्थशास्त्र गायन।
गणित खनिज औषधि रसायन।।
प्रतीचि-प्राची का मेल सुन्दर, यह विश्वविद्या की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

यह मालवीय जी की देशभक्ति।
यह उनका साहस यह उनकी शक्ति।।
प्रकट हुई है नवीन होकर, यह कर्मवीरों की राजधानी।
मधुर मनोहर अतीव सुन्दर, यह सर्वविद्या की राजधानी।।

(डा0 शान्ति स्वरूप भटनागर द्वारा रचित)

शमीमा सिद्दिकी
SHAMIMA SIDDIQUI
भारत के राष्ट्रपति की उप प्रेस सचिव
Deputy Press Secretary
to the President of India

सत्यमेव जयते

राष्ट्रपति सचिवालय,
राष्ट्रपति भवन,
नई दिल्ली-110004
PRESIDENT'S SECRETARIAT
RASHTRAPATI BHAVAN,
NEW DELHI-110004

Message

The President of India, Shri Pranab Mukherjee, is happy to know that the Centre of Food Science and Technology, Institute of Agricultural Science, Banaras Hindu University, Varanasi is organising an International Conference on "Recent Advances in Food Processing and Biotechnology" on April 5-6, 2016.

The President extends his warm greetings and felicitations to the organisers and participants and sends his best wishes for the success of the Conference.

(Deputy Press Secretary to the President)

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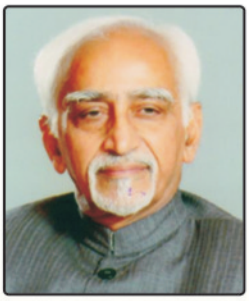

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भारत के उप-राष्ट्रपति के विशेष कार्य अधिकारी
OFFICER ON SPECIAL DUTY
TO THE VICE-PRESIDENT OF INDIA
नई दिल्ली/NEW DELHI-110011
TEL.: 23016422/23016344 FAX : 23012645

Message

The Hob'ble Vice President of India is happy to learn that Centre of Food Science and Technology, Institute of Agricultural Science. Banaras Hindu University, Varanasi is organizing an International Conference on 'Recent Advances in Food Processing and Biotechnology' on April 5 - 6, 2016.

The Vice President extends his greetings and congratulation to the organizers and the participants and wishes the event all success.

New Delhi
9th February, 2016.

(Anshuman Gaur)

सत्यमेव जयते

प्रधान मंत्री
Prime Minister

Message

I am happy to learn that the Centre of Food Science and Technology, Institute of Agricultural Sciences, Banaras Hindu University, is organizing an International Conference on 'Recent Advances in Food Processing and Biotechnology' on April 5th and 6th, 2016.

The development of the Food Processing and Biotechnology sectors in India, is vital to ensure our continued food security, and to fulfil our vision to enhance the income of our farmers. I hope this conference shall be able to suggest a roadmap for the future development of these sectors.

On this occasion, I extend my best wishes for the success of the conference.

(Narendra Modi)

New Delhi
15 March, 2016

राधा मोहन सिंह
Radha Mohan Singh

सत्यमेव जयते

कृषि मंत्री
भारत सरकार
MINISTER OF AGRICULTURE
GOVERNMENT OF INDIA

Message

I am happy to know that the Institute of Agricultural Sciences, Banaras Hindu University, is going to organize an International Conference on "Recent Advances in Food Processing and Biotechnology" during 5 - 6 April, 2016 to celebrate the Centenary year of Banaras Hindu University.

India is attaining position of global player for marketing and supply of processed foods, feed and wide range of other plant and animal products. Processing of agro-produce is regareded as 'Sunrise Sector'. We are among the largest producers of milk, wheat, rice, fruits and vegetables. Therefore, the theme of the International Conference on "Recent Advances in the Food Processing and Biotechnology" is very relevant. Food processing technology can be fruitfully utilized for tackling the problems of malnutrition and hunger in the country. Food processing is an excellent tool for value addition which will in turn boost agricultural produce in India. It is also instrumental in enhancing the income of the producers as well as in reducing wastages and losses.

I hope this Conference would provide an opportunity to delegates to exchange new ideas of their research on nutritional and medicinal aspects of processed foods.

I wish this Conference a grand success.

Radha Mohan Singh

(Radha Mohan Singh)

Office : Room No. 120, Krishi Bhawan, New Delhi - 110 001 Tel.: 23383370, 23782691 Fax : 23384129

डॉ. हर्ष वर्धन
Dr. Harsh Vardhan

सत्यमेव जयते

मंत्री
विज्ञान और प्रौद्योगिकी एवं पृथ्वी विज्ञान
भारत सरकार
नई दिल्ली-110001
MINISTER
SCIENCE & TECHNOLOGY AND EARTH SCIENCES
GOVERNMENT OF INDIA
NEW DELHI - 110001

Message

I am very glad to know that Centre of Food Science and Technology, Institute of Agricultural Sciences is organizing International Conference on "Recent Advances in Food Processing and Biothechnology" during 5-6 April, 2016 at Banaras Hindu University, Varanasi.

Centre of Food Science and Technology contributes to achieve academic excellence, valuable human resource and R & D for driving economic growth through food processing. It is a good platform for discussing all related issues regarding the Food Processing and Biotechnology.

I convey my best wishes to Centre of Food Science and Technology on this occasion and wish for its successful completion.

(Dr. Harsh Vardhan)

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हरसिमरत कौर बादल
Harsimrat Kaur Badal

खाद्य प्रसंस्करण उद्योग मंत्री
भारत सरकार
Minister of Food Processing Industries
Government of India

सत्यमेव जयते

Message

The Centre of Food Science and Technology, Institute of Agricultural Sciences, Banaras Hindu University (BHU), Varanasi is conducting an International Conferences on the "Recent Advances in Food Processing and Biotechnology" on the April 5-6, 2016. It is heartening that this conference is being organized as a part of centenary year celebrations of the prestigious BHU.

Food processing industry is the bridge which links Agriculture to the Manufacturing sector. This sector also provides huge direct and indirect employment opportunities. With changing needs, eating preferences and rapid urbanization, the demand for packaged, processed, ready-to-eat, and instant foods is on the rise globally as well as in our country. Hence, we need to focus on increasing production and reducing wastage by evolving new and innovative methods. Tremendous improvements in technology, equipment, infrastructure and increase in the number of upcoming food processing industries in India over the past couple of year are highly commendable.

Biotechnological advancements with regard to food are a major contributor to the enhancement of crops yield & its quality, production of several enzymes, microbial strains and ingredients. A need exists to explore the latest technology and advances to reach further heights. Biotechnology hold the key in this direction.

This conferences is an ideal platform for delegates, researchers, academicians, and most importantly students all around the world, to share their views and exchange ideas for the benefit of the world.

I hope that the conference provides new insights into improving use of technology in food processing which would go a long way in addressing issues of relevance and satisfying the expectations of the society at large. I wish the conference all success.

Harsimrat

(Harsimrat Kaur Badal)

Place: New Delhi

Dated: 23rd March, 2016

Office : Panchsheel Bhawan, August Kranti Marg, New Delhi-110049
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DR. KARAN SINGH
MEMBER OF PARLIAMENT
(RAJYA SABHA)
CHAIRMAN
COMMITTEE ON ETHICS

सत्यमेव जयते

Office:
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New Delhi - 110001
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Message

Despite our growing production of food and horticultural products, our food processing and packaging status is still far from satisfactory, as a result of which a lot of food, vegetables Sciences, BHU is organising an international conference on recent advances in food processing and bio-technology, also coinciding with the centenary celebrations of this great university founded by the late Mahamana Pandit Madan Mohan Malaviya.

As Chancellor of the University, as well as a fruit grower myself, I send the organisers and the participants my warm greetings for the success of this conference. I hope it will result in concrete suggestions for improvement in this important area of agrecultural production.

Karan Singh

(Karan Singh)

Residence : 3, Nyaya Marg, Chanakyapuri, New Delhi-110021
Tel.: 2611-1744, 2611-5291 Fax : 2687-3171 E-mail : karansingh@karansingh.com
Website : http://rajyasabha.nic.in - http://rajyasabhahindi.nic.in

काशी हिन्दू विश्वविद्यालय
BANARAS HINDU UNIVERSITY
An Institution of National, Importance, established by on Act of Parliament

प्रो० गिरीश चन्द्र त्रिपाठी
कुलपति
Prof. Girish Chandra Tripathi
Vice-Chancellor

VARANASI-221005 (INDIA)
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E-mail : vc@bhu.ac.in
website : www.bhu.ac.in

March 28, 2016

Message

It is a great pleasure to know that Centre of Food Science and Technology, Institute of Agricultural Sciences is organizing an International Conference on "Recent Advances in Food Processing and Biotechnology" on 5th - 6th April, 2016.

Food processing sector is highly fragmented industry, which is making use of various unit operation and technologies to convert perishable and typically inedible raw material into more useful shelf stable and palatable foods and beverages.

Biotechnology in food processing sector makes use of microbial cultures for use in food application include organism for preservation of food and for the production of range of value added products such as enzymes, flavor, vitamin, microbial cultures and food ingredients.

Biotechnology application in food processing sector, therefore target the selection and manipulation of microorganism with the objective of improving process control, product quality, safely, consistency, and yield, which is increasing process efficiency and their implementation for betterment of human life.

I hope that this conference will highlight the recent developments in area of food processing and shed light on the future course that the research in the field has to follow.

I, on behalf of Banaras Hindu University, extend a hearty welcome to the participants of the Conference and wish the organizers all the success.

(Girish Chandra Tripathi)

Dr. D. S. Rathore
Founder Director

WISDOM International

- **Chairman,** Biotechnological Programme Promotion Committee, Department of Biotechnology, Govt. of India, New Delhi
- **Member,** Executive Council, Banaras Hindu University
- **Member,** Executive Council, Central University of Himanchal Pradesh
- **Member,** Academic Council, Central University Punjab
- **Former Vice Chancellor,** Himanchal Pradesh Krishi Vishwavidyalaya, Palampur
- **Former :** Dean, College of Horticulture & Forestry, CAU, Pasight
- **Former Assistant Director General (Horticulture),** ICAR, New Delhi
- **Former Director,** Department of Horticulture and Food Processing UP (Hills)

Message

21.03.2016

India is going to attain a good position of global player soon for marketing and supply of processed food, feed and wide range of other plant and animal products. Processing of agro-produce is regarded as 'sunrise sector'. Our country is the largest producer of milk, wheat and rice. We are second in production of fruits and vegetables with more than ten per cent at world share. This International Conference on "Recent Advances in Food Processing and Biotechnology" during April 5-6, 2016 to celebrate the centenary year of BHU is a need of the day.

I feel that technologies of Food Processing and Biotechnology can be fruitfully utilized for tackling the problems of malnutrition and hunger in the country. This is one of the excellent methods of value addition to our agro-food which will boost processing of agricultural produce in India.

At present, only about five per cent of agricultural produce is processed in the country whereas seventy per cent or more is processed in other countries. Processing is an important method of value addition which is necessary to be adopted in order to increase the income of the producers (farmers) as well as to reduce the wastage of the produce. The International Conference would provide an opportunity to delegates, students, researcher and industrialist to exchange new ideas of their research on nutritional and medicinal value of processed foods inclining the biotechnology.

I wish this International Conference a grand success.

(D. S. Rathore)

DSM
BRIGHT SCIENCE.BRIGHTER LIVING

DSM Food Specialities
No. 476, Li Bing Road, Zhangjiang Hi-Tech Park
201203 Pudong New area, Shanghai
China

Gregory A Kesel
Regional President, Asia Pacific

17th March, 2016

Message

It is great pleasure to note that a International Conference is being conducted by the Centre of Food Science and Technology, Institute of Agricultural Science, BHU on 5th and 6th April, 2016 with the theme of "Recent Advances in Food Processing and Bio-technology".

At DSM Food Specialities, we Enable Better Food for Everyone. By applying our science-based creativity, consumer and customer insights and unique abilities in fermentation and biotechnology, we unlock value for our customer. At DSM Food Specialities we want to help make existing diets healthier and more sustainable. We are driven to help create foods that people around the world can truly enjoy without compromises. Better food should be affordable and accessible to more people - today and in the future. We apply over 100 years' expertise in fermentation to the food is our focus and we have more to offer than any of our peers. Everywhere - every day we work to enable our customers to respond faster with better food - for everyone.

Therefore, I am thankful to the Organizers of this Seminar and the participants of the Indian food processing industries. I hope the deliberations during the two day conference will bring commendable results. I wish this program a grand success.

Gregory A Kesel

(Gregory A Kesel)

DSM
BRIGHT SCIENCE.BRIGHTER LIVING

DSM Food Specialties BV
Alexander Fleminglaan 1, PO Box 1
2600 MA Delft, Netherlands

S.K. BATRA
India Business Advisor

19th March, 2016

Message

Sub: International Conference on Recent Advances in Food Processing and Bio-technology.

Greetings from DSM Food Specialties®

It gives me immense pleasure that a two days International Conference is going to be organized by the Centre of Food Science and Technology, Institute of Agricultural Sciences, BHU on 5th and 6th April, 2016 with the theme of "Recent Advances in Food Processing and Bio-technology".

Every day, scientists across the globe strive to provide answers to global challenges such as hunger, disease and climate change etc. They make huge personal sacrifices to develop real solutions to the world's most important challenges.

Their passion inspire us because it resonates with our mission: Using bright science to create brighter living and what sets us apart.

We believe that the Scientists who are doing their utmost to create impactful solutions are the unsung heroes of our time and we honor them with full dignity. At the same time, we should have conversation with the general public, opinion leaders, governments, business, industries and other stakeholders about the importance of science with a societal purpose.

Advances in Food Processing through Bio-technology have a high acceptability among the diversified food habits of Indian Culture. Food Processing signify a modification of food ensuring functional benefits with its probiotic effect. In this era of increasing processed food market, fermented food like Lactose Free Milk can be the target area to flourish and thereby Indian traditional product can reach every corner of the world through DSM.

Therefore, I am thankful to the Organizers of this Conference who have invited DSM Food Specialties on such important topic and Indian Food Processing Industries will have a fruitful outcome in the near future through investment and technology.

I hope the deliberations during the Two Day Conference will bring commendable results. I wish this program a grand success to the Industries.

S.K. Batra

HEALTH * NUTRITION * MATERIAL

India Office Address: DSM Food Specialties USA Inc., 29 Kailash Enclave, Second Floor, Pitampura, Delhi -110034
Tel. + 91 11 27034200 & + 91 11 42670207 & Cell No.+ 91 9871291110

Dr. K.P. Upadhyay
Registrar

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BANARAS HINDU UNIVERSITY
AN INSTITUTION OF NATIONAL IMPORTANCE, ESTABLISHED BY AN ACT OF PARLIAMENT

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February 8, 2016

Message

It gives me immense pleasure to note that Centre of Food Science and Technology, Banaras Hindu University is going to organize International Conference on 'Recent Advances in Food Processing and Biotechnology' as a part of Centennial Celebration of the University on April 5-6, 2016.

Food processing helps in toxin removal, preservation, easing marketing, distribution task and increasing food consistency. It also increases yearly availability of many foods, enables transportation of delicate perishable foods across long distances and makes many kinds of foods safe to eat. The Conference will certainly discuss critically the benefits and drawbacks of food processing and I am sure that the deliberations will go a long way in alleviating food shortages and improving overall food nutrition.

I congratulate members of the Organizing Committee and extend all good wishes for success of the Conference.

(K. P. UPADHYAY)

BHU
capital of knowledge

Residence: Old F-10, Hyderabad Colony, BHU, Varanasi - 221005
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काशी हिन्दू विश्वविद्यालय

BANARAS HINDU UNIVERSITY

AN INSTITUTION OF NATIONAL, IMPORTANCE, ESTABLISHED BY AN ACT OF PARLIAMENT

Abhay Kumar Thakur, IRS
Finance Officer

February 17, 2016

Message

I have great pleasure to learn that Centre of Food Science and Technology (CFST), Institute of Agricultural Sciences, Banaras Hindu University is organizing International Conference on April 5 - 6, 2016 on the topic "Recent Advances in Food Processing and Biotechnology".

I am very glad that CFST is working continuously on various challenges in achieving global health. The themes of the conference are very relevant for the contemporary world.

I am sure that this International Conference will deliberate on latest developments in the field of food processing. It shall also provide an opportunity to the participants to communicate with the eminent speakers participating from all over the world. This conference will also help in developing co-ordinations between agricultural scientists, food technologists and other health professionals for the benefits of the society.

I express my sincere appreciation to all the organizers who are working day and night to make this conference a success and also thank and welcome all the delegates.

(Abhay Kumar Thakur)
Finance Office

BHU
capital of knowledge

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कृषि विज्ञान संस्थान
Institute of Agricultural Sciences

प्रो. रवि प्रताप सिंह
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काशी हिन्दू विश्वविद्यालय
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Message

I have learnt that Center of Food Science and Technology, Institute of Agricultural Sciences ,Banaras Hindu University is organizing a two days International Conference on "Recent Advance in Food Processing and Biotechnology" as a part of centenary year celebration of the BHU.

Having worked with faculty members of Food Science and Technology for research and development on Recent Advances on Food Processing, I realize the importance of this Centre in the development of the food sector locally as well globally. This Centre has not only increased the nutritional value of food product but also extended storage stability of many variety of raw food materials. Food processing also provide a viable means of extra income for farmer and their families and hence it give impetus to rural development towards their self dependency. Such development based on solid research to ensure safe and healthy food products through transfer of knowledge to interested producers and entrepreneurs. has great importance to provide plate form for the exchange of knowledge and interaction between Scientist and Industries.

I am sure that present International Conference will ensure the linkages between Scientist and entrepreneurs and will also help in the of development of food industry in India and abroad. The conference will also provide knowledge in the area of food processing and biotechnology to increase value of food product & their self life (specially through food processing) to over come huge post harvest losses to save drainages of foreign exchange of our country.

I Congratulate all the faculty members of Centre of Food Science and Technology for their great effort and day and night hardwork for successfully orgnizing this Interactional conference and I extend my best wishes for the success of the conference.

Ravi P. Singh

DIRECTOR

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Prof. A. Vaishampayan

Dean, I.Ag.Sc, BHU

February 15, 2016

Message

I feel so happy to note that the Centre of Food Science and Technology, Faculty of Agriculture, Banaras Hindu University is organizing an International Conference on "Recent Advances in Food Processing and Biotechnology". Evidently, the food processing industry is the oldest and largest industry that has been using the biotechnology depends upon the improvement of existing processes, such as fermentation, immobilized biocatalyst technology, and production of additives and processing aids, as well as the development of new opportunities for food biotechnology. Improvements are needed in the characterization, safety, and quality control of food materials, in processing methods, in waste conversion and utilization processes, and in currently used food microorganism and tissue culture systems. Also needed are fundamental studies of the structure-function relationship of food materials and of the cell physiology and biochemistry of raw materials, and certainly, it is the need of the time to have a platform for such an important global meet commensurate with the available expertise and facilities available at the Banaras Hindu University, blended with the world repute of this institute epitomizing ancient wisdom and modern scientific temper. I am sure of the fruitful recommendations of wider acceptability to churn out of this world meet and heartily wish for all success of the entire programme at the hands of Conference Secretariat.

Vaishampayan

(A. Vaishampayan)

Prof. S.P. Singh
Coordinator
Centre of Food Science & Technology
Institute of Agricultural Science
Banaras Hindu University

Message

Research and development efforts used to focus on finding was and means to produce adequate food for rapidly increasing world population. Science togetherwith technology has almost succeeded in addressing the problems of food Shortage. However, one very important point is always before the scientists andthat is the quantity of the produce which is equally important. To help in the elimination of malnutrition. Recent advantage in food processing have to develop functional foods and nutracuticals that provide an opportunity tc improve human health with lesser care costs and boost the economic development in rural sectors. In this scenario , is a matter of great pleasure to know that the center of food science and technology is organizing a two day International seminar on recent advance in food processing and biotechnology on April !i and 6, 2016 to ponder over the work done and give further innovative idea pertinent to the themes of the seminar. I believe that the deliberations and interactions during the seminar will facilitate formulation of effective strategies and techniques with regards to development of health promoting food and betterment of food industries.

I wish all success to the international seminar.

(S.P. Singh)

डॉ0 अनिल कुमार चौहान
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PREFACE

In recent years, food technology has been fast growing applied science sector. With rapid developments in food processing technologies a number of new food products with attractive functional attribute and extended self life have promoted the food industry to investigate several alternative food processing technologies.

Increase in consumer demand for safe, nutritious and minimally processed food has increased the demand for search for food processing technologies that can provide food with these characteristics. This lead to the genesis for the organization of this International Conference on "Recent Advances in Food Processing and Biotechnology" during April 5-6, 2016 to celebrate the centenary year of BHU by faculty members of Institute of Agricultural Sciences, BHU, which is known for harboring ancient wisdom of India and bringing in scientific temper.

The university has established a Centre of Food Science and Technology to cater such needs and hence, we took-up the challenge of organize this conference. At the same time Swedish South Asian Network on Fermented Food (SASNET-FF) and International College of Nutrition is marching ahead to achieve its goal connect food with health status and social well-being.

They came forward and collaborated in this conference with common objective of promoting processed food, functional foods and fermented food. The exchange of rich sources of processed foods that can present a golden opportunity for the expansion of the processed food market. However, it is a fact that development of scientifically sound, commercially viable and socially useful food product needs extension R&D starting from raw food material cultivation, harvesting, processing, storage, nutritional analysis, safety testing, clinical studies and marketing.

Hence, there is great need to work in cooperation and form consortia for more efficient and cost effective research and development in this sector. Organization of an International Conference of such stature is not possible without teamwork. In this mega event I am highly indebted to Banaras Hindu University and its Vice Chancellor Prof. G. C. Tripathi for hosting the International Conference at Centre of Food Science and Technology. Thanks to director Institute of Agricultural Sciences Prof. Ravi. Pratap. Singh, Dean Prof. A. Vaishampayan, Coordinator Prof. S. P. Singh for their valuable contribution, planning and organizing this conference.

Thanks are also to Dr. R. B. Singh former president of International College of Nutrition, Dr. Baboo Nair, Chairman of SASNET (FF), Prof. J. B. Prajapati, Coordinate of SASNET (FF) and Dr Meenakshi Singh, former director FSSAI and Senior Principal Scientist, CSIR, New Delhi, and S K Batra country head and Gregory Akesel, Regional President, Asia Pacific, DSM for good initiative and constant source of inspiration, technically and moral support. I acknowledge all those organizations like MFPI, ICAR, DBT, DST, NABARD, ICMR, DSM. Paras Dairy that they have extended their financially support for this conference. I also extended my compliment to the editorial board for bringing out this souvenir. I also thank all the faculty members and other staff and students of Centre of Food Science and Technology for their hard work and valuable contribution to organize this conference. I am grateful to all the renowned scientists resource persons, delegates and guests coming from all over the world in this conference at this temple of learning, BHU,Varanasi, India.

I am sure that deliberation of the International Conference will be highly fruitful and well set the research agenda for us for better research work in this area of Food Processing.

At last, I pray to almighty and bow my head before Bharat Ratna, great visionary and founder of this great university Pt. Madan Mohan Malaviya ji whose blessing are always with us for any constructive work.

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Anil Kumar Chauhan
Convener, ICRAFPB-2016

Dr. Abhishek Dutt Tripathi
Assistant Professor
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From the Desk of the Organizing Secretary

Food is basic need for survival of human being and it becomes vital once its availability is adequate to quench the hunger of world population. Food and Agricultural Organization current survey shows that every year millions of people die due to inadequate food and malnutrition. One of the measure reasons of inadequate food is postharvest losses which can be minimized by adopting modern food processing technology leading to value added diversified healthy food products. Although, processed food with enhanced functional and nutritional attributes are attracting consumers residing in developed countries, but the conditions are severe in developing countries like India. India is world's largest producer of food but in terms of processed food we stand far behind which requires sustained efforts to minimize the postharvest loss for building the nation's economy. Biotechnology is also a field which has gained enormous potential for sustainable development. Biotechnological intervention in food sector will led to development of processed food with improved texture, flavor and shelf life.

The growth of this industry will bring immense benefits to the economy, raising agricultural yields, enhancing productivity, creating employment and raising life-standards of a large number of people across the country, especially those in rural areas. The organization of such mega event will provide us an opportunity to assemble the learned delegates coming from different parts of the world including USA, UK, Australia, Nigeria, Iran, Thailand etc. at one place where they will dissipate their knowledge and experiences among the participants. This conference will create an opportunity for researchers, academicians to gain new ideas and understand the recent advances in food processing and biotechnology on global perspective.

Organization of such mega event is impossible without team work. In this event we are highly indebted to the Hon'ble Vice Chancellor Prof. G.C. Tripathi and other University authority especially Dr. K.P. Upadhyay, Registrar, BHU and Sh. Abhay Kumar Thakur, Finance Officer, BHU for their kind support and cooperation. We are really grateful to Prof. Ravi P. Singh, Director, institute of Agricultural Sciences, Prof. A.Vaishampayan, Esteemed Dean, Institute of Agricultural Sciences, Banaras Hindu University, Prof. S.P.Singh, Coordinator, Centre of Food Science and Technology and Prof. Anil Kumar Chauhan, Convener for their guidance, constant encouragement and kind cooperation to make this event successful. We are also grateful to our co-organizers SASNET and ICN for their support and cooperation. I Acknowledge all those government organization like MOFPI, ICAR, DST, DBT, NABARD, ICMR, INSA, for their financial assistance for organizing this international conference. The contribution of private industries specially DSM, Relaince food, PARAS Dairy, SCIL is praiseworthy who supported this event by providing financial assistance. The contribution other agencies and industries in bringing out this souvenir is also acknowledged. The entire team of organizing committee specially Dr. Arvind, Er. D.S. Bunkar, and other teaching and non teaching staff of Centre of Food Science & Technology deserves special thanks for bringing out this souvenir and successful organization of this conference. I also extend my heartiest welcome to all the delegates and guest coming from India and abroad for their memorable stay at Banarans Hindu University Varanasi a great sheet of learning founded by a great visionary, patriot and learnet Bhart Ratna Mahamana Pandit Madan Mohan Malviya Ji.

I pray almighty to bless us for making this International Conference a grand success.

ADTripathi

(Abhishek Dutt Tripathi)

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Most people say that is it is the intellect which makes a great Scientist.
They are wrong: it is Character.

Albert Einstein

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Keynote Abstract

Functional foods for health: Gut-brain axis and microbiota; food, environment and chronobiological interactions.

Buttar H[1], Singh RB[2], Griffiths K[3], Takahashi T[4], Wilson DW[5], Hristova K[6], Wilczynska A[7] and De Meester F[7].

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[2]Halberg Hospital and Research Institute, Civil Lines, Moradabad (UP), India;

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[5]Senior Honorary Fellow, School Medicine Pharmacy and Health, Durham University, UK;

[6]National Heart Hospital, Sofia, Bulgaria.

[7]The Tsim Tsoum Institute, Krakow Poland;

This is to further review and extend this group's work on gut-brain interactions mediated through gut microbiota. Literature review and collective expertise in epidemiology, phyto-oestrogens, flavonoids, omega-3 fatty acids, ROS, Q10, nutrition, gut microflora, colon cancer, cardiovascular diseases, gut-brain interactions, endocrine cancer, inflammatory cytokines, digesta flow and nutrient absorption, etc. This review focuses on functional foods (rather than 'Superfoods' often a misnomer), defined as natural or processed foods that contain known or unknown biologically-active compounds. The functional foods are effective, non-toxic, and provide a clinically proven and documented health benefits for the prevention, management, or treatment of chronic diseases. In the context of this review, viz, primary and secondary human metabolomes are derived from existing or transformed gut microflora. This review has different platforms. Commensal gut microflora, of which there are many species of anaerobes that may be manipulated by dietary intake and by monitoring blood glucose to produce an acceptable post-prandial response. This may potentially lead to reduction in obesity, risk of pre-metabolic syndrome, type 2 diabetes and cardiovascular diseases. Future studies may involve 16S ribosomal RNA sequence analysis to identify the diversity of bacterial genera, e.g., Actinobacteria, Bacteroidetes and Firmicutes combined with solid phase microextraction-gas chromatography-mass spectroscopy of faecal specimens for quantification of short chain fatty acids such as acetic, butyric and proprionic acids, thus providing an epidemiological dimension to health and disease. Isoflavonoids like genistein and diadzin and their methylated derivatives-bichanin A and formononetin are metabolised by gut microflora to genistein and daidzein. Short-term dietary intervention studies using plant- or animal-based, and other selected diets may lead to beneficial changes in cancer, cardiovascular-related or other chronic diseases. The gastrointestinal tract (GIT) is also under the influence of the environment through light, specifically through bidirectional interaction of neural and humoral pathways between the suprachiasmatic nucleus and sets of GIT clock genes. These issues, including the roles of the hypothalamus and liver, will be reviewed and presented to enable further research.

Keynote Abstract

Utility And Necessity of Genetically Modified Foods for Health Promotionand Disease Prevention

R. B. Singh and Anil Kumar Chauhan
International College of Nutrition Expert Group.
Email: rbs@tsimtsoum.net

Plant breeding and genetic modifications are latest technologies for developing diversity in foods by altering nutrient content of foods, to solve the problem of functional food security.Green revolution had contributed greatly to staple plant food productivity but without consideration on micronutrient.In certain specific cases, the improvement in the quality and nutrition of foods by altering their composition were also monitored. Agriculture played a vital role during the era of green revolution initiated by Norman Borlaug, the "Father of the Green Revolution" who saved over a billion people from starvation and developed high-yielding varieties of cereal grains. However, these food varieties were deficient in micronutrients which are known for health promotion and disease prevention.Therefore, the practice of biotechnology has also upraised concerns about its potentialrisks to the environment as well as human being resulting in to emergence of non-communicable (NCDs) due to increased availability of energy rich, rapidly absorbed foods. Now at this point of time, agriculture can again play a vital role by developing food varieties high in micronutrients, macronutrients, organic acids, trace mineral, antioxidants, flavonoids and vitamins leading to functional food security, health promotion along with disease prevention. The fruits and vegetables which are consumed raw can be subjected for the improvement of micronutrients through imparting new technologies of plant breeding and genetic engineering. A number of genetically engineered variety of foods havebeen developed, which have become important nutraceuticals; most notably canola, cotton, maize and soybean, were developed employing this modern technology, and at present the traits introduced are herbicide and/or pest tolerance. Gene transfer technology is employed to alter the physical and chemical composition with nutraceutical worth such as golden rice rich in carotene, American corn rich in flavonoids but it also has more sugar and is rapidly absorbed hence needs modification. This technology leads to increase the production in the species, as well as the elevation of resistance to pests, viruses, frost, etc.In brief, gene modification can be used to increase protective nutrients; omega-3 fatty acids, monounsaturated fatty acids, flavonoids, amino acids, vitamins and antioxidants and soluble fiber and decrease harmful nutrient contents; saturated fat, linoleic acid, sugar and erucic acid in a food by these two methods. In future, attempt should be made urgently, to develop omega-3 fatty acid, amino acids and flavonoid rich slowly absorbed foods to provide functional food security, for control of under-nutrition so that there is no increase in obesity which is important for prevention of CVDs and other chronic diseases.In brief, multiple forms ofmalnutrition can coexist within the same country, household and individual. Functional food security with genetically modified foods appears to be important, if it ismore sustainable and moresupportive of good nutritional outcomes related to disease prevention.

Invited Papers

International Conference on Recent Advances in Food Processing and Biotechnology - Centre of Food Science and Technology, I. Ag. Sc., BHU, Varanasi - April 5-6, 2016

IAS - BHU

Research on Development products from Hibiscus sabdariffa Extract for NCDs Treatment

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Keywords : Hibiscus sabdariffa, Roselle, antihypertension, antidiabetic and antihyperlipidemia, NCDs

Objective : Hibiscus sabdariffa or Roselle has long been used by Thai traditional medicine for reduce blood pressure and as diuretic drug . Roselle tea is also used as diuretic drug in National Drug list of Thailand nowadays. The objective of this research were to investigate for product development from Roselle extract to be drug and health food for treatment and prevention of Non-communication Diseases (NCDs) such as hypertension, diabetic, hyperlipidemia and cancer.

Method : The pattern of this research was the same study for drug discovery process. We studies on 3 parts The first part , we studies on the best cultivar which showed the highest antioxidant activity and higher yield production. The second part were studied the extraction methods which showed the highest activities by using different in vitro assay which related with health such as, four assay of antioxidant, antimicrobial, cytotoxic activities against many types of cancer cells. The pharmacological studies were also conducted by using animal model such as, antihypertension, antidiabetic, antihyperlipidemia, antiinflammation and antipyretic activities. Chronic toxicity and development of the Roselle tablets were also studied. The last part, the clinical trial phase 1 and phase 2 were conducted in hypertension , diabetic, and hyperlipidemia patients.

Results : Roselle calyx (fresh and dry form) were extracted by different extraction method. Boiling in water and spray dry was the method which make Roselle have high antioxidant, antihypertension, antidiabetic and cytotoxic activities against specific only prostate and liver cancer cells. The isolated pure compounds such as cyanidine 3-glucoside , quercetin and gallic acid were isolated by bioassay guided fractionation method. They were used to be marker for quality control of Roselle extracts of each activity. The stability of its extracts on 45C, 75%RH were tested for setting expired date of the extracts. The Roselle extract are stable more than 2 years because antioxidant activity and total phenolic content did not change when compared with day 0. The Roselle tablet for oral anti-hypertention drug were developed. The Roselle extract can increased glucose uptake in adipose cell and it also reduce glucose , triglyceride level in the blood of rat . It can reduce lipid in the liver of diabetic rat. The chronic toxicity in animal model showed no toxic on all organ when the rats took the Roselle extract on dose 1000 mg/ml long period time (9 months) . The clinical trial phase I and II were also studied. The roselle extract showed high efficiency on anti-hypertension and diuretic in hypertension patients and can reduce insulin resistance value of Diabetic patients. It also

reduce cholesterol, triglyceride and LDL on hyperlipidemia patients. The food products from Roselle extract such as tea, cookies, sausage, jelly were also studied.

Conclusion: By the conclusion, the development products from Roselle to be drugs, nutraceutical, health food and cosmetic depend on relative of biological activities and extraction method of Roselle extract. Roselle product were used for prevention and treatment NCDs patients

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Post-harvest Prediction of Storage Quality of Spiced African Locust Beans (Parkiabiglobosa) in Different Packaging Materials

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A study was carried out to examine the effect of storage time (week 1 to week 4), packaging materials (LDPE, PP, AF and HDPE), perforation (0, 3, 6 and 9%) and preservatives (garlic, ginger and mixture of both) on the nutritional qualities of African locust beans; and predict the storage quality of the spiced beans in different packaging materials. African locust bean seeds were soaked, steamed, dehulled and fermented naturally for three days. The samples were packaged in four different packaging materials (Low Density Polythene, Polypropylene, Aluminium foil and High Density Polythene) with each having 0%, 3%, 6%, and 9% perforations respectively. The samples were stored in a refrigerator set at 10^0C temperature and 70% relative humidity for a period of four weeks. A 4^4 factorial experiment in a Completely Randomized Design was used in this study. The results were analyzed, checked and presented using ANOVA/Regression Analysis. Further analysis by Duncan's New Multiple Range Test (DNMRT) was carried out to compare the means; and also with histogram. The results obtained showed that significant differences ($P < 0.05$) exist between the control and the treated samples. Seven model equations (using Essential regression software package) were developed and checked for adequacy and validity. The result shows that there is no significance difference between the mean of observed and the predicted for all the models developed. The R^2_{adj} values obtained were 97.9%, 97.6%, 91.1%, 87.2%, 82%, , 88% and 95'1% for moisture content, crude protein, bulk density, iron, calcium, vitamin A and Ph respectively.

Introduction

African locust beans (Parkiabiglobosa) are fermented to produce condiments. Fermented locust bean is a well-known condiment with characteristic ammoniacal smell and flavour which enhances taste of traditional soup and sauces especially those used as accompaniments to starchy foods (Odebunmiet al., 2010). Locust bean condiment is known to contribute to calorie and protein intake. (Odunfa, 1985; Potter and Hothkiss, 1995). It is generally added to soups as low cost meat substitute by poor families (Odebunmiet al., 2010). The flavouring properties of dawadawa are most likely to be due to its amino acid content, in particular glutamate, which contributed to flavour enhancement as well as peptides and aroma volatile constituents (Ohenhenet al., 2008). Odebunmiet al. (2010) published that the nutritional components of fermented locust beans (except ash) are significantly higher than those of the raw beans. Their result showed that about

79% increase was observed in the moisture content from 8.67% in raw to 41.85% in fermented, while fat and protein content increased by about 45% and 40% respectively. High protein content of fermented locust beans (35.73%) is similar to those reported by Alabiet al. (2005) 34.02%; Okpala (1990) 31.6%; Obizoba (1998) 34.3% and Omafuvbeet al. (2004) 37.2% for the fermented locust bean seeds. Omafuvbeet al. (2004) reported that the protein content increased as fermentation period increased. Odebunmiet al. (2010) confirmed that nutrient enrichment occurs as fermentation takes place in African locust beans.

Garlic is a functional food which is very nutritionally complete and contains numerous mineral substances and trace elements such as Calcium, Copper, Bromine, Magnesium, Manganese, Phosphorus, Potassium, Selenium, Sulphur, Zinc, and Iron. It contains practically all the existing vitamins such as Vitamins A, B1, B2, B3, B5, B6, B9, C and E. It is thus one of the most nutritionally complete foods. Garlic is also one of the most powerful medicinal plants for combating high blood pressure, protecting the heart, and promoting good blood circulation. The plant is also effective in combating diabetes and cholesterol, and in purifying the blood.

Ginger is very rich in minerals such as Manganese, Phosphorus and Magnesium, but it also contains small quantities of Vitamins B1, B2, and especially B3.Fresh Ginger also contain Vitamin C, but once it is dried this vitamin disappears completely. It effectively combats nausea and vomiting whether during travel, following an operation, during pregnancy, or illness. Ginger is also effective in reducing fever, fighting pain and it has powerful anti-bacterial and anti-viral properties.

Packaging should not give rise to any health hazard to the consumer. No harmful substances should leach from the packaging material into the food. Packaging should not lead to the growth of pathogenic microorganisms when anaerobic conditions are created within the package. Packages should be convenient to use. They should be easy to open and re-sealable, if appropriate. The contents should be readily dispensed from the container (Brennan and Day, 2006). Packaging foods in materials that are highly permeable to gases is not likely to bring about any significant change in the microflora, compared to unpackaged foods (Brennan and Day, 2006). Perforated packaging materials allow gas exchange, controlled access of oxygen (aeration), prevent water vapor condensation against microbial (bacterial) contamination and excess humidity thereby extending the products' shelf life.

Model equations show the relationship between dependent and independent variables. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and improve decisions. Model verification and validation (V and V) are essential parts of the model development process if models are to be accepted and used to support decision making. Model verification should precede model validation (Macal, 2005).

The objective of this study was to carry out postharvest prediction of storage quality of spiced African locust beans in different packaging materials.

Materials and methods

Sample Collection

The seeds of African locust bean tree (Parkiabiglobosa) used in this work were purchased from a local market in Ilorin, Kwara State. The variety was identified at the Plant Biology Department of University of Ilorin, Ilorin, Nigeria and then manually prepared and processed.

Sample Preparation and Experimental Set-up

The seed coats were cleaned to remove every impurity like shafts, stones, then soaked in hot water for thirty (30) minutes and washed. Steam method was used to cook the seeds for eight (8) hours. Major equipment used for this research includes: a refrigerator. Other apparatus and materials include a digital thermo-hygrometer (Acurite - 00613), a digital pH meter (InoLab - pH7310), electric oven (Gallenkamp: BS. OV-330) a sensitive electronic weighing balance (Camry-Ek5350), cotton wool, industrial alcohol (70%), raw locust bean seeds, plastic hand gloves, buckets and spoons, cooking pots, stainless bow, clean water, electric and kerosene stoves, metal sieves, small wooden mortar and pestle, packaging materials, natural herbs (garlic and ginger), a cutter, a puncher and a sealer.

Experimental Procedure

One thousand and six hundred grams (1600 g) of freshly prepared locust beans were measured with an electronic sensitive weighing balance and initially divided into four equal portions making a portion to be four hundred grams (400 g) each. According to research, garlic and ginger as natural spices can be toxic if consumed in very high dosages, so supplementation should never go beyond 5% of the diet. Hence, considering a lesser percentage (4%), the preservatives were prepared by adding 4% (16g) of garlic powder to the first portion of the beans, 4% (16g) of ginger powder to the second portion and a mixture of 2% (8g) each of garlic and ginger powder (16g of garlic-ginger powder) to the third portion respectively while no preservative was added to the fourth portion. After this, each of the four portions was measured and further divided into sixteen equal portions, to make twenty-five grams (25g) each and sixty - four (64) samples altogether. Each of the samples was packed in four different sterilized plastic films (16 cm × 8 cm) each having sixteen pieces with different thicknesses and same number of perforation at the same diameters viz. Low Density Polyethylene as M1 (LDPE 0.017 mm with 8, 16, 24 and 0 perforations), Polypropylene as M2 (PP 0.015 mm with 8, 16, 24 and 0 perforations), Aluminium foil as M3 (AF 0.450 mm with 8, 16, 24 and 0 perforations) and High Density Polyethylene as M4 (HDPE 0.013 mm with 8, 16, 24 and 0 perforations) each at 3%, 6%, 9% and 0% respectively. The total surface area of each film bag was 128cm^2.

Experimental Design and Arrangement

A 4×4×4×4 (4^4) factorial experiment in Completely Randomized Design (CRD) was used in this research work. The factors taken into consideration were Packaging materials (M), Percentage perforations (P), Preservatives (A) and Time (T). The packaging materials investigated were Low Density Polyethylene (M1), Polypropylene (M2), Aluminium foil (M3) and High Density Polyethylene (M4), number of perforation were 8, 16, 24 and 0 while the preservatives were garlic, ginger, garlic mixed with ginger and no preservative. Each treatment combination was replicated three times, making all the test trials to be 768. There were four levels for each of the factors that is,

a) Packaging materials - M1 as LDPE, M2 as PP, M3 as AF and M4 as HDPE.
b) Percentage perforations- P1 as 3%, P2 as 6%, P3 as 9% and P4 (no perforation).
c) Preservatives- A1 as Garlic, A2 as Ginger, A3 as Mixture of garlic and ginger and A4 (no preservative).
d) Time – T1 as Week 1, T2 as Week 2, T3 as Week 3 and T4 as Week 4.

Storage Procedure

Storage was done carefully by packaging, labeling and storing the samples in a thoroughly sterilized refrigerator (Haier Thermocool Mini Bar Fridge Model HR-142S TEC.) set at a constant temperature of 10^{0}C and relative humidity of 70% (monitored by a thermo-hygrometer (Acurite Model 00613)) at the Agricultural and Biosystems Engineering processing Laboratory of University of Ilorin. During the period of storage (four weeks), the environmental conditions such as temperature and relative humidity of the storage environment were constantly checked prior to proximate analyses which were carried out at an interval of a week in the Chemistry Departmental Laboratory under the supervision of an Analytical Chemist at the same University.

Plate 1: Packaged and Labeled Samples before Storage and Under Refrigeration

Measurement of Parameters

Temperature and relative humidity were checked in the refrigerator using a digital thermo-hygrometer (Acurite Model - 00613). The temperature and relative humidity were monitored daily at constant values of 10^{0}C and 70% respectively till the end of storage period of four (4) weeks. Nutritional values were determined in the laboratory using AOAC (2002) nutritional guidelines. The nutritional values determined were Vitamin A, Crude protein, Calcium, Iron and pH value.

The moisture content was calculated as follows:

$$\% \text{ Moisture content} = \frac{W2 - W3}{W2 - W1} \times 100$$

Where: w_1 is weight of clean dish (g),

w_2 is weight of clean dish and wet sample (g), and

w_3 is weight of clean dish + dried sample (g).

The bulk density was calculated as follows:

$$\text{Bulk density} = \frac{\text{Weight of sample (g)}}{\text{Volume of sample (ml)}} = \frac{W2 - W1}{V} \times 100$$

Where: w_1 is weight of empty density bottle (g)

$w_2$is weight of empty bottle + sample (g)

v is the volume of sample (ml)

Results and Discussion

Model Equations

The data obtained for Moisture content, Crude protein, Bulk density, Vitamin A, Iron, and Calcium and PH were modeled using the STATA version 11 computer software. The essence is to find a functional relationship that can adequately relate measured nutritional parameters of stored African locust beans (moisture content, crude protein, bulk density, vitamin A, iron, calcium content and PH.) and the factors investigated (storage time, packaging material, percentage perforation and type of preservative used). From the regression analysis carried out, the best performing functional models were developed, one for each measured parameter as seen in equation 1 through 7. The criteria for adjudging these models were the value of their adjusted coefficient of multiple determinations $R^{2,}$ prediction error sum of squares, PRESS (also called deleted residuals), R^2 for prediction, coefficient of variation CV and Dubin-Watson test for auto correlation. Models were checked for adequacy using these criteria and those found to be adequate were selected from among the other possible combinations of the models. Process parameters such as Storage time, Packaging material, percentage perforation, Preservatives and their interactions were used to determine the outcome of Moisture content, Crude protein, Bulk density, Vitamin A , Iron, Calcium content and pH value.

The model equations developed for Process parameters such as Storage Time, Packaging Materials, Percentage Perforation, Preservative Agents used and their interactions all proved to determine the outcome of Crude Protein, Calcium content, Iron Content, Vitamin A, Moisture Content, Bulk Density are as presented in the equations below:

$MC = 6.0426 - 0.1440T + 0.0462M + 0.0035Q + 0.0060P + 0.1499T^2 - 0.0071TM - 0.0053M^2 - 0.0012TQ,$ $(R^2_{adj} = 97.9\%)$

$CP = 39.07841 + 0.78850T - 0.01764P - 0.50981T^2 + 0.00466TM - 0.00031TQ + 0.00345TP + 0.00303P^2 - 0.00585M,$ $(R^2_{adj} = 97.6\%)$

$BD = 0.36319 + 0.00126Q + 0.00963P + 0.00428T^2 + 0.00082TM - 0.00040TQ - 0.00075TP - 0.00030MP - 0.00014QP - 0.00118P^2,$ $(R^2_{adj} = 91.1\%)$

$Iron = 50.5015 + 0.2165M + 0.0670T^2 - 0.0628M^2 - 0.0143MQ + 0.0966MP + 0.0051Q^2 - 0.0618P^2,$ $(R^2_{adj} = 87.2\%)$

$Calcium = 1427.6585 + 0.4191Q - 0.1441T^2 + 0.2080TM - 0.0458TP - 0.0599MQ - 0.0296Q^2,$ $(R^2_{adj} = 82.0\%)$

$VA = 157.0822 + 0.7721T - 0.1024M - 0.1637P + 0.2307T^2 + 0.0178TP + 0.0205M^2 + 0.0241P^2 - 0.0005Q,$ $(R^2_{adj} = 88.0\%)$

$PH = 8.115 + 6.01 \times 10^{-3}T^2 + 5.404 \times 10^{-2}T + 1.32 \times 10^{-4}TQ^2 + 4.205 \times 10^{-2}P - 7.955 \times 10^{-3}P^2 - 1.316 \times 10^{-2}TP + 2.55 \times 10^{-3}TP^2 - 2.22 \times 10^{-4}MQ^2 + 1.439 \times 10^{-2}M - 6.83 \times 10^{-4}TM^2 + 2.97 \times 10^{-4}Q^2 + 2.90 \times 10^{-4}QM^2 + 2.16 \times 10^{-3}MT^2 - 8.42 \times 10^{-3}TM - 7.58 \times 10^{-4}TQ,$ $(R^2_{adj} = 95.1\%)$

M- Packaging Materials (1- Low Density Polyethylene, 2- Polypropylene,
3- Aluminum Foil, 4- High Density Polyethylene)
P- Preservative (1 - Garlic, 2 - Ginger, 3 - Garlic + Ginger, 4 - No Preservative)
Q- % Perforated (0%, 3%, 6%, 9% Perforations)
T- Time (1 - Week One, 2 - Week Two, 3 - Week Three, 4 - Week Four)

Model Adequacy Checking

The adequacy (reliability) of the models was also examined using Analysis of Variance (ANOVA) of the Multiple Regression Models shown in Table 1. This is because ANOVA tests for Significance of the Regression Model from statistical point of view. The analysis was carried out using Essential Regression computer Software Package.

Table 1: Analysis of Variance Showing Residual Sum of Squares for the Models Developed

	Source	SS	MS	F	F Signif	Df
Moisture Content	Regression	345.13	43.14	4553.9	0.000*	8
	Residual	7.219	0.00947			762
	Total	352.35				770
Crude Protein	Regression	3121.9	390.24	3958.7	0.000*	8
	Residual	75.12	0.09858			762
	Total	3197.0				770
Bulk Density	Regression	0.402	0.04467	876.35	0.000*	9
	Residual	0.03879	5.1E-05			761
	Total	0.441				770
Vitamin A	Regression	3804.5	345.86	475.97	0.000*	11
	Residual	551.52	0.727			759
	Total	4356.0				770
Iron	Regression	145.02	20.72	6.358	0.000*	7
	Residual	2486.2	3.258			763
	Total	2631.2				770
Calcium	Regression	331.72	55.29	2.153	0.046*	6
	Residual	19617.1	25.68			764
	Total	19948.9				770
pH Value	Regression	5.228	0.3485	995.94	0.000	15
	Residual	0.264	0.0003			755
	Total	5.492				770

*Significant at $P < 0.05$

Table 1 above shows the analysis of variance for the models developed. The analysis of variance tests for models were significant at $P < 0.05$ for all the models developed. The null hypothesis of no functional relationship is rejected. This implied that there exist a functional relationship between the process input and process output understudied.

The adequacy of the models was checked using regression statistics and graphical method. Table below presents the results of the test statistics (Regression Statistics for Model Adequacy). From Table 2 it can be inferred that the adjust coefficient of multiple determination which defined the percentage of total variability explained by the model was 97.9%, 97.6%, 91.1%, 87.2%, 82.0%, 88.0% and 95.1% for Moisture content, Crude protein, Bulk density, Vitamin A, Iron, Calcium and pH value respectively. These high percentages of total variability explained by the models implied good fits. The adjusted coefficient of multiple determinations is preferred to coefficient of determination because it takes into account the degrees of freedom in the model.

Also shown in Table 2, the values of coefficient of multiple determinations (R^2), adjusted coefficient of multiple determination and R^2 for predictions are relatively close for all process parameters. This is what we would expect of good models (David et al., 1998).

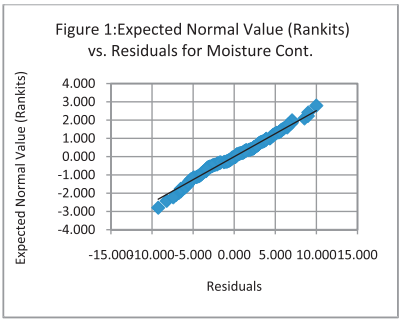
Table 2 Multiple Regression Statistics on the Physical and Nutritional Parameters of Stored Locust Beans

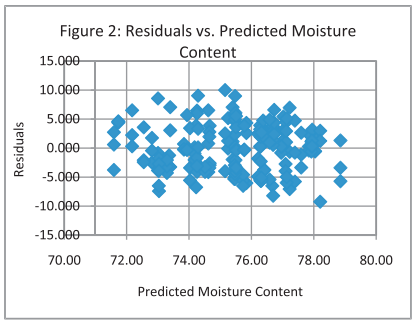
Regression Statistics	MC (%)	CP (%)	BD (g/cm3)	VA (mg/100g)	Iron (mg/100g)	Calcium (mg/100g)	pH Value
|R|	0.990	0.988	0.955	0.935	0.92	0.93	0.976
R^2	0.980	0.977	0.912	0.873	0.85	0.90	0.952
R^2 adjusted	0.979	0.976	0.911	0.872	0.82	0.88	0.951
Standard Error	0.097	0.314	0.007	0.852	0.08	0.03	0.019
PRESS	7.354	76.470	0.041	565.541	1.32	0.21	0.277
R^2 for Prediction	0.979	0.976	0.908	0.870	0.79	0.84	0.949
Durbin-Watson d	0.093	0.061	0.658	0.038	2.13	0.69	1.212
First Order Autocorr.	0.953	0.970	0.646	0.980	-0.07	0.65	0.393
Collinearity	0.000	0.000	0.000	0.000	0.05	0.00	0.000
Coefficient of Variation	1.420	0.843	1.748	0.531	5.22	42.19	0.225

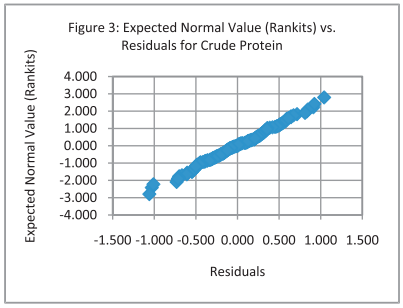
Another statistics that guarantee goodness of fit is called Prediction Error Sum of Squares (PRESS). Models with lower prediction error sum of squares (PRESS) imply good fit. Table 4.4 shows the lowest prediction error sum of squares associated with the various models developed.

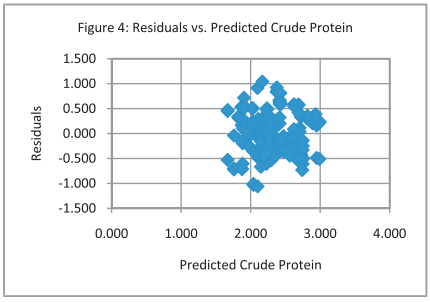
Finally, the coefficient of variation (C.V) which is the unexplained variances in the data, given by the standard error of regression models was relatively small for all the models developed as shown in

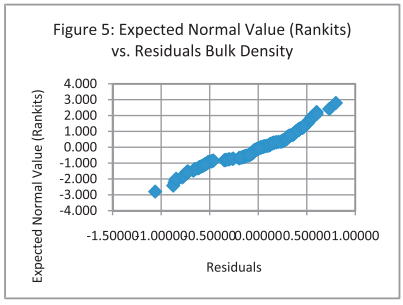
Table 2. Small values for C.V are obtained if the fit is good (David et al., 1998). Therefore, it can be concluded that all the models developed are adequate and can be used to relate process input to

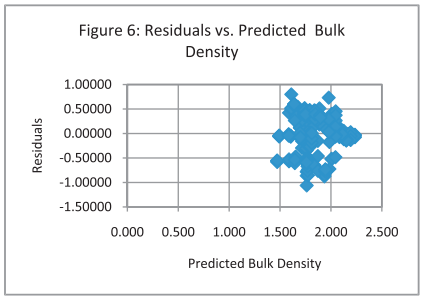




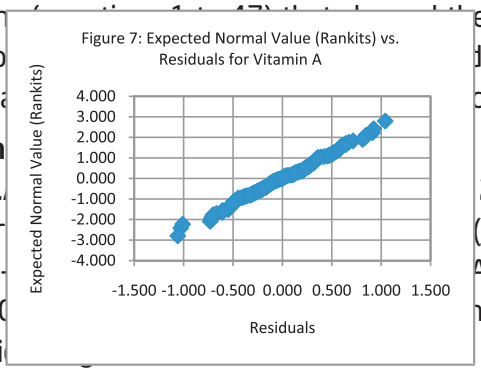


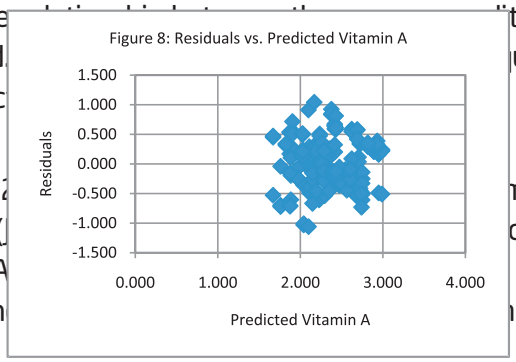






used were seen to improve the nutritional qualities of the stored locust beans depending on the packaging material and percentage perforation. Ginger increased most of the nutritional qualities and other parameters compared to garlic but the mixture of ginger and garlic best increased the output parameters for four (4) weeks higher than either ginger or garlic alone. The Seven model equation[illegible]tions and output p[illegible]uacy and validity, a[illegible]





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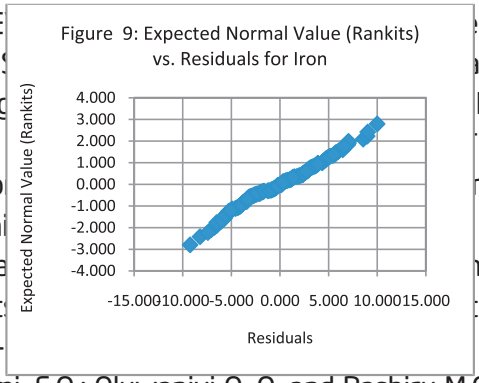

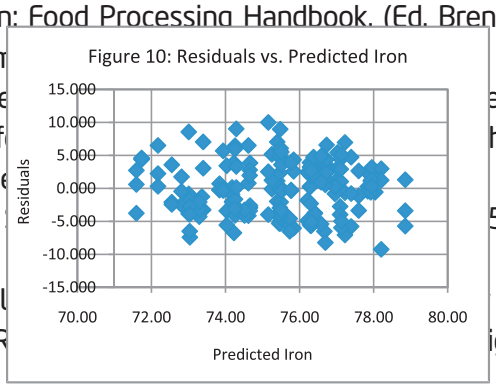

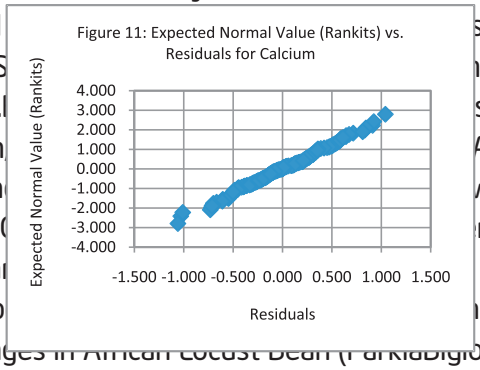

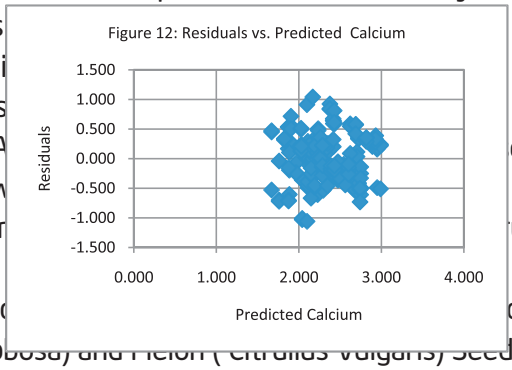

Probiotic food products and gut health

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Relationship of food, microbes and man known since ancient times. In modern times this has become more relevant as we see more and more reports on probiotic foods, which involve consumption of microbes through food. Role of microbes in gut is well established since long. Now we are talking about role of microbes 'beyond gut'. We are in the era of deep understanding of the relationship between gut microbiome and human functions. Further, we also hear some noise about our thinking on 'sterile sites' in human system that require re-thinking our old concepts. This knowledge is further proving the role of microbes not only in present life but over generations too!

The concept of consumption of fermented milk centered on beneficial bacteria and their health effects in the gut. This shows that the association of man and microbes was known since ancient times (Prajapati and Nair, 2007). Tradition of using fermented milks and synbiotic product called 'Panchamrut' (milk + curd + honey + sugar + clarified butter) was interwoven in religious functions in Hindu culture since Vedic times for its health benefits. However, the scientific momentum on probiotics was gained after the publication of 'prolongation of life' by Eli Metchnikoff in 1907.

Microbes play an important role in gut as they offer protective, metabolic and trophic functions. Hence, modulation of gut flora with beneficial bugs - probiotics will positively affect all these functions. A review by Howarth and Wang (2013) mentioned the main effect of probiotics viz., shift in composition of gut flora towards beneficial ecosystem, improved barrier functions, antimicrobial property against certain pathogens, affect immunity and affect cell kinetics such as cell proliferation and apoptosis. Modulation of gut flora by probiotics have shown great potential in many intestinal disorders. Studies have shown evidence of the role of gut microbiome in control of obesity and diabetes. A paper by Vrieze et al (2012) demonstrated that stool transplant from lean individuals improved insulin sensitivity showing that gut flora influence the host metabolism systematically. During the studies on irritable bowel syndrome, Burnet (2012) yielded evidence for the link between gut bacteria and neurological functions, proving concept of microbiome-gut-brain axis.

Lot of work is done in developing food products that carry probiotic microbes and deliver them safely in gut. Most of the products are milk based, but cereals, fruits, vegetables, tuber crops, fish, meat, etc. also used as carrier of probiotics. Probiotics are also being delivered in pharma forms like tablets, capsules, sachets, etc. At AAU, Anand we have developed number of fermented dairy products with Indian origin isolate of probiotic culture Lactobacillus helveticus MTCC 5463 (Prajapati et al, 2011).

In last few years, lot of clarity has come on regulations and labelling aspects and it is agreed that

probiotic health benefits are strain dependent and hence stress on strain identification and characterization is given. In the past, studies of the gut microbiome have been largely dependent on cultivation techniques. However, due to their inherent limitations, the future of the study of microbiome diversity and its relationship to health and disease rely heavily on next-generation sequencing technology or the "omics" like metagenomics, metatranscriptomics, metaproteomics and metabolomics (Backhed et al, 2012). These tools are widely used to identify novel functional genes, microbial pathways, antibiotic resistance genes, functional dysbiosis of the intestinal microbiome, and co-evolution between microbiota and host. In a recent clinical trial in geriatric volunteers, we tried to understand the influence of probiotic intervention on the gut microbiota population. Metagenomic analysis of gut microbiome indicated significant changes in responders and non-responders to probiotic intervention.

Nutrigenomics help reveal individualistic physiological reactions towards different diets at the omics level, affecting host metabolism in relative health or disease. Probiotics have established their role in metabolic, barrier effect, and trophic functions along with recent foray in mental diseases like autism and depression, by crossing the gut brain barrier. The field of personalized nutrition employs metagenomic studies to identify specific biomarkers that contribute to nutritional status, disease pathogenesis, and learn how manipulation of gut microbes influences the host response. The knowledge of specific host-diet interaction can bring about a revolution in the area of health and nutrition through bioengineered probiotics, and clinical metagenomics. With a deluge of probiotic products with health claims, the most important step in the future should be the implementation of statistically and clinically sound regulatory framework for efficacy studies of probiotics in humans with special reference to disease state. Additionally, the future of probiotic products in health management requires recommendations for optimal dosing and duration of therapy, eliminating risk factors like rare occurrence of probiotic associated endocarditis and defining validated biomarkers of physiological disorders.

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Cholesterol, Lipids and Life Style Factors for Middle-aged Dyslipidemia: Middle Age Dyslipidemia Treatment Program (MADTP 2015)

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Key Facts

- Dyslipidemia is a major growing risk of cardiovascular disease among fast developing economic Asian countries
- MADTP 2015 suggests that discipline of diet, exercise, behavior and positive attitude play a significant role to bring normal blood lipid levels in reducing risk of cardiovascular disease among middle aged persons
- LONGLIVE LIFESTYLE is a cholesterol lowering program to reduce risk of cardiovascular disease by diet, exercise prescription and modified habits of smoking, alcohol and behavior
- Literature suggests a mixture of evidences in favor of beneficial effects of diet, exercise, life style modification in dyslipidemia management to keep low risk of cardiovascular disease
- Exercise prescription of walking-running exercises, exercise intensity, frequency, and duration is not the main factor of dyslipidemia treatment. Better improvement of blood lipid lowering profiles might appear after longer consistent exercise period.
- Recommended diet plan along with walking-running exercise might improve serum high density lipoprotein cholesterol (HDL-C) appeared earliest; and the improvement of low density lipoprotein IV; cholesterol (LDL-C) and Apolipoproteins will appear after long-period exercise.

Summary Points

- MADTP 2015 with literature evidences suggests a tentative guideline for diet restriction, exercise prescription, behavior modification and positive attitude of social habits in reducing risk of cardiovascular risk among middle aged persons.
- LONGLIVE LIFESTYLE serves a s a code of long live philosophy by practicing supervised exercise and monitoring blood lipids after high morale attitude counseling sessions.
- After a long six-months period of walking-running exercise, serum HDL, serum apoE levels increase while serum estrogen stabilize with aging.
- Low fat-complex carbohydrate, antioxidant-nut-fiber rich diet plan with walking-running exercise can also improve the cardiopulmonary function of middle-aged dyslipidemia and decrease the resting heart rate and systolic blood pressure.
- In Asian fast changing society, background data is not available on lifestyle factor influence on blood lipids and cardiovascular functions. Western standards are followed in decision making and policy making.
- The walking-running exercise of six months can improve body composition efficaciously, reduce body fat weight, increase muscle weight, and strengthen the patient.

Pomegranate for entrepreneurship development through production of bioactive compounds as ingredient for food, pharmaceuticals and cosmetic industry

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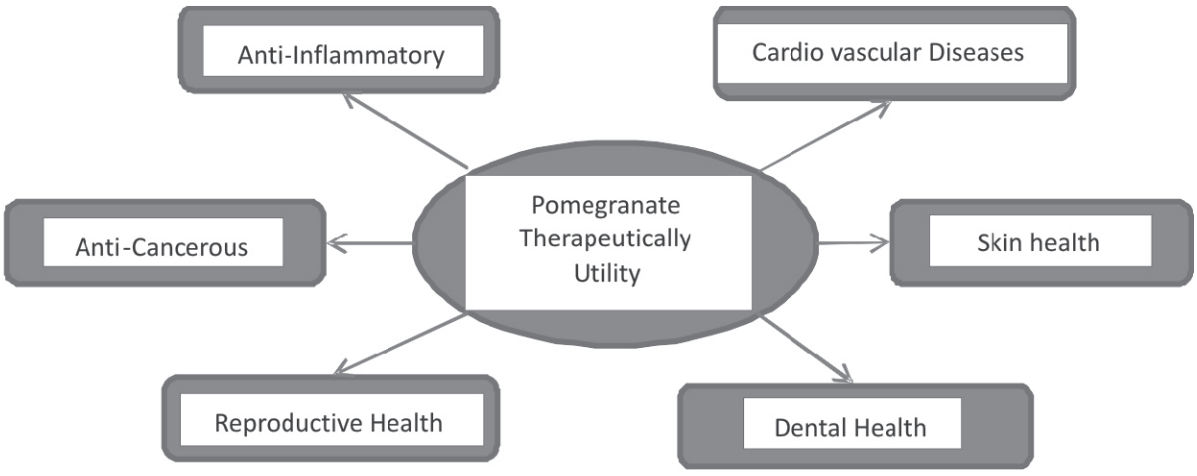
India is one of the leading countries in pomegranate acreage and production worldwide. The area under pomegranate cultivation in India is 1.31 Lakh ha with production of 13.46 Lakh tonnes in year 2014-15(NHB). The area under cultivation of pomegranate has increased from 96.9 thousand hectares (2003-04) to 131 thousand hectares (2014-15). The pomegranate is grown in the states of Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Himachal Pradesh, Rajasthan and Tamilnadu. Cultivation of pomegranate is expanding at a rapid rate in several non-traditional regions viz. M.P., U.P., U.K., W.B. and Nagaland.Pomegranate fruit has wide acceptability among the consumers because its arils have attractive colour, juiciness, sweet acidic taste, refreshing juice and known nutraceutical values. The rise in production of pomegranate has compelled to rethink about future marketing and utilization strategy for this high value produce. Although pomegranate is a very attractive fruit having great visual appeal yet it is classified under difficult to eat category of fruits for fresh consumption (unlike the easy to eat fruits viz. banana and oranges). Opportunities for value addition are plenty for total utilization of pomegranate. For example, a farmer with all available modern agri-horticultural technologies can harvest approximately 80 per cent of fruits suitable for export and domestic market. Rest 20 per cent of the harvest is neither marketable nor will fetch any return even to meet the transportation cost for taking this produce up to the market. Potentiality of use of high value nutraceutical compounds and bio-colouring agent in pomegranate peel have not been exploited so far in commercial scale. Similarly, use of high value pomegranate seed oil as active ingredientoffood, pharmaceutical or cosmetic products has not yet been explored in India. Formulation of dietary supplements from pomegranate for management of several important human ailments viz. atherosclerosis, diabetes and even cancer may be possible in the coming years. Therefore, the enormous scope of entrepreneurship development using pomegranate for production of high value ingredients for food, pharmaceutical and cosmetic industries is discussed in this paper.

Keywords: Pomegranate, bioactive compounds, ingredients, entrepreneurship

Introduction

Pomegranate in dry regions has already acquired a central place fruit basket of India. It is valued by the consumers for its attractive coloured arils, juiciness, sweet acidic taste, refreshing juice and outstanding nutraceutical properties. This wonderful crop is serving as a lifeline for the farmers of dry tracts of Deccan Plateau region which is characterized by the challenging edaphic and climatic factors. Pomegranate grows better than any other crop in this tract as far as returns on investment is concerned. India is the global leader in pomegranate production and cultivation. The area and production under pomegranate have increased tremendously during last two decades registering

almost 20 folds increase since 1995. The area under pomegranate cultivation in India is 1.31 Lakh ha (1.84 Lakh ha as per advance estimate for 2015-16) with production of 13.46 Lakh tonnes (18.20 Lakh tonnes as per advance estimates for 2015-16) in year 14-15 (NHB, www.nhb.gov.in). In this context the post-harvest management of produce to improve its shelf life by adopting modern handling, storage, packaging, processing and value addition and transportation to distant places in India and international destinationshave acquired a paramount importance for sustainable returns from pomegranate. The fruit is rich in flavonoids, anthocyanins, punicic acid, ellagitannins, alkaloids, fructose, sucrose, glucose, simple organic acids, and other components (Aida Zarfeshany et al. 2014). Pomegranate arils contain 85% water, 10% total sugars, mainly fructose and glucose, and 1.5% pectin, organic acid, such as ascorbic acid, citric acid, and malic acid, and bioactive compounds such as phenolics and flavonoids, principally anthocyanins (M. Viuda-Martos, 2010). Pomegranate arils provide 12% of the Daily Value (DV) for vitamin C and 16% DV for vitamin-K per 100g serving. The red color of juice can be attributed to anthocyanins, such as delphinidin, cyanidin and pelargonidin glycosides. The pomegranate peel is an important source of bioactive compounds such as phenolics, flavonoids, ellagitannins, and proanthocyanidin compounds, minerals, mainly potassium, nitrogen, calcium, phosphorus, magnesium, and sodium, and complex polysaccharides. Pomegranate seeds are approximately 10 per cent of the fruit weight. Pomegranate seeds are excellent sources of dietary fiber. The soft seeded varieties of pomegranate contain seeds oil to the tune of 25-26 % (V/W). The pomegranate seed oil contains more than 70 % of conjugated linolenic acid The Pomegranate seed oil contains punicic acid (65.3%), palmitic acid (4.8%), stearic acid (2.3%), oleic acid (6.3%) and linoleic acid (6.6%). The pomegranate fruit contains approximately 40 % arils, 10 % seeds and 50 % peel.The processing of pomegranate into various value added product as well as utilization of processing industry by products into high value nutraceutical and pharmaceutical products are useful components of modern day total utilization concept.



Value Added Products from Pomegranate

In India major part of production is utilized for table purpose fresh fruit consumption. The pomegranate arils, peel, seeds and flowers can be processed into various value added products. The

pomegranate can be processed into traditional and non-traditional value added products. The traditional products like anardana, juice and ready to serve beverage can be prepared from pomegranate. Non-traditional products like minimally processed arils, wine, seed oil, bio colours, peel extracts can be developed.

Pomegranate Juice

Pomegranate juice is nutritionally an important beverage since it is consumed frequently for its phenolic compounds (such as anthocyanins, ellagic acid, phytoestrogenic flavonoids and tannins). The screw presses are used prominantly for juice extraction from pomegranate arils in small scale processing using half cut fruits directly. The juice extraction from whole fruits is carried out by subjecting the cut fruits to hydraulic press. The pressure of less than 100 psi is used to avoid undue yield of tannin. The juice from crushed whole fruits contains excess tannin from the rind (as much as 0.175%) and which is precipitated out by a gelatin process. The juice is clarified by heating in a flash pasteurizer, cooling, settling, racking up and filtering or decanting. The clear juice can be preserved by heat treatment or by using chemicals. However, at large scale arils are separated from fruits in bulk using aril extractor and then arils are subjected to hydraulic press to extract juice.

ICAR-NRCP has standardized process protocol for processing of juice and RTS beverage. The centre is also in process of establishment of pomegranate processing pilot plant.

Material and cost for Development of 5 Litre Ready to serve beverage (RTS)

- Pomegranate fruits @ 40 Rs/kg : 80 Rs
- Sugar: 30 Rs
- Preservatives and CA: 10 Rs
- Packaging: 50 Rs
- Labour: 10 Rs.

25 bottles of 200 ml each can be prepared from 5 lit. of RTS and at sale cost of 20 Rs/bottle 500 rupees can be earned Carbonated ready to serve beverage can be prepared by application of CO_2 at 80 PSI pressure. The carbonation is carried out at 4 °C. The packaging is also carried at cool conditions of 4 °C

Anardana

The dried arils of fruits of wild pomegranate are utilized mainly in form of pomegranate raisins or 'Anardana'. Anardana has a distinct tart flavour, and is commercially available in many Asian countries, where they are consumed in large quantities. Anardana is also used in the ayurvedic medicine as digestive and stomachic. The cracked fruits at matured stage can be economically used traditionally for preparation of dried value added product called anardana. It is used as acidulent and condiment in Indian culinary or traditional system of medicine. The cabinet drying at 55^{0}C for 7 hours of the arils is best for getting quality anardana. Varieties having high natural acidity are suitable for preparations of anardana are being developed at ICAR-NRCP.

Anardana

Minimally processed pomegranate arils

The pomegranate is basically a difficult to eat fruit. Though, mainly consumed fresh, but the difficulty encountered in separating the edible arils from the fruit has several limitations for its direct consumption unlike the other fruits e.g. Oranges, banana, grapes etc. Hence, minimal processing of pomegranate is of great importance for convenience of the consumers. Commercialization of minimally processed and "ready-to-eat" fresh arils is the good alternative. In the minimal processing generally various hurdles are created for spoilage of freshly extracted arils using low temperature, pH regulation and edible GRAS chemicals as anti-microbial agents. The minimal processing consists the washing with sanitizing agents to reduce the primary inoculum load, pH modification, use of antioxidant agents, temperature control and others, to control partially the high perishability of the fruits. On the other hand, the selectively permeable polymeric films for packaging of minimally processed pomegranate arils are used for generation of Modified Atmospheric Packaging (MAP) system in order to develop a micro controlled environment that reduces the respiratory activity and maintains unfavorable conditions for the action of many contaminating microorganisms.

Minimally processed arils in retail and commercial pack

There are some commercial units of minimal processing operating in country. The units are processing the fruits to the tune of 5 tonns/day. These units had unit operations such as washing, manual aril extraction, weighing, gas mix (O_2, CO_2& N_2) flushing, and sealing. The units are packaging and marketing the arils in retail pack of 100 g and commercial pack of 10 or 20 kg. ICAR-NRCP has developed technology for pretreatment of arils for extension of shelf life up to 18 days.

Pomegranate seed oil

Pomegranate seed oil is a unique natural product, with no equal among all other plant oils. It is one of only about six plant sources known that contain conjugated fatty acids. Conjugated fatty acids are important because they inhibit eicosanoid metabolism at several points in the synthesis of prostaglandins from arachidonic acid. This makes them significant natural anti-inflammatory agents. Pomegranate seed oil contains other significant bioactive compounds. For example, Pomegranate Seed Oil is the richest known plant source of a steroidal estrogen, estrone. Other important compounds found in Pomegranate seed oils include gamma-tocopherol, a rare and potent form of Vitamin E and the phytosterols: beta-sitosterol, stigmasterol and campesterol. It has been linked to improve heart health and also indicates to protect against cancer (Hernandez, et al., 2002; Lansky and Newman, 2006) and artheroschlerosis (Boussetta, et al., 2009).

The studies on determination of pomegranate seed oil content revealedaverage per cent oil in Bhagwa, Ganesh and Arakta cultivar was found to be 28%, 26.43 % and 23.70 % (w/w). The fatty acid profile of Bhagwa and Ganesh cultivar revealed both prominent cultivars grown in India have high level of linolenic acid content.

Fatty acid profile	Bhagwa Seeds	Ganesh Seeds
Linolenic (%)	68.7	69.8
linoleic (%)	13.9	11.4
Oleic (%)	12.0	9.1
Palmitic (%)	2.1	2.4
Stearic (%)	1.9	2.1

Pomegranate seed oil

Bio-Colours from Pomegranate

The natural dyes from rind of pomegranate are used in coloration of lipsticks and other cosmetics. The rind of pomegranate contains a considerable amount of tannin, about 19% with pelletierine (Adeel et al., 2009; Tiwari et al., 2010). The main coloring agent in the pomegranate peel is granatonine which is present in the alkaloid form N-methyl granatonine (Goodarzian and Ekrami, 2010). This compound gives colour as dye.

Pomegranate Wine

Pomegranate wine is an excellent source antioxidants and have higher antioxidant activity and total phenol content than red wine and green tea. Pomegranate wine is the product of anaerobicfermentation by yeast in which the sugars are convertedinto alcohol and carbon dioxide. Melatonin (N-acetyl-5-methoxytryptamine) is a neurohormone related to a broad array of physiological functions and proven therapeutic properties.Melatonin was observed to be absent in pomegranates juices but it is detected in prominent amounts with respect to other food matrixes (0.54–5.50 ng/mL) in pomegranate wine. The presence of this biogenic amine makes pomegranate wineuse as bioactive phytochemicals supplementation.

The protocol for preparation of pomegranate wine was refined at NRCP, Solapur with the inclusion of enzyme pre-treatment. Pomegranate wine was prepared from pomegranate juice using the shake flask culture method and bioreactor.The TSS was adjusted and KMS is added to restrict the growth of undesirable microorganisms. The juice was pasteurized and treated with of is added with enzyme. Fermentation of juice was carried out using yeast in incubator shaker. Wine was then clarification by adding clarifying agents to wine. The wine is flash pasteurized, bottled hot and sealed. The wine prepared by the above method was found to be superior in clarity / transparency compared to the control.

Pomegranate wine developed at ICAR-NRCP

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Opportunities for Make in India in Food & Dairy Processing Sector

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Introduction

It is estimated that the current size of food sector in India is about US$180 bn which is growing approximately at the rate of 9%. The organised food business in India is worth US$ 48 billion, of which food delivery is valued at US$ 15 billion. With online food delivery players like FoodPanda, Zomato, TinyOwl and Swiggy building scale through partnerships, the organised food business has a huge potential and a promising future.In milk we are already number one producer and the estimated market size is US$ 70 bn and the milk production is growing at a robust 4%. The demand for processed milk and milk products in the organised sector is registering a growth of around 15-20%. Since most of the products are being handled by unorganised sector, the processing level is as low as 2% in case of Fruits and Vegetablesand as high as 35% in case of milk. Due to low level of processing, the wastages are ranging between 0.8% in milk to 18% in fruit and vegetables. Apart from this, the cost of production of various food ingredients is comparatively low in the country due to availability of low cost farm labour. With latest initiative of the Government of India, to Make in India programa success, these competitive advantages in case of dairy and food processing sector coupled with initiatives taken by the government, can be leveraged to develop this country as sourcing and manufacturing hub not only to cater the growing demand of processed food, milk and milk products within the country but also can be used as an export hub for the neighbouring countries which are invariably deficient in food and dairy products. However, the challenge of maintaining the quality and developing the cold chain for these sectors will remain and have to be tackled efficiently even though Government of India has taken several initiatives to address this problem.

In this paper we will discuss the opportunities mainly in two segments :

(1) Dairy Processing Equipment; and
(2) Manufacture of Value Added Dairy Products.

1.0 Dairy processing equipment

Dairy processing equipment market can be segmented on the basis of equipment type and process technology. Various processes used for processing dairy products are direct heating, microfiltration, deep-bed filtration, indirect heating and bacteria-removing separation.

Increased adoption of efficient technologies by dairy product manufacturers and automation provided by the equipment is supporting the growth of dairy processing equipment market. Additionally, demand for dairy products with low fat contents and healthy milk products are fuelling the market growth.

However, government regulations and policies are posing a challenge for equipment manufacturers which are affecting the market growth. Competitiveness and cost of production are key areas of

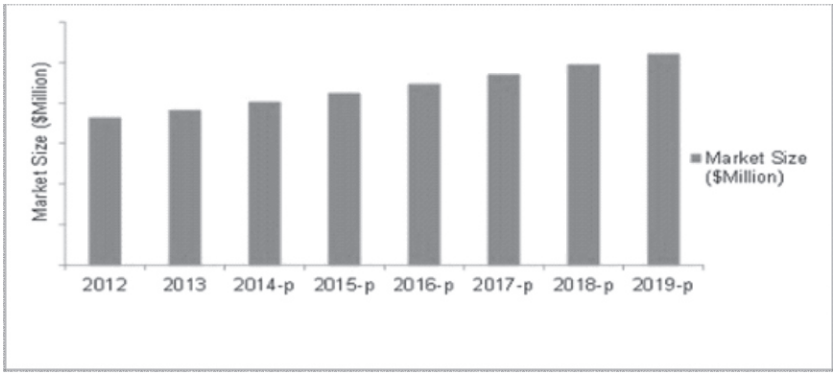
concern for the dairy equipment manufacturers. With the increasing demand for high quality dairy products, the manufacturers which have low cost of production are expected to benefit in a long run. Key trends in the market are shift of consumer preferences towards health-oriented dairy products and mandatory safety issues by regulatory bodies.

The dairy processing equipment market is growing in accordance with the increasing demand for dairy products and the technological advancements in dairy processing equipment. This market is driven by the rise in consumption of dairy products, such as processed milk, cheese, cream, and particularly the increase in demand for milk powders and protein concentrates. North America and Europe are mature markets in dairy processing and emerging economies such as China & India provide greater opportunity for the growth of the dairy processing equipment market.

1.1 Global Dairy Equipment Market

The global dairy processing market is projected to reach $10,433.3 million by 2019, at a CAGR of 5.3% from 2014 to 2019. In 2013, the Asia–Pacific region was the largest dairy processing equipment market, wherein Australia dominated this market.

Dairy Processing Equipment Market Size Trend, 2012-2019 ($Million)



p - Projected

The market for dairy processing equipment in the Asia-Pacific region is estimated to be the fastest-growing market from 2014 to 2019. The dairy processing equipment market is a concentrated market, with leading players driving the market growth.

The key dairy processing equipment manufacturers in the market identified in this report are Tetra Laval (Switzerland), Alfa Laval (Sweden), SPX Corporation (U.S.), GEA Group (Germany), Krones Group (Germany), IMA Group (Italy), A&B Process Systems (U.S.), Feldmeier Equipment Inc. (U.S.), IDMC Limited (India), and Scherjon Equipment Holland B.V. (The Netherlands).

1.2 Challenges in the Dairy Equipment Sector

- Dependence of International suppliers for Dairy equipment & Automation
- Import of Milk Analyser
- Lack of Skilled Manpower
- Dairy Sector dominated by unorganised player

- Mostly unprocessed milk is sold in loose in the domestic market
- Non Conformity of Quality Norms across the supply chain

1.3 Opportunities for Make in India in Dairy Processing Segment

- Milk Analyser
- Milking Machines
- Cold Storage
- BMC, Pasteuriser
- AI Gun
- Dairy Automation for identifying traceability in Raw Material
- Long Shelf Life Packaging Material
- IOT

1.4 Make In India

The 'Make in India' program is an initiative launched to encourage companies to increase manufacturing in India. This not only includes attracting overseas companies to set up shop in India, but also encouraging domestic companies to increase production within the country.
'Make in India' aims at increasing the GDP and tax revenues in the country, by producing products that meet high quality standards, and minimising the impact on the environment.

Fostering innovation, protecting intellectual property, and enhancing skill development are the other aims of the program.

1.4.1 Vision of Manufacturing

- To increase manufacturing sector growth to 12-14% per annum over the medium term.
- To increase the share of manufacturing in the country's Gross Domestic Product from 16% to 25% by 2022.
- To create 100 million additional jobs by 2022 in manufacturing sector.
- To create appropriate skill sets among rural migrants and the urban poor for inclusive growth.
- To increase the domestic value addition and technological depth in manufacturing.
- To enhance the global competitiveness of the Indian manufacturing sector.
- To ensure sustainability of growth, particularly with regard to environment.
- Incentivizing through Capital subsidies for adoption of innovative technologies in the areas of Energy & Water Conservation, Controlling Pollution, Waste Water treatment, Rain Water harvesting, Renewable Energy and Green Buildings.

Technology Acquisition Development Fund scheme is a transformational mechanism for Indian MSMEs to acquire Clean, Green & Energy Efficient Technologies, in form of Technology / Customised Products / Specialised Services / Patents / Industrial Design available in the market with requisite level of proof from individuals, organizations located in India or anywhere else across the Globe.

TADF is revolutionary scheme for enabling Technology Acquisition and Development as per the National Manufacturing Policy 2011 (NMP) through patent pool and licensing; reimbursement of direct patent acquisition cost; incentivizing production of equipment for controlling pollution,

reducing energy consumption and for water conservation through interest and capital subsidies; and incentives for energy and environmental audit, waste water treatment, rain water harvesting, renewable energy and Green Buildings.

- It aims to provide funding support for the acquisition and development of Clean and Green Technologies.
- The Scheme is applicable to all existing and new Micro, Small and Medium Enterprises (MSMEs) including those in the National Investment and Manufacturing Zones (NIMZs) in respect of their investments made after notification of the Scheme which will remain in force upto March 31, 2017

1.4.2 Technology Acquisition Development Fund Scheme

Sl.No	Schemes of TADF	Funding Support
1	Direct Technology Acquisition	Reimbursement of 50% of technology transfer fee or Rs 20 Lakhs, whichever is lower
2	In-direct Technology Acquisition	Subsidy of 50% of the mutually agreed value or Rs 20 Lakhs, whichever is lower
3	Subsidy for Manufacturing Equipment/ Technology	Subsidy of upto 10% of capital expenditure incurred on new Plant & Machinery subject a maximum of Rs 50 Lakhs
4	Incentive Scheme for Green Manufacturing **	The scheme facilitates resource conservation activities in industries located in NIMZ through the introduction of incentive / subsidy schemes for energy/ environmental / water audits, construction of green buildings, implementation of waste treatment Facilities and implementation of renewable energy projects.

** Refer Gazette

1.4.3 Mode of Technology Acquisition

- Outright Purchase of Technology with or without the engagement of a Consultant
- Joint Venture with counter parts of Relevant Technology Acquisition
- Purchase of Active Intellectual Property Right (IPR) for large scale deployment of relevant technologies
- Creation of Technology Pool / Patent Pool

1.5 Government Initiative for Make in India

In a bid to push the 'Make in India', Government of India has taken several initiatives to promote a healthy environment for the growth of manufacturing sector in the country. Some of the notable initiatives and developments are:

- The Government of India has asked New Delhi's envoys in over 160 countries to focus on economic diplomacy to help government attract investment and transform the 'Make in India' campaign a success to boost growth during the annual heads of missions conference.
- The Government of Uttar Pradesh (UP) has secured investment deals valued at Rs 5,000 crore (US$ 752.58 million) for setting up mobile manufacturing units in the state.
- The Government of Maharashtra has cleared land allotment for 130 industrial units across the state with an investment of Rs 6,266 crore (US$ 943.13 million)
- Government of India, has announced the 'Make in Northeast' initiative beginning with a comprehensive tourism plan for the region.
- Government of India has planned to invest US$ 10 billion in two semiconductor plants in order to facilitate electronics manufacturing in the country.
- Entrepreneurs of small-scale businesses in India will soon be able to avail loans under Pradhan Mantri MUDRA Yojana (PMMY). The three products available under the PMMY include: Shishu - covering loans up to Rs 50,000 (US$ 752), Kishor - covering loans between Rs 50,000 (US$ 752) to Rs 0.5 million (US$ 7,520), and Tarun - covering loans between Rs 0.5 million (US$ 7,520) and Rs 1 million (US$ 15,052).
- Food processing is recognised as a priority sector in the new manufacturing policy in 2011.
- Government had announced setting up of special fund of INR 2,000 Crore in the Financial year 2014-15 in NABARD for extending affordable credit to designated food parks and the individual processing units in the designated food parks at concessional rates. The fund is being continued in 2015-16.
- Reserve Bank of India has classified loan to food & agro-based processing units and Cold Chain under Agriculture activities for Priority Sector Lending (PSL) subject to aggregate sanctioned limit of INR 100 Crore per borrower. It will ensure greater flow of credit to entrepreneurs for setting up of food processing units and attract investment in the sector.

1.5.1 Food Processing Machinery

- Excise duty on machinery for the preparation of meat, poultry, fruits, nuts or vegetables and on presses, crushers and similar machinery used in the manufacture of wine, cider, fruit juices or similar beverages and on packing machinery is reduced from 10% to 6%
- All refrigeration machinery and parts used for the installation of cold storage, cold room or refrigerated vehicles for the preservation, storage, transport or processing of agricultural, apiary, horticultural and marine produce as well as dairy and poultry, are exempt from excise duty.
- Pasturising, drying, evaporating etc. machinery used in Dairy sector is exempted from excise duty

1.6. Investments

According to the data provided by the Department of Industrial Policies and Promotion (DIPP), the food processing sector in India has received around US$ 6,429.15 million worth of foreign investments during the period April 2000—June 2015. The Confederation of Indian Industry (CII)

estimates that the food processing sectors have the potential to attract as much as US$ 33 billion of investment over the next 10 years and also generate employment of nine million person-days.
Some of the major investments in this sector in the recent past are:

- Foodpanda acquires food ordering portals TastyKhana and Just Eat India to strengthen its presence in India.
- Gujarat Cooperative Milk Marketing Federation (GCMMF), popularly known as 'Amul', plans to invest Rs 5,000 crore (US$ 753.16 million) to establish ten new processing plants as well as expand the current capacity to touch 32 million litres per day (MLPD) capacity by 2020.
- Restaurant search service Zomato raised US$ 110 million from existing investors including Info Edge, Vy Capital and Temasek. Zomato is now present in 22 countries and over 500 cities around the globe.
- Earlier this year, Zomato acquired Urbanspoon, for an undisclosed amount, in an all-cash deal marking its entry into the US.
- Papa John's India acquired the Pizza Corner from Global Franchise Architects for an undisclosed sum. It is now the third-largest pizza chain in India, after Domino's and Pizza Hut.
- ITC Limited plans to invest Rs 800 crore (US$ 120.51 million) to set up a world-class food processing facility in Medak, a district located in Telangana. The company has also formulated plans to enter the dairy market.
- The Ministry of Food Processing Industries has taken some new initiatives to develop the food processing sector which will also help to enhance the incomes of farmers and export of agro and processed foods among others.
- The Government of India has approved the setting up of five numbers of Mega Food Parks in the states of Bihar, Maharashtra, Himachal Pradesh and Chhattisgarh. The Government plans to set up 42 such mega food parks across the country in next three to four years.
- In the Budget 2015-16, a corpus of Rs. 2,000 crore (US$ 301.27 million) was created under National Bank for Agriculture and Rural Development (NABARD) to provide cheaper credit to food processing industry. Excise duty on plant and machinery for packaging and processing has been brought down to six per cent from 10 per cent.
- The Government of India has planned to set up 42 mega food parks across the country in next three to four years.

2.0 Manufacturing of Value Added Dairy Products in India

As already mentioned, India is number one producer of milk in the world consistently for more than a decade and its production is growing at double the rate of a major milk producing countries. Further as the current productivity level of animal is low, it has a huge potential to grow especially when the Government has initiated National Dairy Plan (NDP) with outlay of approximately US$ 3bnto improve the productivity of the animal,availability of the fodder and improving quality of milk on a sustainable basis

2.1 Competitive advantages:

- Abundant availability of raw material - Surplus in Milk Production;

- Trained low cost skilled manpower;
- Comparatively Cheap Raw Material;
- Mushrooming of some indigenous manufacturers of dairy equipment and milk product processing plants;
- Opportunities for exporting to neighbouring countries including Africa;
- Growing domestic consumption for all the dairy and processed food products.

Cost of Milk Production and farmgate prices in India is very competitive as compared to most of milk producing countries in the world which can give an impetus in setting up manufacturing hubs for rolling out dairy equipment as well as manufacturing of value added products. Both dairy equipment and values added dairy products will not only be used for catering domestic demand but can also be exported to Middle East Asian nations and to Africa which are by and large milk deficient areas and where dairy development is getting lot of momentum.

India could prove to be the final destination for the MNCs for tying up with Indian companies in setting up manufacturing hubs under the Make in India Logo which would also pave the way for growth for the food processing and dairy Sector by bringing new technology, processes and product formulations in the country.

2.2 Challenges in milk product manufacturing sector :

- Fragmented milk production
- Lack of cold chain
- Quality of milk
- Development of back end infrastructure for collection of milk

Conclusion

Going forward, the adoption of food safety and quality assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) by the food processing industry offers several benefits. It would enable adherence to stringent quality and hygiene norms and thereby protect consumer health, prepare the industry to face global competition, enhance product acceptance by overseas buyers and keep the industry technologically abreast of international best practices.

Make in India is an ambitious project, but it is one that India desperately needs to kickstart and sustain its growth momentum. With relentless policies towards this end, it is possible to make India the powerhouse of manufacturing sector in the world.

Nutritional Management of Severe Acute Malnutrition

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Malnutrition usually refers to under nutrition which is produced due to deficiency of various nutrients required for growth and development of body. Malnutrition also includes over nutrition. Here we are concerned with under nutrition. In our country under nutrition (malnutrition) is quite common especially in children under five year of age. Some degree of malnutrition is seen in more than 50% children of this age group. According to National Family Health Survey-3, 6.4% children under five years of age are severely malnourished. Such children are easy victims of diseases and death. Mortality in these children is nine times higher than well nourished children. Cause of death in severely acute malnourished (SAM) children is often their compromised immunity and body physiology. Some management practices which are suitable for most children may be dangerous in SAM children and may result in death. With appropriate nutritional management lives of many children can be saved.

Severe Acute Malnutrition (SAM) is defined by very low weight for height/length i.e. z-score below -3SD of the median WHO child growth standards. Clinically it can be identified by presence of severe visible wasting or nutritional oedema or mid upper arm circumference <115 mm. This condition results due to lack of exclusive breast feeding, late complimentary feeding, inadequate feeding in the form of diluted feeds, ignorance, poverty, natural calamities, war and repeated infections.

In SAM children median case fatality rate is high ranging from 24 to 50%. With proper case management fatality rate can be brought down to 7-10 %. The factors responsible for high case fatality are inability to distinguish between acute and rehabilitation phase, fluid over load, use of diuretics and albumin in oedematous children, hypothermia, hypoglycemia, early use of energy and protein rich food and of course infections. Early treatment of anaemia with oral iron is also hazardous in this condition.

SAM children are compromised physiologically and they are in reductive adaptation so they should be treated differently. Their systems slow down and run at very slow pace in order to allow survival on limited resources. Physical activity and basal metabolism is reduced. Fat stores are mobilized then protein is mobilized from muscles, skin and intestine. Haemoglobin production is reduced, children become anaemic in spite of sufficient iron stores. Sodium pump is energy dependent, becomes slower down, distribution of sodium, potassium and water inside and outside cells is disturbed resulting in potassium loss and accumulation of sodium and water in the body. Fluid over load and cardiac failure become evident due to compromised functioning of kidneys and heart. Hypoglycemia results due to decreased supply and increased demand. Hypothermia is produced due to decreased basal metabolic rate and decreased insulating fat. Infections may go unrecognized as usual signs of inflammation may be absent due to compromised immune response.

SAM children should be managed keeping above facts in mind. Their emergency demands should be

met urgently. Hypoglycemia, hypothermia, shock and dehydration if present, should be treated appropriately. Infections should be controlled. As we are mainly concern with nutritional management, our focus will be on requirement of nutrients and micro nutrients, feeding schedule, amount and different feeding formulae, assessment and monitoring.

Nutritional management is the critical part of managing SAM. In acute phase, intake of high calories and protein is avoided. Feeding is started as soon as possible with a formula which provides 75 kcal and 0.9gm protein per 100ml. It is less in sodium and high in carbohydrate. It is called 'starter' diet. It is given in small amount and frequently for first few days. Gradually the amount per feed and time interval per feed is increased. The choice of recipe depends on availability of ingredients, principle behind recipe is that it should contain desired amount of nutrients. For example a recipe prepared with 300 ml of cow's milk, 70gm sugar, 35gm of powdered puffed rice, 20ml vegetable oil and water to make it 1000ml.This will provide 75 kcal and 1gm protein per 100ml. In cases of lactose intolerance, suggested recipe is egg white 50gm, glucose 35gm, powered puffed rice 70gm, vegetable oil 40gm and water to make it 1000ml. This lactose free diet will provide 75 kcal and 1gm protein per100ml. On first day, two hourly feed i.e. 12 feeds in 24 hours, including night feeds, are given. Night feeds are extremely important because SAM child may die due to hypoglycemia if night feeds are missed. After first day increase the amount of feed gradually with three hour interval and then four hourly. To determine the amount of feeds, weight of the child is recorded; amount is determined by consulting diet Reference Card. Usual amount of feed is 100 to 120ml/kg/day in divided doses. If child has severe oedema, true weight may be 20 to 30% less. When the child is stabilized usually after a week, 'Catch up' formula is used to rebuild the wasted tissues. Catch up diet contains 100 kcal and 2.9gm protein per 100ml. Transition from starter feed to catch up formula should be gradual and carefully monitored. For first two days of transition, catch up diet should be given 4 hourly, in the same amount as the last starter diet. On third day increase each feed by 10ml as long as the child is finishing feeds. Continue increasing the feed until some food is left. After transition the child is in rehabilitation phase and can feed freely on catch up diet. Catch up formula can be prepared by mixing 750ml cow's milk, 25gm sugar, 20gm vegetable oil, 70gm puffed rice and water to make it 1000ml. It will provide 100kcal, 2.9gm protein and 3gm lactose per 100ml. Amount of feed is usually 150 to 220ml/day of catch up feed in divided doses. Solid foods can be introduced to older children.

Electrolyte imbalance should be corrected. Potassium 3-4 meq/kg/day should be given. Syrup of potassium chloride containing 20meq/15ml is commercially available. On day one 50% magnesium sulphate IM once , at the dose 0.3ml/kg, is given. Then orally 0.5mmol/kg/day is given for two weeks. Sodium supplement is avoided. Elemental zinc 2mg/kg/day is given. Copper 0.3mg/kg/day is recommended. Elemental iron in the dose of 3mg/kg/day in two divided doses should be given between meals. Iron should not be given in acute phase. Vitamin A orally to all children with SAM, single dose, 50000 IU below 6months of age, 100000 IU between 6 months to one year and 200000 IU above 12 months of age should be given. If there is clinical evidence of vitamin A deficiency, same doses on day 1, 2 and 14 is recommended. Vitamin A,C,D,E and B12 should be given

in twice recommended amount. Folic acid 5mg on day 1, then 1 mg/day should be given.
SAM children less than 6 months of age should be fed with appropriate milk, whenever possible breast feeding or expressed breast milk. For non breast fed babies, cereal free starter diet is preferred. Give supplementary milk feeds if breast milk is not enough.

These children should be kept warm and under close monitoring. Weight should be recorded daily. If weight gain is <5gm/kg/day on catch up feed, it indicates inadequate intake or some underlying infection. Such children should be reviewed thoroughly. Mothers or care takers should be involved in the management process including preparation of food, feeding the child, keeping the child warm, importance of cleanliness etc. Mothers too should be supplemented with rich diet and micronutrients. Sensory stimulation of babies for proper weight gain is also very important. Smile on the face of child and return of appetite are early indicators of improvement.

Source: Manual for Facility based care of Severe Acute Malnutrition, Ministry of Health and Family Welfare, Government of India,2013.

Enrichment of Millet Foods for Dietary Bioactive Molecules Through Fermentation

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Cereals are considered to be rich in phenolics, gamma-aminobutyric acid and carotenoids. They are a very good source of prebiotics as well. In spite of cereals being used as major staple crop in most part of the world, certain pseudo cereals like millets remain underutilised. Of all the millet polyphenols, ferulic acidahydroxycinnamic acid derivative is a ubiquitous and abundantphytochemical found as an integral moiety of plant cell walls. Apart from protecting plants againstpathogen invasion, ferulic acid has a potent antioxidant, antidiabetic and anticancer properties in humans. Due to its boundform, as cross linking molecule with proteins and carbohydratesof plant cell walls, ferulic acid received less attentionfor food application. Realisation that bound ferulic acid can bereleased by processing involving breaking of sugar–phenoliccross linkages ushered in a new area of development. In thisregard feruloyl esterases gained attention for increasing thebioavailability of ferulic acid during food processing. Complete nutritional benefits of these cereals could be utilised by probiotic fermentations having feruloyl esterase activity. The available information regarding the properties and characteristics of feruloyl esterases from probiotics is scarce. Exploration and further research in this direction would lead to the development of probiotic functional foods with integrated feruloyl esterase activity that confer the bioavailability and health benefits of polyphenols (Sakthikumaran and Vijayalakshmi, 2015).

Kambukoozh is a non alcoholic naturally fermented pearl millet porridge, usually consumed as a traditional beverage in rural India for its characteristic taste and aroma and people attribute this product to therapeutic properties such as prevention of constipation.It is prepared by overnight fermentation of pearl millet dough.The unique property ofkambukoozh is that it is fermented twice in its preparation. The second fermentation after cooking of the millet in koozh preparation gives it an excellent source of live bacteria. Presence of ester linked with arabinoxylan-ferulic acid residues in pearl millet would thus indicate naturally fermented pearl millet porridge (Kambukoozh) a good source of Lactobacilli exhibiting high feruloyl esterase activity Feruloyl esterase producing lactic acid bacteria was isolated from pearl millet porridge (kambukoozh) characterized for its probiotic properties with respect to their biological barrier resistance. Among the five feruloyl esterase hyperproducers, CFR5 (Lactobacillus fermentum) was found to tolerate phenol,salt, bile acids and survive in simulated gastro-intestinal passage conditions to about 85%. Ability of the strain CFR5 to -galactosidase (9.29±0.32mol/ml/min)and glutamate decarboxylase enzyme (15.27±0.78 mol/ml/min)as well as invitro cholesterol reducing activity (78%) makes the strain suitable for its utilization in the formulation of functional foods (Sakthikumaran and Vijayalakshmi, 2016).

The formulated millet porridge using the screened isolate, showed an 86% and 30% increase in free ferulic acid and GABA content respectively, thereby improving their bioavailability. Such an increase

of 1-1.5 fold free phenolics in the product compared to commercially available koozh samples with its correlated antioxidant activity substantiated its bioactive properties in terms of its ability to prevent erythrocyte, lipid DNA and Protein oxidation in invitro studies. It was evident that thermal processing of millet such as cooking improved the nutritional potential in terms of protein and starch digestibility by 42 and 120% respectively. Fermentation further retained aminoacids content and significantly reduced antinutritional content such as phytic acid, trypsin inhibitors and tannin content to about 60-80% in these fractions. Feeding the formulated millet porridge to diabetic rats reduced free radical formation to about 80-84% in serum with concomitant increase in antioxidant enzymes, superoxide dismutase, catalase and glutathione peroxidises. Among the three millets (Pearl, Finger and Kodo) studied, functional property of kodo porridge in terms of its free ferulic acid content gives it an advantage to be considered more suitable for the preparation of millet porridge.

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Optimization of the Drying Step for Preparing Tomato Soup Powder

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The objective of the study was to optimize the spray drying conditions for a dried tomato soup product, with the best specific characteristics, from soup premix base. A three-level, three-factor central composite rotatable design was employed for selecting the independent variables i.e. inlet air temperatures (T_{inlet}), X1, (130, 140 and 1501^{0}C); outlet air temperature (T_{outlet}), X2, (80, 90 and 1001^{0}C) and pectin, X3, (1,1.5 and 2 g).The study indicated that an inlet air temperature of 142.27 ^{0}C, outlet air temperature of 80.03 ^{0}C and rate of addition of pectin (1.84 g) were optimum to produce acceptable tomato soup powder with moisture content of 4.01%, solubility of 85.45 %, density of 0.4173 g/ml and wettability of 15.95 s.

Introduction

Consumer demand for high quality, minimally processed products has increased remarkably in recent years. Preferences have shifted towards the fresh, healthy and rich flavoured ready-to-eat foods with an enhanced shelf life. The demand for dried soups is rapidly increasing. . Dehydrated soup mix is a convenient product due to its less volume and long storage life at ambient temperatures. Tomato and tomato-based products are important sources of many established nutrients such as folate, vitamin C, carotein, potassium and are predominant sources of some photochemical that may have health benefits. The health benefits could be enhanced by manufacturing of soup by using whey powder for substituting the corn flour and also substituting MSG with yeast extract for having the umami taste. Spray drying is a gentle drying process and results in minimum los of nutrients. Goula and Adamopoulos (2008) observed that addition of maltodextrin improved powder hygroscopicity, caking, and solubility, whereas it deteriorated slightly its moisture content and density. Sousa et al. (2008) produced spray dried tomato powder with a varying feed flow rate (127-276 g/min), air inlet temperature (200-220°C) and the atomisation speed (25,000-35,000 rpm). All the powder samples became significantly darker and less red with an increase of the variables under study. A low atomisation speed (25,000 rpm) and lower inlet air temperature (220°C) produced the powders with a higher colour index (a/b) and less darkening.

Goula and Adamopoulos (2005) reported an increase in bulk density and solubility while decease in moisture content of powders produced by the two drying systems proved and by using dehumidified air which promoted rapid particulate skin formation. Goula et al. (2004) observed, , that with increases of compressed air flow rate moisture content and solubility always decreased, whereas density increased in a spray drying with cocurrent regime and a two-fluid nozzle atomizer using a pilot scale spray dryer (Buchi, B-191) In this work, spray drying was selected to produce a dry

product from tomato soup base using RSM and wettability, density, solubility and moisture content as reponses.

Experimental design:

A three level, three-factor central composite rotatable design was employed. The independent variables selected were: inlet air temperatures (T_{inlet}), X1, 130, 140 and 1501°C; outlet air temperature (T_{outlet}), X2, 80, 90 and 1001°C; pectin, X3, 1,1.5 and 2 g. Tomato soup powder prepared was then evaluated for moisture (%), solubility (%), density (g/ml), wettability (s).

The variables and their levels were chosen based on the limited literature available on development of a soup powder enriched with microencapsulated linseed oil as a source of omega-3 fatty acids (Rubilar et al., 2012); spray-dried tomato powder: reconstitution properties and colour (Sousa et al., 2008), and influence of spray drying conditions on tomato powder properties (Goula et al., 2004). The actual value of each level is detailed in Table No 1.

Table No 1. Values of independent variables at three levels of CCRD design employed for spray drying.

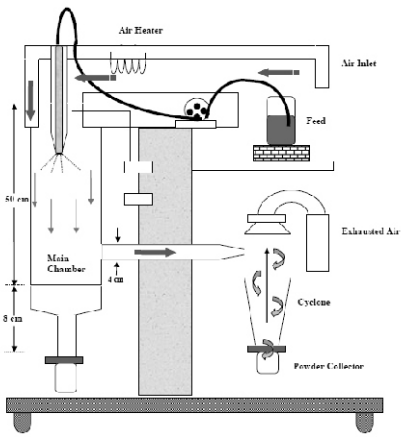
Independent Variables	Code	Levels		
Inlet air temperature (T_{inlet}) °C	X1	130±1 °C	140±1 °C	150±1 °C
Outlet air temperature (T_{outlet}) °C	X2	80±1 °C	90±1 °C	100±1 °C
Pectin (g)	X3	1.0	1.5	2.0

Preparation of liquid soup and procedure of spray drying:

Tomato soup base was prepared as mentioned by Chavan et al. (2015) and constituted 34 g of tomato powder, 42 g of whey powder, 9.87 g of salt, 11.13 g of sugar, 3 g yeast extract, 0.08 g citric acid, 3 g of skim milk powder, 3 g of creamer and 1.02 g flavour. It was evaluated for drying properties after addition of pectin (1, 1.5 and 2 g). Before subjecting the tomato soup base for spray drying the powder was dissolved into distill water in a proportion to achieve a total solids of 30%.

A lab scale spray dryer (SprayMate) of Jay Instruments & Systems Pvt. Ltd., Navi Mumbai, (India) was used for manufacturing of tomato soup powder premix (Figure 1).

Figure 1. Schematic view of Lab scale spray dryer (SprayMate).



The spray drier was of a cocurrent regime and a fitted with a nozzle atomizer. The atomizer had an inside diameter of 0.5 mm and used compressed air with a flow rate that was controlled by a variable area flow meter. Feed was metered into the dryer by means of a peristaltic pump. Inlet drying air, after passing through an electrical heater, flowed concurrently with the spray through the main chamber. The main chamber was made of thick transparent glass and had an inside diameter of 10.50 cm and outside diameter of 12.50 cm and a total height of 58 cm. The distance between the tip of the atomizer and the axis of the side exit tube was 31.50 cm. The bottom of the chamber is cone shaped and makes an angle of 60^0 with the walls. A thick transparent glass cyclone air separator/powder recovery system was used. The cyclone separator had a height of 22 cm, and an inlet of 4 cm diameter tube connected with main chamber. The total length of the glass tube connecting the main chamber and the cyclone separator was 23 cm and the diameter was 4 cm. Dried powder samples were collected in a thick transparent glass bottle from the base of the cyclone with a height of 13 cm and outer diameter of 10 cm. In all experiments the atomizer pressure, the feed rate, the feed temperature, aspirator and vacuum in the system were kept at 2 kg/cm^2, 20 rpm, 320.5^0C, 1400 rpm and -100 mm respectively. During spray drying, the feed solution was held on a hot plate to maintain a constant temperature and was agitated continuously. The variable operating conditions were within the following ranges: inlet air temperatures (T_{inlet}) 130, 140 and 1501^0C and outlet air temperature (T_{outlet}) 80, 90 and 1001^0C. Inlet and outlet air temperatures were read and manually logged from the digital displays on the dryer's control panel with an accuracy of 1^0C.

Analysis of Powders:

Solubility: The solubility of the tomato soup powder was determined by adding 100 g of the powder to 1000 ml of distilled water at 25°C. This solution was stirred for 30 min to allow for complete dispersion which was then centrifuged at 1000 rpm for 10 min, the supernatant was placed in a pre-weighed dish and dried in an oven at 105°C, cooled in a desiccator (to avoid condensation affecting the results) and weighed (El-Tinay and Ismail 1985). The powder solubility was calculated as.

Solubility (%) = m_1/m_0 x 100, where: m_0 was the total weight of the powder (100 g), and m_1 was the weight of the powder soluble in the solution (g).

Density: Hundred millilitre graduated cylinder was weighed with a plastic funnel. Then the powder sample was allowed to run into the cylinder through the funnel up to the 100 ml mark. For loose bulk density the weight of the cylinder with the powder was taken (X g). For the packed bulk density, the powder in the cylinder was tapped gently for 100 times (till a constant volume was reached) and the volume was noted. Loose bulk density in g/100 ml was calculated as follows (Sjollema, 1963).
Density (g/100 ml) = weight of the powder up to 100 ml mark / 100.

Wettability: Wettability of the tomato soup premix was checked in triplicate. 1 g of powder was deposited on liquid surface to become completely submerged in 400 ml of distilled water at 25°C (Reddy, 2014).

Moisture content: Moisture content of tomato soups was determined using oven method (AOAC,

2000). The percentage moisture content was calculated as Moisture content (%) = $W_1 - W_2 / W_1$ X 100; Where, W_1 = Weight of sample before drying; W_2 = Weight of sample after drying to constant weight.

Results and Discussion

The values of the optimization for inlet and outlet air temperature and rate of pectin alongwith the responses including moisture (%), solubility (%), density (gm/ml), and wettability (sec), are delineated in the Table No 2.

Table No: 2. Effect of Inlet air temperature, Outlet air temperature and pectin concentration during spray drying on tomato soup powder.

Trial No	Variables			Responses			
	Inlet air Temp.	Outlet air Temp.	Pectin	Moisture	Solubility	Density	Wettability
1	130	80	1	10.21	69	0.46	14
2	150	80	1	8.34	60	0.42	10
3	130	100	1	10.3	76	0.51	13
4	150	100	1	2.85	70	0.3	11
5	130	80	2	9.1	87	0.42	17
6	150	80	2	8.27	70	0.44	11.5
7	130	100	2	10.1	86	0.49	17.5
8	150	100	2	2.6	73	0.32	11
9	123.18	90	1.5	10.28	84	0.48	17
10	156.81	90	1.5	8.24	82	0.4	12.8
11	140	73.18	1.5	13.22	76	0.51	13
12	140	106.81	1.5	7.94	86	0.38	15.5
13	140	90	0.65	4.65	62	0.37	14
14	140	90	2.34	5.2	78	0.36	16
15	140	90	1.5	4.75	95	0.37	19
16	140	90	1.5	4.88	90	0.38	19
17	140	90	1.5	4.85	92	0.36	19
18	140	90	1.5	4.7	95	0.35	19
19	140	90	1.5	4.8	95	0.35	19
20	140	90	1.5	4.75	90	0.36	19

Moisture content of tomato soup powder:

The measured points for moisture content of the tomato soup powder varied from 2.6% to 13.22% (Table No 2). Among different combinations tomato soup powder prepared by imparting inlet air temperature (150°C), outlet air temperature (100°C), and pectin (2 g) had the least moisture content of 2.6% while the combination of 140°C, 73.18°C and 1.5 g produced tomato soup powder with 13.22% moisture. Regression model fitted to experimental results (Table No 3) had an F-value of

15.29 and was significant ($P<0.0001$), cofiecent of determination (R^2) of 0.93 and Adj R^2 of 0.87 and Adequate Precision of 12.16. Considering all the above criteria, the model (Eq. 3.1) was selected for representing the variation of moisture content of tomato soup powder.

Moisture content = 4.812357 - 1.54361 * A - 1.38757 * B - 0.05162 * C + 1.423963 * A^2 + 1.890653 * B^2 - 0.10869 * C^2 - 1.53125 * A * B + 0.12375 * A * C + 0.09125 * B * C Eq ... (1)

Where A, B, and C are the coded values of inlet air temperature, outlet air temperature and pectin respectively.

Sum of squares for inlet air temperature was more (32.54), suggesting the significant effect on moisture content. Magnitude of p-value (Table No 3.2) indicated that linear terms including inlet air temperature and outlet air temperature, quadratic terms, interaction between inlet air temperature-outlet air temperatures had significant effect on moisture content on tomato soup powder while other interactions were not significant ($P>0.05$). Inlet air temperature and outlet air temperature affected the moisture content of tomato soup powder more positively and is in total conjunction with Goula et al. (2008). They reported that greater the temperature difference between the drying medium and the particles, the greater will be the rate of heat transfer into the particles, providing the driving force for removal of moisture. In the present study role of pectin in decreasing the moisture content of tomato soup powder was less and similar observations in moisture content were reported for maltodextrin as a carrier medium by various scientists. A similar observation was reported by Adhikari et al. (2004) who studied the effect of maltodextrin addition on drying kinetics and stickiness of sugar- and acid-rich foods during convective drying and concluded that the addition of maltodextrin lowers the drying rate. On the contrary, Quek et al. (2007) reported that the moisture content of spray-dried watermelon powder decreased when the added maltodextrin increased. However, in that case, the addition of the drying additive increased the total solids content of the feed and reduced the amount of water for evaporation.

Table No. 3. ANOVA for moisture content of tomato soup powder

Source	Sum of Squares	DF	Mean Square	F Value	Prob > F
Model	154.01	9	17.11	15.29	< 0.0001
A	32.54	1	32.54	29.08	0.0003
B	26.29	1	26.29	23.50	0.0007
C	0.03	1	0.03	0.03	0.8605
A^2	29.21	1	29.22	26.11	0.0005
B^2	51.51	1	51.51	46.04	< 0.0001
C^2	0.17	1	0.17	0.15	0.7046
AB	18.75	1	18.75	16.76	0.0022
AC	0.12	1	0.12	0.10	0.7475
BC	0.06	1	0.06	0.05	0.8122
Residual	11.18759	10	1.118759		
Lack of Fit	11.16451	5	2.232902	483.6611	< 0.0001
Pure Error	0.023083	5	0.004617		
Cor Total	165.2075	19			

A: Inlet air temperature, B: Outlet air temperature, C: Pectin

Solubility of tomato soup powder:

Solubility of tomato soup powder varied from 60 to 95 % (Table No. 2). Tomato soup powder (Trial No 15, 18, 19) prepared by imparting inlet air temperature (140°C), outlet air temperature (90°C), and pectin (1.5 g) had the maximum solubility of 95%, while the combination of 150°C, 80°C and 1 g (Trial No 2) had the minimum solubility (60%). Coefficient of determination (R^2) was 0.584 and the "lack of fit test" was significant and the adequate precision was found to be 3.85 (Table 4). Considering all the above criteria, the model (Eq. 2) was selected for representing the variation of solubility of tomato soup powder.

Solubility of tomato soup powder = 92.93747-3.54134 * A + 2.62270 * B+4.97249 * C -4.15720 * A2 -4.86431* B2 -8.75339 * C2 + 0.875 * A * B -1.875 * A * C -1.875 * B * C Eq ... (2)

Where A, B, and C are the coded values of inlet air temperature, outlet air temperature and pectin respectively.

Table No 4. ANOVA for solubility of tomato soup powder

Source	Sum of Squares	DF	Mean Square	F Value	Prob > F
Model	2127.53	9	236.39	15.79	<0.0001
A	171.27	1	171.27	11.44	0.0070
B	93.93	1	93.93	6.27	0.0312
C	337.67	1	337.675	22.56	0.0008
A^2	249.06	1	249.06	16.64	0.0022
B^2	340.99	1	340.99	22.78	0.0008
C^2	1104.22	1	1104.22	73.77	< 0.0001
AB	6.12	1	6.12	0.40	0.5367
AC	28.12	1	28.12	1.87	0.2004
BC	28.12	1	28.12	1.87	0.2004
Residual	149.66	10	14.96		
Lack of Fit	118.83	5	23.766	3.85	0.0825
Pure Error	30.83	5	6.16		
Cor Total	2277.2	19			

A: Inlet air temperature, B: Outlet air temperature, C: Pectin

According to Equation 2, solubility of tomato soup powder increased with increase in inlet air temperature and decreased with increase in outlet air temperature and pectin concentration. Solubility of tomato soup powder is limited in water as it is rich in liposoluble substances such as the carotenoids. This property is inversely correlated with the moisture content, as lower moisture content favors fast solubilization (Papadakis et al., 1998, Goula and Adamopoulos, 2005). Solubility showed an increase with an increase in inlet air temperature and the reason may be that increasing

the drying air temperature generally produces an increase in particle size, (Papadakis et al., 1998) and so a decrease in time required for the powder to dissolve. According to Potter, (1968) large particles may sink, whereas small ones are dustier and generally float on water, making for uneven wetting and reconstitution. In a previous work, (Goula et al., 2004) where tomato pulp was spray-dried in a standard spray dryer with undehumidified air as drying medium, it was found that the solubility of tomato powder showed an decrease with an increase in inlet air temperature due to the fact that the higher air temperature may have resulted in denaturing more protein and, hence, affected solubility. This variation may be due to the much lower air and, thus, droplet temperatures when using dehumidified air, which reduces the extent of protein denaturation and, thus, its effect on powder solubility. The relationship between dissolution and moisture content is in agreement with the conclusions made by Quek et al. (2007).

Density of tomato soup powder:

Density of tomato soup powder varied from 0.3 to 0.51 g/ml (Table No 2). Tomato soup powder (Trial No 4) prepared by imparting inlet air temperature (150°C), outlet air temperature (100°C), and pectin (1 g) had the least density of 0.3 g/ml while the combination of Trial No 3 and 11 produced tomato soup powder with 0.51 g/ml density. Density of tomato soup powder ranged from 0.35 to 0.38 g/ml when the values of inlet air temperature, outlet air temperature and pectin (Trial No 15-20) were 140°C, 90°C and 1.5 g respectively, which is the ideal for tomato soup powder. Considering the data from Table No. 5, the models (Eq. 4) was selected for representing the variation of density of tomato soup powder.

Density of tomato soup powder = 0.361667 - 0.03914* A - 0.0248 * B - 0.0027 * C + 0.027694 * A2 + 0.029462 * B2 + 0.001178 * C2 - 0.045 * A * B + 0.0125 * A * C + 0.0025 * B * C Eq ... (4)

Where A, B, and C are the coded values of inlet air temperature, outlet air temperature and pectin respectively.

The magnitude of p-value (Table No 4) indicated that inlet air temperature and outlet air temperature (A and B respectively), quadratic terms A^2 and B^2, interaction term inlet air temperature-outlet air temperature (AB) were significant and other interactions were not significant ($P > 0.05$) for density of tomato soup powder. The reason for reduction in bulk density of tomato soup powder may be attributed to high inlet air temperature and is well supported by various scientists that as evaporation rates were faster, products like tomato soup dry to a more porous or fragmented structure. Similarly as per Walton (2000), increasing the drying air temperature produces a tomato soup powder with low bulk density, and the particles are more hollow. Increase in pectin concentration lead to a decrease in bulk density and the reason may be attributed which to the fact that addition of pectin minimizes thermoplastic particles from sticking which in turn produces tomato soup powder with a high bulk density which is in conjunction with the reports of Shrestha et. al. (2007) and Goula et. al. (2004).

Table No. 5. ANOVA for density of tomato soup powder

Source	Sum of Squares	DF	Mean Square	F Value	Prob > F
Model	0.06	9	0.007	15.66	< 0.0001
A	0.02	1	0.020	43.00	< 0.0001
B	0.008	1	0.008	17.26	0.0020
C	0.009	1	0.009	0.20	0.6611
A^2	0.011	1	0.011	22.72	0.0008
B^2	0.012	1	0.012	25.71	0.0005
C^2	0.002	1	0.002	0.04	0.8434
AB	0.016	1	0.016	33.30	0.0002
AC	0.001	1	0.001	2.56	0.1400
BC	0.005	1	0.005	0.10	0.7551
Residual	0.004865	10	0.000486		
Lack of Fit	0.004181	5	0.000836	6.119223	0.0343
Pure Error	0.000683	5	0.000137		
Cor Total	0.073455	19			

A: Inlet air temperature, B: Outlet air temperature, C: Pectin

According to Kwapinska and Zbicinski (2005), particles of skin-forming spray-dried materials often contain air bubbles, which can occur as a result of desorption of air that was initially present in the liquid feed or was absorbed during atomization. Generally, an increase in the volume of trapped air caused a decrease in the apparent density of the particles and this apparent density primarily determines the tomato soup powder bulk density. According to the equation 4.15, the coefficient values of linear terms inlet air temperature, outlet air temperature and pectin (A, B and C respectively) were negative but the contribution of increasing level of pectin in decreasing the density of tomato soup powder was less as compared to the inlet and outlet air temperature.

Wettability of tomato soup powder:

The wettability of tomato soup powder varied from 10 to 19 s (Table No 2). Tomato soup powder (Trial No 2) prepared by imparting inlet air temperature (150°C), outlet air temperature (80°C), and pectin (1 g) had the least wettability of 10 s, while the combination of 140°C, 90°C and 1.5 g (Trial No 15, 16, 17, 18, 19, 20) produced tomato soup powder with a wettability of 19 s. From the data presented in Table 6, the models (Eq. 5) was selected for representing the variation of wettability of tomato soup powder.

Wettability of tomato soup powder = $19.043 - 1.83523 * A + 0.307866 * B + 0.905303 * C - 1.73062 * A^2 - 1.96043 * B^2 - 1.69526 * C^2 + 0.125 * A * B - 0.75 * A * C + 0 * B * C$ Eq ... (5)

Where A, B, and C are the coded values of inlet air temperature, outlet air temperature and pectin respectively.

Table No 6. ANOVA for wettability of tomato soup powder

Source	Sum of Squares	DF	Mean Square	F Value	Prob > F
Model	180.05	9	20.00	15.53	< 0.0001
A	45.99	1	45.99	35.72	0.0001
B	1.29	1	1.29	1.00	0.3397
C	11.19	1	11.19	8.69	0.0146
A^2	43.16	1	43.16	33.52	0.0002
B^2	55.38	1	55.38	43.01	< 0.0001
C^2	41.41	1	41.41	32.16	0.0002
AB	0.12	1	0.12	0.09	0.7618
AC	4.5	1	4.5	3.49	0.0911
BC	0	1	0	0	1.0000
Residual	12.87537	10	1.287537		
Lack of Fit	12.87537	5	2.575074		
Pure Error	0	5	0		
Cor Total	192.9255	19			

A: Inlet air temperature, B: Outlet air temperature, C: Pectin

According to the Equation 5, the coefficient values of linear term inlet air temperature (A) were negative. Wettability of tomato soup powder decreased with increase in inlet air temperature, while increase in outlet air temperature and pectin increased wettability. Sousa et al. (2008) reported the values of 10 to 15 g/min for wettability of tomato powder. Wettability can be improved by increasing the maltodextrin concentration (Bhandari et al., 1993) and by increasing the air exit temperature (Borges et al., 2002).

Compromised optimum condition for phase three of tomato soup powder:

The compromised optimum condition (Table 7) for the spray drying of tomato soup was then determined using Design expert Software (DX 6) and the optimum condition criteria applied for numerical technique optimization were maximum: solubility and density and minimum: moisture and wettability. After analysis of the tomato soup powder according to the formulation given by the RSM it was observed that, there was very less deviation in calculated values of responses and the predicted values (Table 8) for compromised optimum solution i.e. inlet air temperature (142.27 °C), outlet air temperature (80.03°C) and pectin (1.84 g) respectively and hence it is considered as the optimum solution.

Table No 7. Compromised optimum conditions for spray drying conditions and pectin for preparation of Tomato Soup powder

No.	Inlet air temperature	Outlet air temperature	Pectin	Moisture	Solubility	Density	Wettability
1	142.27 °C	80.03 °C	1.84 g	4.01%	85.45	0.4173	15.9585

Table No 8. Comparison of response values given by RSM and actually calculated values

Moisture		Solubility		Density		Wettability	
RSM	Actual	RSM	Actual	RSM	Actual	RSM	Actual
4.12	4.11	85.76	85.66	0.4166	0.4155	15.972	15.934
4.22	4.21	86.88	86.98	0.4154	0.4163	16.033	15.998
4.09	4.08	85.43	85.32	0.4176	0.4182	16.211	16.118
4.11	4.08	85.18	85.10	0.4135	0.4148	15.876	15.765

Conclusion:

A tomato soup premix base using whey powder and yeast extract previously prepared by Chavan et al. (2015) was spray dried able into a powdered product for commercialization purpose. An inlet air temperature of 142.27°C, outlet air temperature of 80.03°C and rate of addition of pectin (1.84 g) were found to optimum to produce acceptable tomato soup powder after spray drying.

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Invited Abstracts

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IAS - BHU

Promising Strategies for Food Processing and Value Addition

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Food processing has long been known as an important tool for providing value to perishable foods. It can be viewed as a technique of manufacturing and preserving food substances in an effective manner with a view to enhance their shelf life, improve quality and provide functionally beneficial foods. Value added products when compared to commodities are more unique in nature, less price sensitive and consumer oriented. With the advent of functional and nutraceutical food concept, the objectives of food processing has changed to some extent in terms of providing value, functionality and nutrition. More focus is now days being laid on how much functionality a value added food product can provide and thus, widening the horizon of food processing industries. Some of the demand drivers for shift in these changes include- Changing profile and tastes of consumer, Product innovation, increased spending on health and nutritional foods, advent of branded food and organized retail and better preservation and packaging techniques.

Value addition of food products is expected to increase from the current 8% to 35% by the end of 2025. Upcoming trends in the field of value addition are the entry of International player such as Del Monte, Walmart, Carrefour etc; New and innovative health claiming products such as Britannia's High fibre biscuits, Aliva snacks, Minute maid from Coca cola, Maggi atta noodles, Multigrain products etc; Development of back end such as contract farming, investment in modern storage and packaging facilities; Emergence of third party logistics. Building awareness, interest and understanding of food production is important to assist consumers in making choices that will strengthen the food system and assist in bridging the agriculture/urban divide. Initiatives that involve youth can increase interest in careers in food production, necessary for ensuring local production for future generations.

In India, about 70% of the food is processed through unorganized sector. The implementation of advanced technologies in the field of food safety, transportation, preservation, processing and storage is low. Improvement in technologies and introduction of non-thermal processing techniques and combined methods of these technologies are the major areas of research in the process and food engineering in order to find their suitability for processing of various food products into value added products. These modern technologies have increased production around the world, allowing for greater access to more and more varied food (and other) products. The MOFPI's Vision 2015 aims to increase the processing levels of perishables from 6 to 20%, to increase the value addition from 20 to 34% and to increase the share in global trade from 1.6 to 3%. Hence, food processing sector in India has a wide scope for increasing the share of functional value added food products nationally and globally. In this direction, the newer approaches for value addition will be highlighted in the presentation.

Studies on effect of gender, age, diet and smoking status on chronomics of circulating plasma lipid components in healthy Indians

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The effect of gender, age, diet and smoking status on the circadian time structure of plasma lipid components was studied under near-normal tropical conditions in 162 healthy volunteers (103 males and 59 females), ranging in age from 7 to 75 years. They were divided into four groups: Group A (7-20 years), Group B (21-40 years), Group C (41-60 years) and Group D (61-75 years), comprising 42, 60, 35 and 25 participants, respectively. Information was available regarding their diet and smoking habits. All participants followed a schedule of diurnal activity from about 06:00 to about 22:00 and nocturnal rest. Blood samples were collected every 6 hours (4 samples) for the determination of T-C (Total Cholesterol), HDL-C (High Density Lipoprotein Cholesterol), PL (Phospholipids) and TL (Total Lipids) concentrations. Data were analyzed by cosinor: a 24-hour cosine curve was fitted by least squares to each individual data series to yield estimates of the MESOR (Midline Estimating Statistic of Rhythm, a rhythm-adjusted mean), and of the circadian amplitude (half the predictable extent of change within a day) and acrophase (a measure of the high values recurring each day). A marked circadian variation was detected for each variable by population-mean cosinor analysis for all age groups. Circadian characteristics (MESOR and 24-hour amplitude of each variable) differed as a function of gender and age, as assessed by the Student t-test comparing males and females and by linear regression assessing changes as a function of age. Results indicated that trends with age were not necessarily linear. In many cases, a second order polynomial provided a better fit, suggesting that maximal (or minimal) values were often reached during adulthood. In order to also determine any effects of diet and smoking, analyses of variance-covariance were applied to the MESOR and 24-hour amplitude of each variable. Main factors were gender, diet, and smoking status; age and age^2 were used as covariates, in keeping with the results outlined above. In each case, the model also included 2-and 3-way interactions between gender, diet, and smoking status. Results related to the MESOR show that 1. The largest effect for most variables investigated was age; the relationship with age was found to follow a parabolic trend reaching maximal values in middle adulthood for HDL-C, PL and TL; T-C underwent only a mild decrease with age. 2. As compared to males, females had a higher T-C, PL, and TL, but a lower HDL-C. 3. Vegetarians had lower T-C, PL, and TL than omnivores. 4. T-C, PL, and TL were higher in smokers than in non-smokers. 5. Hardly any interactions were found between gender, diet and smoking status. Results related to the 24-hour amplitude indicate that 1. The largest effect was age; the relationship with age followed a parabolic trend reaching minimal values in middle adulthood for T-C and maximal values for PL; a linear decrease with age was found for TL, while no statistically

significant change with age was found for HDL-C. 2. It was not affected by diet or the smoking status. 3. Hardly any interactions were found between gender, diet and the smoking status. Results from this investigation suggest that reference values for lipids should account for the circadian variation and that they would best be qualified by gender and age. Smoking cessation should be recommended, and dietary recommendations may be encouraged before initiating drug treatment to lower elevated T-C.

Combating Micronutrient Deficiencies Using Nanotechnology

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Micronutrients (vitamins, minerals and trace elements) are nutrients required by organisms throughout life in small quantities. Micronutrient deficiency has been interested for both developed and developing countries which is a major threat and at least two billion people were reported. Generally, it has been addressed that micronutrient deficiency contributes some non-infectious diseases. Therefore, micronutrient supplementary for food and drinking products have been well interested, due to their potential health benefits human. However, the bioactivity of micronutrient can be decreased by environmental conditions such as light, moisture, oxygen, temperature and pH during food processing and storage -. Nanotechnology is one of the advanced food technology technique which is applied by creating a variety of delivery system for the encapsulation, protection and controlled release of micronutrient -in nanoscale, -. It has been reported that - nanotechnology is considered as a good approach to protect micronutrients from physical and chemical degradation, increase the retention of nutrients, prevent undesirable changes and improve- bioavailability.
Keywords: Micronutrients; Nanotechnology; Bioavailability

Food Detoxification by Probiotics

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The Food and Agriculture, FAO estimates that 25% of the world's food crops are affected by mycotoxins, so, losses of crops and livestock damage is noticed.On the other hand indirect costs to regulate and control programs in reducing the risk of product contamination and diseases in humans and animals spent. Removal of toxins using microbial biomass has been introduced as an inexpensive, new promising method on top of conventional methods for decontamination of food, raw material and concentrated. LABs also have been reported to be able to eliminate, inactivate or

reduce bioavailability of myco-toxins in foods and feed.Also the mechanism of decontamination and the process variables (including the strains, surface charge, pH, temperature, presence of other cations) influencing yield of removal will be discussed.

Keywords: probiotics; decontamination;mycotoxins; Food

Food Processing Methods and Their Microbiological Implications

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This paper provides an overview of conventional food processing techniques in relation with food safety from the microbiological perspective. First of all, it is essential to choose the preservation procedures in function of various factors such as microorganisms of concern, consumer perception and acceptance of food preservation methods and impact on safety and cost. It is important to consider consumer requirements and concerns such as more convenience: ease of storage, satisfactory shelf-life, higher quality, fresher, more natural, nutritionally healthier and safer. Then, the paper reviews the major quality loss mechanisms such as enzymic, microbiological, chemical, physical and mechanical mechanisms. Then, the paper deals with various food preservation methods: inhibition, inactivation and avoidance of recontamination. The next section is focusing on potential hurdles for foods of animal or plant origin to improve the stability and / or the quality of these products. This includes limitations of traditional food preservation methods based on one hurdle. Emerging spoilage and pathogenic microorganisms are dealt with in the subsequent section. Following that, the paper focuses on the traditional food preservation techniques. They include:heat processing, low temperature storage,a_w reduction, pH control, chemical preservatives,fermentation/biopreservatives, modified atmospheres, irradiation and combination processes. The effects of these techniques on the microorganisms associated with food are described in this section.

Osmotic Dehydration for Functional Semi Dried Tomato

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Osmotic dehydration is one of the most popular preservation techniques to prolong food shelf life. Generally, a high moisture fruits which are rich source of nutrients are preserved by osmotic treatment. This technique can remove part of water content of fruit replacing due to osmotic pressure different between fruit and sugar solution. The moisture content is decreased to a level at which the quality of fruit meet consumer acceptance as it is called intermediate moisture food product. Mostly osmotic medium is used high calorie sugar such as sucrose which the diabetes

patient should be avoided.Therefore, an artificial sweetener having low calorie is an alternative source to replace a high calorie sugar such as aspartame, sucrarose, sorbitol, maltitol and etc. However, these low calorie sugar provide higher sweetness value than the high calorie sugar, thus a small amount of low calorie sugar is used for osmotic pretreatment. Therefore, a rate of moisture removal during osmotic process will be different from the hypertonic sugar solution. This research selected 3 types of sugar included sucrarose, maltitol and control (sucrose). The osmotic process took 6 hrof soaking before hot air drying at 60°C to obtain an intermediate moisture dried cherry tomato at the moisture content of 42-43% (wb).It was observed that using low calorie sugar provided as high value of moisture diffusivity as control ($P>0.05$) during osmotic treatment. But low values of solid diffusion were observed compared to control treatment ($P\leq0.05$). Fortunately, a quality of final product after 72 hr of hot air drying using low calorie sugar did not significantly different with control ($P>0.05$) such as color, hardness, shrinkage. Moreover, bioactive compounds of dried cherry tomato such ascorbic acid and antioxidant activity (DPPH, FRAB) did not significantly different with control ($P>0.05$). On the other hands, It was found that flavonoid content of sucrarose-treated tomato was higher than the others ($P\leq0.05$). Therefore, using sucrarose as a low calorie sugar for osmotic dehydration provide functional semi dried cherry tomato which can be eaten as a snack food for health benefit.

Keywords: Low calories sugar, Osmotic hydration, Bioactive compounds, Cherry tomato

Food Hedonics: The Science behind Consumer Acceptability Tests

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Food hedonics can be defined as the pursuit of pleasure through food. Since ancient times we humans have sought pleasure through consumption of food, which is still true today. Consumers play a key and integral role in development of food products by food companies by giving them feedback on the acceptability of their products through affective/consumer testing. Through these tests companies and researchers gain insight into consumer preferences, attitudes, opinions, behaviors and perceptions related to their products. Consumer testing is vital not only for the product development and optimization process, but also for maintaining the product in the market and find ways to improve the product, mainly because of competition. Affective testing can be either qualitative or quantitative. Examples of qualitative tests are focus groups and one-on-one interviews where pre-concepts or behavioral/attitudinal information is gathered. In this review, three quantitative tests will be discussed with an example of each using a food product. The first method that will be discussed is overall acceptability test using a 9-point hedonic scale. The second method that will be discussed is check-all-that-apply (CATA), used mainly for understanding product usage data. The last test that will be discussed is a recent technique where emotions elicited by consumption of food and beverages are studied. It is a method to uncover underlying dimensions related to likes and dislikes of consumers. For the first two methods an example with olive oil will be shown, while for the last test coffee will be used as an example.

Keywords: Food, Hedonics, Consumer, Acceptability

Grain processing in India

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Production of cereals in World is around 2536 million tonnes (MT) and our country produces around 257 MT as on 2012-13. From this 720 MT of paddy is produced in World and India grows around 150 MT. From this, 10% (15 MT) goes for the production of rice products like rice flakes, expanded rice and popped rice. Around 67.5 MT goes for the production of raw rice and balance (~ 67.5 MT) is used for the production of parboiled rice. World rice have been classified into 8 groups based on some of the physico-chemical properties like total and insoluble linear polymer (amylose), equilibrium moisture content on soaking at room temperature, gelatinization temperature, alkali score, properties like viscography while cooking in different types of Amylograph, hardness and softness of cooked rice. Based on these properties, even Indian rice have been classified. Importance of brown rice as well as nutri rice will be highlighted. Parboiling and various methods of parboiling, their advantages and disadvantages will also be highlighted. Medicinal rice Njawara, its various physicochemical properties, protein and lipid profile in comparison with non-medicinal rice will be touched upon. Usage of millets, legumes and cereals in the preparation of multi grain ready to cook and ready to eat snacks/break fast foods will also be touched upon.

Minimizing anti-nutritional factors in food through biotechnological means

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Pulses and millets are known for their varying amount of anti-nutritional factors viz. trypsin inhibitor, phytic acid, saponin, glucosinolic acid. Trypsin inhibitors (TI) are serine protease inhibitors known to inhibit trypsin,that is known to require for the digestion of the food. The high specificity of TI towards trypsin leads to decrease in protein absorption and primary cause for protein energy malnutrition. Several processing methods were employed to overcome these negative attributes. However, over usage of these methods also causes the loss of heat labile nutrients. As a biotechnological approach, we identified a novel property of bacillopeptidase F (Bpr) originated from native isolate of Bacillus subtilis CFR5 for "Inhibitor of TI" (ITI) activity. The relative specificity of Bpr towards TI of soybean was 89 ± 4 % and Kunitz trypsin inhibitor 73 ± 3 %. ITI is produced during the late log phase of B.subtilis CFR5 growth and confirmed its ITI activity through N-terminal sequencing. In addition, we have cloned and expressed the gene encoding for Bpr protein with ITI

activity and evaluated its functional studies. We have also investigated ITI activity in different food system (millets and pulses). It was observed that, TI content was reduced up to 69 ± 4 and 83 ± 6 in millets and pulses, respectively. Simultaneously, we also confirmed our results under in in vivo conditions by reducing pancreatitis effect induced by TI and down-regulation of pancreatitis marker gene expressions. Thus, bacillopeptidase F based enzyme-mediated process is a novel effective method to overcome TI effects that assists in increasing the bioavailability of nutrients (upon trypsin digestion) to a larger extent.

Keywords – Trypsin inhibitor, Bacillopeptidase F, Pancreatitis.

Food Tolerance/Intolerance and Safety Issues

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Food intolerance is the term used to describe a range of responses to food, including allergic reactions, adverse reactions resulting from enzyme deficiencies, pharmacological reactions, and responses to toxic or irritant components of food affects as many as 6% of young children and 3% to 4% of adults Although any food can provoke a reaction, relatively few foods are responsible for the vast majority of significant food-induced allergic reactions: milk, egg, peanuts, tree nuts, fish, and shellfish. One way of distinguishing food intolerance and food poisoning is to consider the former as a defect in the individual and the latter as that of the food. These are abnormal reactions of a person's immune system to foreign but normally harmless substances, such as pollen grains or food constituents. These reactions may often be mediated by immunoglobulin E (IgE), but there are some reactions which are delayed and which do not involve IgE. The most common intolerance linked to an insufficiency of an enzyme is lactose intolerance Approximately 20% of the population alters their diet for a perceived adverse reaction to food, the cause of which might include a verifiable adverse immune response to a food protein (eg, food allergy), a host-specific metabolic disorder (eg, lactose intolerance), a response to a pharmacologically active (eg, caffeine) or toxic (eg, food poisoning) food component, or non reproducible adverse reactions, such as food aversions .Food allergy might result from a breach in oral tolerance to foods while they are being ingested (class 1 food allergy) or might result from sensitization to allergens apart from their exposure to the gastrointestinal tract, recognized instead during respiratory exposure. The symptoms which can occur as a result of reactions to food fall into three main groups: immediate (within 1 h of ingestion); delayed or late (more than1 h after ingestion); and remote. Once the food or range of foods or ingredients has been identified as the cause of intolerance, a diet which avoids these foods must be followed. Various drug treatments such as antihistamines and anti-inflammatory drugs may be used as an adjunct to the diet, depending on the severity of the condition.

Role of Enzyme-infusions in Food Industries

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Enzyme infusion has been defined as the application of exogenous enzymes specifically to alter the characteristic of the intact tissue which include texture, flavor, storage stability and other sensory attributes of the foods. To do so, the driving force is needed to facilitate the entry of enzyme into the tissue of intact fruit and vegetables. Also by the passive osmotic diffusion enzyme can enter into the plant tissues. However the effectiveness of osmotic diffusion is limited by cell-wall porosity and macromolecular size. Some sort of pressure-assisted infusion and vacuum-assisted infusion methods have been focused for fresh tissues of fruit and vegetables.

There are wide applications of enzyme infusion in food industries such as enhancement of mushroom and fruit aroma by lipoxygenase, reducing the bitterness caused due to the high concentration of naringin in grapefruits by naringinase, softening the peel of citrus fruit for removal by pectinases, and many more.
Keywords: Enzyme infusion, osmotic diffusion, vacuum-assisted infusion, pressure-assisted diffusion.

Present State of Art and Recommendations on Bioactive Foods and Herbal Formula in Cancer Prevention

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Herbs are naturally rich in bioactive herbiceuticals with food value to keep energy balance in the body and promise substantial therapeutic value in several diseases. Major herbs have shown active ingredient(s) with cancer therapeutic effects. Herbs are now part of nutrition supplements and Genetically Modified Foods (GMF) is available at nonprescription counters. The self-prescription has increased at large scale in hope of cancer prevention. The government agencies monitor and regulate the herbal or GMF use in cancer prevention and cancer management with update information of GMF side effects and safety to public. In present paper, different herbs and GMF are surveyed with an account of recommended potential herbs and GMF in cancer prevention. The biochemical mechanism of cancer prevention in tissues by herb based GMF is proposed. Broadly herbs are rich in alkaloids, flavones, antioxidants, xanthones, omega-3 fatty acids, vitamins, minerals and fibers. Most of the GMF are derived from herbal plants and they act as regulatory biochemical metabolites either by direct intermediary metabolism or regulating apoptosis pathways and stimulating immunity. Present state-of-art on available herbs, GMF biochemical action is

presented for herbiceutical anticancer formula design. The herbal anticancer formula may be prepared by using: antiproliferative herb extracts combined with GMF including vitamin supplement, lactate dehydrogenase enzyme inhibitor, palliative alkalizing sodium or potassium salts as mixture in liquid, paste or syrup form. Herbiceuticals along with GMF are potential anticancer supplements if used with care and regulatory guidelines.

Nutraceutical and Functional Foods: Current Scenario and Future Prospectus. Special Reference to Fruits and Vegetables for better Health and Wealth

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Nutraceuticals/Functional food science is based on the way in which specific nutrients and food components positively affect target functions (biological responses) in the body for early development and growth, regulation of basic metabolic processes, defence against oxidative stress, physical performance and fitness etc. There is a growing health and wellness consciousness among consumers and an increasing importance given to fitness and healthy lifestyle choices. Nutraceuticals/Functional foods are showing a growing trend and offer immense opportunity for developing countries like India and have the potential to be a major growth driver for the food/agro based industry. The lecture reports the possibilities of value added nutraceutical/functional foods such as fresh/natural juice, fruit concentrates, fruit bars, fruit toffees, RTS-beverages, canned and dehydrated products, herbal jam and jellies, instant vegetable soup mixes, vegetables curries etc. enriches with added nutrients and micronutrients prepared from various fruits and vegetables. India stands second in the world for production of fruits and vegetables, and owing to the remarkable diversity of its geographical conditions, produces a great variety of these invaluable horticultural produce for common use. Conversion of these fruits and vegetables in to various value added nutraceutical/functional foods and utilization of the by-products through application of established technologies will not only ensure better returns to the growers through value addition and bulk reduction but also act as a catalyst for growth of fruit and vegetable processing industry. Formulation of such value added food nutraceutical/functional foods from various fruits and vegetables would definitely cater the need of new blended fruit and vegetables based health food products which are highly nutritious and delicately flavoured.

Potential Application of Breathable Film- An Innovative Packaging Material for Fresh Food Produce

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Packaging of fresh fruits and vegetables is an important issue to preserve their shelf-life and quality and to protect them from early spoilage. Polymeric materials are predominantly used for fruit and

vegetable packaging. Breathable film can be used as an innovative packaging material for maintaining freshness of fresh fruits and vegetable. Blends of a commercial polypropylene (PP), typically as food contact material, with poly (4-methyl-1-pentene) (PMP) may enhance the gas permeation for fresh vegetable packaging. The breathability of PVP-CMC based hydrogel packages enhances the preservation and quality and self-life. It has been also noticed that the PVP-CMC package is more breathable compared to traditional one. Permeability, haze, and transparency of monolayer films produced by casting are mimicking the breathing mechanism of selective films. O_2 and CO_2 permeability can also be increased by increasing PMP content in the blends from 5 to 20 wt %. Different plastic films of biaxially oriented polypropylene (BOPP), biaxially oriented polyethylene terephthalate (BOPET) and low-density polyethylene (LDPE) perforated can also be used by laser technology. Incorporation of certain inorganic filler (i.e. silica based anti-blocking agent used in packaging film) of 0.5wt% into the LDPE films (0.5Si-LDPE) could improve perforation performance for LDPE. It is concluded that perforation by laser is an effective process in developing breathable films with tailored oxygen transmission property for fresh produce packaging.

Keywords: Breathable films; Food Packages, Perforation, Laser Technology

Spices as Functional Food

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Spices have not only long been used in food to increase flavour but also for treatment of different diseases. They are rich in anti-oxidants, different trace elements, vitamins and micronutrients. Like Functional foods, spices are consumed as part of the normal diet and contain biologically active components which offer the potential of enhanced health or reduced risk of disease. Chilli, garlic, pepper, ginger, cardamom and clove are used for treatment of hyper cholesterol and pain related diseases. Fenugreek is used in diabetes. Fennel, Bishops weed, anise is used for treatment of gastric disorders.

Recent studies indicate that capsaicin from chilli, piperizine from pepper, gingerone from ginger, curcumin from turmeric, anethole from star anise, fennel, thymol from bishop`s weed, cuminaldehyde from cumin, etc have a lot of antioxidant properties. Extensive studies from our laboratory have shown that pretreatment of rats with these active principles (isolated from natural spices) protected the pulmonary system against free radical induced damages produced from gaseous irritants like formaldehyde, nitrogen dioxide, sulfur dioxide, carbon tetrachloride, dicholoro methane and smoke. Cigarette smoke in particular, causes clastogenicity and DNA strand breakage in mice bone marrow cells which may be prevented by treatment with some of these compounds. The spice extracts also showed similar type of beneficial effects. Hence, with the increasing pollutants in the earth`s atmosphere, there are a lot of future therapeutic prospects for using spices as anti-oxidants in combating pollution. As spices are a part of daily food in Indian diet, consumption of these as functional food may offer the potential of enhanced health or reduced risk of disease.

Enhancement of the bio-active principle in the spice through biotechnological methods will help in consuming the food as medicine in future.

Utility and Necessity of Food Security and Functional Food Security for Health Promotion

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FAO's latest estimates indicate that the proportion of the world's population suffering fromunder-nourishment is around 12.5 percent, down from almost half of the world's population in 1947.This is a remarkable achievement, yet 868 million people remain hungry, an estimated 2 billionpeople suffer from one or more micronutrient deficiencies and an estimated 1.4 billion people are overweight, of whom 500 million people are obese. The UNO High Level Meetings (2011)reiterates the persistence of undernourishment but too much worried about the emergence of obesity, leading to non-communicable diseases (NCDs); heart attack, high blood pressure, diabetes and cancer which are taking away world resources for treatment, rather than prevention of these problems. This indicates that our approach for management of transition from poverty to affluence and from undernutrition to health promotion, needs modification. Increased food availability has a tremendous impact on undernutrition but due to poor implementation of policies and un-equality in distribution, it continues. The policy makers should understand this issue while developing policies for Food Security for the country, because a wrong policy on quality of foods,prevents undernutrition with simultaneous increase in diseases related to over-nutrition. Hence International College of Nutrition Expert Group advises to develop Functional Food Security by developing Functional Farming and Functional Food Industry, to solve the problem of food availability.Wheat, corn and rice account for three fourths of the world's grain production on which humans are dependent for their food supply. Grains are high in omega-6 fatty acids and carbohydrates and low in omega-3 fatty acids and antioxidants compared to legumes.Fruits, vegetables, nuts and legumes especially green leafy vegetables are considered functional foods because they may be poor in energy but are rich sources of antioxidants, magnesium, w-3 fatty acids, vitamins and carotenoids which appear to be high in the Mediterranean region.There is a need to collaborate all relevant stakeholders; health care professionals, food and Agricultural scientists and in particular Food Industry; to make a concerted effort to close the gaps that remainregarding basic data on diets and functional foods for health promotion.

Food Safety and Standards

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India is the second largest producer of food and holds the potential to be the biggest on the global food and agriculture canvas. The food industry in India comprises food production and food-related processing industries. The food processing industry is one of the largest in India – it is ranked fifth in terms of production, consumption, export and expected growth.The Agriculture sector is the basis for most of the food processing industry and this sector has touched a growth rate of 4.4 per cent in 2012-13. The food processing industry is growing at an annual rate of 13% and for the Indian economy the growth of industry is crucial for the overall growth of the nation. The biggest challenge and national concerned is that the food processing sector is dominated by unorganized players who contribute to 80% of the processed food (by volume), unlike other sectors viz. Pharma, Automobile and IT where over 90% of the sector is under organized sector. There is a conversion of un-organized to organized sector but we still need to cross quite a distance.

Due to rapid growth of food industry,a variety of foods are now available to consumerswhich have created new challenges to the food safety. Food Safety begins with the suppliers of agricultural inputs to farmers and those involved in food production, since materials such as pesticides and veterinary drugs pose different risks and therefore require specific attention. Animal feeding material containing pathogens, including bacteria or toxic chemicals, may also pose specific risks. Agricultural inputs, such as pesticides, fertilizers and veterinary drugs may lead to unsafe levels of the residues of these chemicals in food supply, for instance in red meat and poultry products farmed fish and agricultural crops. Similarly, irradiations, preservatives and other additives added for improving shelf life, flavor, taste, texture of food products poses new risks. Climate change also has its impact on safety of food.

Rapid changes in diets and lifestyles that have occurred with industrialization, urbanization, economic development and market globalization, has accelerated over the past decade. With this the food processing and availability has also expanded. There have been negative consequences of these lifestyle changes as well. Because of these changes in dietary and lifestyle patterns, chronic non-communicable diseases (NCDs) such as obesity, diabetes mellitus, cardiovascular disease and some other types of cancer are becoming increasingly significant causes of disability and premature death. The Food Safety and Standards Authority of India (FSSAI), which has been established under the Food Safety Standard Act, 2006, is responsible for food standards, safety and hygiene control. FSSAI has been created for laying down science based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption. The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.FSSAI being the regulator has initiated notification of standards under FSS Act 2006.

Oral Presentations

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Abstracts
OP - 01 to OP - 17

OP - 01

Development of Curd Fortified by Pineapple and Orange Juice

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Milk and dairy foods are nutrient-dense foods supplying energy and significant amounts of protein and micronutrients. The inclusion of dairy products adds diversity to plant-based diets. On the other hand fruit and vegetables should be an important part of our daily diet. They are naturally good and contain vitamins and minerals that can help to keep us healthy. The present study aimed to develop a curd fortified by pineapple juice and orange juice. Therefore in combination of both the benefits of dairy as well as fruit in a single product can be obtained. Many trials have been done with different proportion of pineapple and orange juice i.e. 5%, 7.5%, 10%, 12.5% and 15%. Initially due to bitterness of the final product, the process was modified by giving heat treatment to pineapple juice at 65°C for 10 min which also support the results of sensory evaluation, rheological characteristics and polyphenols content of pine apple fortified curd.

Finally according to sensory evaluation, curds containing 10% orange juice and 12.5 % pineapple juice are most acceptable. Therefore, curd fortified with 10% orange juice and 12.5 % pineapple juice was selected for further analysis. Total polyphenol content of 10% orange juice and 12.5 % pineapple juice fortified curd are 1.67g GAE/100g and 1.68g GAE/100g respectively. Therefore fortification of curd with orange and pineapple juice will improve its functional quality as well as overall acceptability.

OP - 02

The Influence of Ammonium Sulphate Feeding Time on Fed-Batch Cyanobacterium Nostochopsis lobatus Cultivation and High Value Pigment Production

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Phycobiliproteins are important pigments of cyanobacteria that play role in light capture and biomass production. The objective of this work was to study the influence of ammonium sulphate feeding time on fed batch culture of Nostochopsis lobatus with pH control. Growth of the cyanobacterium was estimated in terms of production of biomass, chlorophyll, phycocyanin and beta-carotene at varying ammonium feeding time (T=6-15 days). N. lobatus was cultivated in 50 cm long minitanks made up of PVC foils, each having total area of 0.125 m^2 at 25°C, 160 µmol photons m^{-2} s^{-1} and initial cell density of 250 mgl^{-1} in a modified Zarrouk medium under pH (8.0) control. The extraction of pigments using ultrasonic bath in the presence of glass beads in biomass (1:5:1) proved

to be the most efficient in comparison to enzymatic treatment. Maximum biomass production (2.91±0.15gl^{-1}), specific growth rate (0.35d^{-1}), phycocyanin (40.64±2.00 mg g^{-1} dry wt), chlorophyll (15.70±0.50 mg g^{-1} dry wt) and beta carotene (3.25±0.2 mg g^{-1} dry wt) were observed at ammonium feeding time of 8 days under pH control. The study has relevance for scale-up production of high value pigments useful in food and neutraceutical industries.

OP - 03

Properties of honey fortified set yoghurt (HFSY) produced by co-fermentation of Streptococcus thermophilus and Lactobacillus bulgaricus

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To study the effect of honey, skimmed milk powder and culture addition at varied ratio of ST and LB on physico-chemical, textural, microbiological and sensory attributes of Honey Fortified Set Yoghurt (HFSY) Milk containing honey (0.536 - 7.464 %), skim milk powder (SMP; 0.536 - 7.464 %) and inoculums at 2 percent of varied Streptococcus thermophilus / Lactobacillus bulgaricus (ST/LB) ratio (0.275/1.725 - 1.289/0.701) were co-fermented. The final products were analyzed for physico-chemical, microbiological, textural and sensory evaluations. The pH varied from 4.06 to 4.88 and the acidity of HFSY as % lactic acid ranged from 0.64% to 0.96%. The total solids of HFSY ranged from 14.65% to 20.83% and the range for syneresis was 29.94% to 52.76%. The HFSY contained 0.68 to 3.1 ×10^{9} c.f.u/ml ST and 0.22 to 2.7×10^{9} c.f.u/ml LB. The hardness (g) of HFSY ranged from 65.42 g to 140.49 g, the cohesiveness: 0.371 to 0.483, the adhesiveness (gs): -184.32 gs to -20.17 gs, the springiness: 0.748 to 0.924 and the gumminess (g): 28.38 g to 50.14 g. Response Surface Methodology was used to search for the optimum conditions. The mean optimum level of 6.55 % honey, 5.17 % SMP and inoculum rate of 2% in a ratio of 1.12:0.88 of ST:LB were acceptable for the production of HFSY.

OP - 04

Bioefficacy of Different Oils against Pulse beetle (challosobruchus chinensis Linn.) in green gram

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The pulse beetle, Callosobruchus chinensis (L) is the major stored grain pest causing substantial loss in the storage. Plant products viz., Mustard oil (Brassica napus), Neem oil (Azadirecta indica), Castor

oil (Ricinus communis), Clove oil (Syzygium aromaticum), Sesamum oil (Sesamum indica), Olive oil (Olea europea), Coconut oil (Cocos nucifera) and soyabean oil (Glycine max L.) were evaluated for their effects on seed damage and weight loss in green gram at different storage intervals i.e., 30, 60, 90 and 120 days after treatment. The losses caused by pulse beetle were estimated by releasing 5 pairs of adults in each jars containing 500g green gram seed. The lowest mean seed damage and weight loss were recorded in mustard oil (4ml/kg) and coconut oil (4ml/kg) i.e., 3.43, 13.59 and 4.12, 8.56 respectively, after 30 days. Similar trend was found even after 120 days i.e., 9.76, 43.58 and 5.76, 16.09 respectively. The next best treatment was sesamum oil (1ml/kg) seed damage and weight losses i.e., 14.65, 10.42 respectively, after 30 days and in 120 days i.e., 47.13 and 26.19, respectively. The rest of the treatment was also found to be significant in reducing the seed damage and weight loss as compared to control. They are in descending order i.e., soyabean oil, olive oil, Clove oil, Castor oil and Neem oil. However, mustard oil and coconut oil provided the best protection of green gram seed against the pulse beetle.

OP - 05
Utilization and Value Addition of Sal (Shorea Robusta) Seeds for Sustainable Livelihood Development of Tribal Mass

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Sal (Shorea robusta) is one of the important non timber forest products (NTFP). About 20-30 million forest dwellers of Orissa, Chattisgarh and Madhya Pradesh depend solely on Sal seeds, leaves and resins for their livelihood. Sal seed contain 34.6% fat, 8.45% moisture and 6% ash. Sal butter is used as cooking oil after refining and a primary ingredient in the food and cosmetic sector, such as oil, soap, cocoa-butter equivalent in chocolate making. At present, Sal fruits were collected, spread on hard ground and set fire for de-winging process. The burning of seeds reduces the moisture content, but increases the free fatty acid (FFA) level, making it unfit for use in the food sector. The tribal receive negligible price per kg of seeds due to the lack of technology for sal seed decortication and processing. A small capacity solar dryer along with a decorticator machine at farm level may help the tribal to generate more income.

OP - 06
Nutritional Significance of Dairy –Coarse Cereals Based Composite Foods

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Coarse cereals are the cheapest source of energy and contain high percentage of calorie and

protein. They are rich in dietary energy, vitamins, several minerals (especially micronutrients such as iron and zinc), insouble diatary and phytochemicals with antioxidant properties. Small millets are a good source of phophorus and iron. Because of these nutritional properties these coarse cereals have of late been also designated as nutricereals. They are rich in compounds that help against several chronic diseases like ischemic strokes, cardiovascular diseases, cancers, obesity and type II diabetes. Among the dairy products whey is and whey nutrients exhibit excellent opportunity for the composite dairy foods. Whey proteins are one of the highest quality food proteins with a high PER (3.6), biological value (104), NPU (95) and highest Protein Digestibility Corrected amino Acid Score (PDCAAS) score that make them an ideal protein source for fortification of wide range of food stuffs. They also provide phenolic compounds include tannins, phenolic acids, coumarins, flavonoids and alkyl resorcinol. Cereal grains contain variety of flavonoids, located generally in the pericarp. Fermented whey cereal based yoghurt/ dahi mixtures play important role in diets of many peoples in developing countries. Cereals/ millets have potential to be incorporated in probiotic dairy foods formulation because of their richness in fibre, oligosachharides, free amino acids and certain minerals which promotes the growth of probiotic bacteria. The substrate comprising underutilized raw materials can substitute as a base for low cost probiotic foods.

OP - 07

Effect of cooking methods on anti-nutritional factors in selected under-utilized green leafy vegetables and their products development

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The present study was focused on the objectives to analyze the nutrient composition and anti-nutritional factors of loni and Pathari leaves, to prepare and evaluate the sensory acceptability of prepared value added products andto study the effect of cooking on anti-nutritional factors. Chemical analysis of fresh Loni (Portulacaquadrifida) andPathri(Boerhaviadiffusa) leaves was done by using standard method of AOAC (2005) andRangana(1986). Anti-nutritional factorsof fresh and cooked loni and pathri leaves - total oxalate was determined by Day and Underwood (1986) and phytate was determined using the method of Wheeler and Ferrel (1971). Two food products were made by incorporating of fresh loni and pathri leaves at 40 percent, 60 percent and 80 percent in 'Crispy leafy vegetable cutlets' and 15 percent, 30 percent and 45 percent in 'Paratha' level refers as T_1, T_2, T_3 respectively and the control T_0 for all the prepared products was made without incorporation. The products were organoleptically evaluated for colour and appearance, body and texture, taste and flavour and overall acceptability using Nine Point Hedonic scale. The data obtained during study were analyzed statistically using analysis of variance, C.D. techniques and t-

test. The nutrient content of Pathri leaves per 100 g were Energy 40 Kcal, Moisture 86.8 %, Ash 2.8 g, Protein 1.95 g, Total Carbohydrate 6.51 g, Fat 1.5 g, Iron16.54 mg, β- Carotene 4100 µg and Loni per 100 g contains energy 24 kcal, moisture 90.68 %, ash 4.4 g, protein 1.4 g, fat 0.4 g, crude fiber 1.6 g, carbohydrate 2.25 g, iron 14.34 mg, β- carotene 3124 µg per 100 g. Oxalate content in fresh Loni (Portulacaquadrifida) and fresh Pathari (Boerhaviadiffusa) leaves, per 100 g are found 48.2 mg and 12.50 mg and Phytate content was found 19.2 mg and 8.08 mg and respectively.After shallow fry, the anti-nutritional content of lonileaves was 14.8 mg phytate and 27.5 mg oxalate;and of pathri leaves 8.4 mg phytate and 18.59 mg oxalate.After deep fry, the anti-nutritional content of loni leaves was 8.5mg phytateand 16.2 mg oxalate; and ofpathari leaves 3.1mg phytateand 10.6mg oxalate per 100 g. Results show that the 60 percent incorporation level of freshloni andpathrileaves for 'Crispy leafy vegetable cutlets' scored highest with regard to colour and appearance, body and texture, taste and flavour and overall acceptability and for Paratha 15 percent loni and pathri leaves was most acceptable. It is concluded that cooking (shallow fry and deep fry) resulted in a significant decrease of oxalate and phytate contents in the selected green leafy vegetables.

OP - 08
Processing and packaging of minimally processed fresh-cut fruits and vegetables

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India is one of the largest producers of a variety of fruits and vegetables in the world. Consumers in the urban markets prefer many commodities in minimally processed form. Some of them are jackfruit, pineapple, melons, pomegranate, papaya, water chestnut, bael, beans, leafy vegetables, shredded cabbage, carrots, moringa etc. Large and medium cities in India have a lot of scope for minimally processed fresh-cut produce as the urban consumers prefer to buy these for convenience, taste, nutrition and eating experience. Scientific studies on processing, packaging, storage and safety of fresh-cut produce has been evaluated for many commodities such as tomatoes, onions, jackfruit, lettuce, melons, eggplant, pomegranate arils, pineapple, apple, lettuce, carrots, broccoli, cauliflower, durian, rambutan etc. Our neighboring countries mainly Thailand and Malaysia have done exceptionally well in fresh-cut produce and the technologies are comparable with those in Europe and America. Fresh-cut processing involves careful selection of raw material variety cultivar, maturity stage, washing, sanitizing, peeling, deseeding, cutting, dicing, slicing, pre-treatment (anti-microbial, firming, flavor enhancer etc.), packaging, storage at appropriate temperature, transportation etc. Maintaining the quality and safety of fresh-cut produce is a challenge as deterioration processes take place due to on-going biochemical and microbiological processes. The combination of sanitizing, packaging environment and temperature are looked into to maximize the quality (nutritional and sensory) and safety of the produce. Active packaging of fresh-cut produce in combination with temperature gives most satisfactory results. Active packaging involves use of oxygen scavengers, ethylene scavengers, humidity regulators (moisture absorbers), release of anti-

microbials etc. This paper discusses the recent processing and packaging technologies for fresh-cut produce. Minimally processed fresh-cut produce has huge market potential and can bring in new opportunities for processing and value-addition for farmers and co-operatives.

OP - 09
Health Benefits of Fenugreek seeds

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Fenugreek is one such plant whose seeds and leaves are used not only as food but also as an ingredient in traditional medicine. Seeds of fenugreek are used as a condiment and as a supplement to wheat and maize flour for bread making and as a constituent of the daily diet of general population in Indian subcontinent. Its leaves are consumed widely in India as a green leafy vegetable and are a rich source of calcium, iron, □-carotene and other vitamins. Fenugreek seeds have high contents of iron (21 mg/100g), calcium (182 mg/100g), zinc (4.9 mg/100g) and other ingredients. It is a potential protein source (20-25%) with high nutritive value. Also, fenugreek seed flour has a great potential, due to its high contents of lysine (5-6%), soluble (20%) and insoluble dietary fiber. Additionally, it also possesses hypocholesterolemic and hypoglycemic properties. Fenugreek has been referred to as a medicinal herb both in Indian Ayurvedic and traditional Chinese medicines. Medicinal uses vary from wound-healing to bust enhancement and, from promotion of lactation in weaning mothers, to its use as a sex stimulant or aphrodisiac.

OP - 10
Significance of Flowers in Food Industry

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With changing life style and increased urban affluence, floriculture has assumed a definite commercial status in recent times and it has emerged as an important agri-business venture. Flower crops do produce many valuable compounds which can be used as dietary supplements. They are the source of pigments, oils, alkaloids, etc. Flower colours mainly fall into three types of classes, namely, flavonoids, carotenoids and betalains which can be utilized as a natural colourants in the food industry being safe as compared to the synthetic colourants. These are also effective food additives. In many industrialized countries with an increasing standard of livings, the health consciousness is on the raise, which drives the market for products beneficial for health. Carotenoids are strong anti-oxidants and when we eat carotenoids such as beta-carotene, lutein and pycopene through food, it protects our body against oxidative and free radical damage as well.

At present, world over the big share of the synthetic colours is gradually being replaced by natural colours which are mostly contributed by the flower crops like marigold, calendula, rose, bougainvillea, chrysanthemum, snapdragon, lily etc. In addition to anti-oxidant activity, beta-carotene converts in our body to vitamin A which increase the efficiency of vision. The most important industrial application of anthocyanin is in the production of wine, where anthocynin analysis has proved to be of great value in differentiating red wine. Gulkand, a value added product of rose, is laxative and is commonly used for flavouring and sweetening PAN in food industry. Pankhuri is used in preparation of cool summer drinks and incense. The food products used as nutraceutical can be categorized as dietary fibre, prebiotics, probiotics, polyunsaturated fatty acids, antioxidants and other different types of herbal/ natural foods. These nutraceuticals help in combating some of the major health problems of the century such as obesity, cardiovascular diseases, cancer, osteoporosis, arthritis, diabetes, cholesterol etc. In whole, 'Nutraceutical' has lead to the new era of medicine and health, in which the food industry has become a research oriented sector.

OP - 11
Review on Nutraceutical Properties of Horse Gram

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The term nutraceutical covers those foods or parts of foods that provide health and medical benefits including prevention, protection and treatment of a disease. In view, of its medicinal synergy, economical status and no side effects, the nutraceuticals foods have gained a wide global interest. Horse gram [Macrotyloma uniflorum Lam. (Verdc.)] is an unexplored food legume and has rich source of protein, minerals, and vitamins. Besides nutritional importance, it has been linked to reduced risk of various diseases due to presence of non-nutritive bioactive substances (phytic acid, phenolic acid, fibre, enzymatic/proteinase inhibitors). To explore and utilise the horse gram, as a source of food and nutraceuticals compounds. An exhaustive and comprehensive literature, are collected, compiled and reviewed from published literatures in journals of national and international repute, as well as conference proceedings, technical bulletins and books. Horse gram has high levels of antioxidant and radical scavenging activities in addition to their traditional role of providing proteins and carbohydrates. These bioactive substances have immense potential for curing varieties of diseases such as common cold, throat infection, fever, urinary stones, asthma, bronchitis, leucoderma, etc. Bowman-Birk inhibitors, the proteinase inhibitors have been identified to treat anti-inflammatory, obesity and several degenerative and autoimmune diseases. HGI-III a Bowman-Birk inhibitors contains seven inter-weaving disulfides and among these seven disulfides, four occur in the trypsin and three in the chymotrypsin reactive site domain, respectively.

OP - 12
Nutraceutical Potential of Mustard Oil

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Fat and oil may improve overall food palatability, flavour and mouth feel of some fried food products but elevated fat diet are dejected because of potential diet connected diseases. The published information on disease preventing food and ingredients (called nutraceuticals) from mustard oil is very limited. Mustard is the most important winter oilseed crop of north region of India. Because of its characteristic taste and good stability, mustard has long been one of the most desirable edible vegetable oil. Among the vegetable oils, mustard oil has the lowest amount of saturated fatty acids, making it safe for heart patients and sufficient quantities of the essential fatty acids, linoleic and linolenic acids which cannot be synthesized by the body but have structural and functional roles in all cells of human body. The relatively high level of oleic acid and the favaourable balance between linolenic and linoleic acids is present in mustard oil. It also contains high amount of erucic acid and glucosinolates which are nutritionally undesirable. The consumption of large amount of mustard oil has been discouraged due to the suspected involvement of erucic acid in heart diseases, carefully conducted studies have revealed that at the present level of consumption in India, there was no need for panic. Studies showed that erucic acid was found to be harmful to male adult rats in high doses but had no harmful effect on female rats and human beings. High amount of erucic acid has been reported to impair myocardial conductance, lipidosis in children and increased blood cholesterol. Meanwhile, epidemiological studies suggested protection against cardiovascular diseases in regions where crude mustard oil was used. Further, cleavage products from the hydrolysis of glucosinolates are detrimental to animal health especially in non-ruminants such as pigs and poultry, as they reduce the feed palatability. However, in human beings, glucosinolates and their derived properties have been reported to have health beneficial effects by reducing the risk of certain cancers. Mustard oil has high level of antioxidants (α-tocopherol, β-carotene, phenolics and Vitamin C) which retards growth of free radicals mainly responsible for diseases like cancers, cardiovascular diseases and ageing. It may be said that it is one of the safest oils for human consumption. The medicinal properties of mustard oil are due to presence of variety of phytochemicals imparting the effect. Hence, this available information attempts to highlight the potential of mustard oil as a source of nutraceuticals in developing highly valued functional food products.

OP - 13

Impact of Different Packaging Material on Storage Stability of Malted Wheat Flour Based Weaning Food

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Packaging systems are designed to sustain nutritional as well as functional properties of food at the time of consumption.The aim of the study was to find out the effect of different packaging material on storage stability of malted wheat flour based weaning food.Malted Wheat Flour (MWF), linseed, carrot,Chickpea and potato flour were used in different ratio. The flour was mixed in different ratio and have four treatments namely T_1, T_2, T_3, T_4 respectively. The different treatments were subjected to organoleptic analysis for testing various sensory attributes via nine point hedonic scale.Total Plate Count (TPC), yeast and mold count of the weaning foods were examined according to BAM (1998).Different treatments of weaning food were packed in HDPE, LDPE and Polyproplene to find out the storage stability. The physicochemical parameters were determined at 0 day and also periodically evaluated after 15 days up to 90 days at ambient storage temperature.ANOVA was used for the statistical analysis. Results revealed that ash, protein, and fat content of weaning food packed in HDPE, LDPE and Polypropylene decreased with increase in storage period. HDPE is a better packaging material in comparison to LDPE and Polypropylene as the nutrient loss was insignificant in weaning food packed in HDPE.

OP - 14

Edentulism a disaster state and nutritional needs of elderly

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Enjoyment of foods is one of the goods of life and is an indicator of quality of life. Edentulous patient is the one who has lost all the teeth and is struggling to eat. Loss of teeth is closely associated with malnutrition as patient start to use foods which are soft in consistancy and easy to ingest. They start avoinding fruits, raw vegetables, whole grain, fibrous meat or partially cooked foods due to difficulty in chewing and start ingesting softer diets like porrage, bread wet in tea or milk, Khichrhi, canned foods, pastries, grond beef etc. Intake of selective diet by the edentulous elderly is the biggest worry because he quits all the hard stuff. Decreased chewing ability, indigestion, worry of getting chocked due to decreased swallowing and declined health of mucous membranes leading to further irritation by the dentures. Malnutrition is generally first reflected in oral cavity in the form of drieness, change in color, texture or irritated tissues, thus, dentists can be of help in detecting the

malnutrition state and its management. Advancing age; degenrative diseases like depression, diabetes, hypertension, cardiac problems; loss of spouse, social isolation, food availability in time and financial pro blems compromise the general health of the elderly who is already compromised due to edentulism and malnutrition. It has been observed that total intake of calories, Vitamin B6 & B12, Vit A, Vit C and folic acid were quite low in case of edentulous elderly. Replacing the dentures with osseointegrated implant supported dentures can significantly help the patients by increaing overall masticatory efficiency. Objective of this presention is to highlight the problems of elderly, their nutritional needs and various diets advisable to edentulous elderly people.

OP - 15

Influence of Diet on periodontal diseases

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Gingivitis and periodontitis are the periodontal diseases that are caused by the specific group of microorganisms residing in the dental plaque. Accumulation of dental plaque is influenced by the physical nature of diet & frequency of meal thereby affect on the periodontium. Dietary components like type of carbohydrate and amount also influence the attachment and growth of types of oral microorganisms on hard surfaces in oral cavity i.e. teeth, denture or dental implant which affect the progression of periodontal disease. Nutritional deficiencies mainly vitamins and proteins produce changes in the periodontium in such a way that small amount of dental plaque can be pathogenic and aggravate the destruction of periodontal tissues. Theses nutritional deficiency directly does not lead to gingivitis and periodontitis but modulates the response of dental plaque on periodontal tissues. Among the vitamins, vitamin c has the great impact on the periodontium and deficiency results in the bleeding & swollen gums, altered collagen synthesis, impaired wound healing. Protein deficiency leads to altered synthesis of collagen and leads to lack of integrity of periodontal tissues that affect the progression of periodontal disease. The objective of the presentation is to discuss the changes in the periodontium due to nutritional deficiency and importance of diet in minimizes the destruction of periodontal diseases to maintain the periodontium in healthy condition.

OP - 16

Consumer's perception of branded milk and milk products in Varanasi, India

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India is the largest milk producer in world accounting around 18% of world's total dairy production.

Milk production during 2013-14 was 137.6 million tonnes with an annual growth rate of 3.9% and the per capita availability of milk was around 302 grams per day. Among states, Uttar Pradesh is the leading milk producer, followed by Rajasthan and Gujarat, whereas the per capita demand was maximum in Punjab followed by Haryana in 2013-14. Out of total milk produced in the country about 70 per cent is used in its raw form while rest is processed into dairy products. Maximum milk is processed into curd followed by ghee and milk powder. The dairy cooperatives procured about 12.5 million tonnes of milk, registering a growth of 2.5 per cent. Liquid milk marketing by the cooperatives stood at 11 million tonnes i.e. an average of 34.2 million kg of milk per day. Sale of liquid milk was 29.4 million litres per day in 2013-14, showing a growth of 5.8 per cent. Consumer's perception is a very important factor influencing their decision. Thus present study was conducted in BHU main campus, Varanasi, Uttar Pradesh with an aim of knowing consumer's perception of branded milk. Total population residing in the main campus was divided into teaching and non-teaching group, of which 25 teaching and 30 non-teaching respondents were selected randomly. Three retailers selling milk and milk products in the campus were also selected for the study. 5 point Likert scale was used to complete the objective. The result shows that 56% of the respondents were consuming unpackaged milk, 42% were consuming both Packaged and unpackaged milk and only 2% were consuming packaged milk only. Freshness, better quality and no added preservatives were the main reasons for preferring unpacked milk. However in case of unavailability of unpacked milk Amul and Sudha were the most preferred brands. BHU dairy milk was most preferred by the respondents as it has guarantee of no adulteration, while due to unavailability of BHU milk service to some of the respondents they purchases it from outside local milkmen. Among packed milk Amul was the most preferred brands by the respondents because of its brand name, freshness and taste. Average milk consumption ranges 1-2 litres per day and its price ranges 25-35 Rs. Per litre. The respondents were currently paying a price of Rs. 41 per litre (Teaching) and Rs. 36 per litre (Non-Teaching) and can shift up to Rs. 50(Teaching) and Rs. 40 (Non-Teaching) if good quality milk will be provided.

OP - 17

Influence of some plant based edible coatings on postharvest quality and shelf life of tomato (Lycopersicon esculentum L.)

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Tomatoes are highly perishable but became necessity as common vegetable in every kitchen. About 40-100% may loss during its transportation and marketing within a week. Keeping this in mind, the present experiment was conducted at Horticultural Research Laboratory, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow, U.P. India during the year 2015 with an aim to study the shelf life and post harvest quality of tomato fruits under

minimal processing with edible coatings. Tomato fruits were treated with eight treatments i.e. T_0 - Control, T_1- EC + $CaCl_2$ @ 1%, T_2 - EC + Ethrel @ 1000 ppm, T_3 –EC+ Na- alginate @ 1.5%, T_4–EC + Na-Benzoate @ 0.1%, T_5 –EC + KMS @ 0.1%, T_6 –EC + Aloevera extract and T_7- EC + Okra extract supplemented with 2% chitosan in each treatment solution. Edible coating (EC) was prepared with carboxymethyl cellulose (1%), ascorbic acid (0.5%), glycerin 0.2%, Calcium chloride (0.2%) and pH was adjusted to 4.0 with citric acid. The observations were recorded at 0, 5, 10, 15, 20, 25, 30 days of storage. The study revealed that the quality parameters was improved continuously upto 15-20 days of storage in all the treatments except control and it was deteriorated thereafter. However, among the all treatments, application of EC + $CaCl_2$ @ 1% + chitosan @ 2% i.e. treatment T_1 was found to be the best having potentiality to preserve valuable attributes like TSS, total sugars, reducing sugar, non reducing sugar, vitamin C for increasing shelf life of tomato fruits showing minimum loss of weight and ripening percentage.

Young Scientist Award

International Conference on Recent Advances in Food Processing and Biotechnology - Centre of Food Science and Technology, I. Ag. Sc., BHU, Varanasi - April 5-6, 2016

IAS - BHU

Abstracts
YSA - 01 to YSA - 33

YSA - 01

Anthocyanin rich purple potato chips: An innovative fusion product with enhanced functionality

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Enriching potato chips with bioactive anthocyanin pigments is an innovative and non-transgenic approach of enhancing antioxidant activity of processed potato products. Acylated black carrot anthocyanins (BCA) known for their remarkable heat stability and GRAS status can successfully replace synthetic pigments in foods. Having high α-glucosidase inhibitory activity (GIA), the BCA will not only impart an attractive purple color to potato chips but also help in managing Type-2 diabetes. A protocol for developing low fat potato chips using microwave processing was standardized and further studies for enhancing its functionality are being explored. Thus, the present study was designed to explore the potential of infusing BCA into potato matrix to transform hitherto unhealthy image of potato chips into a low fat functional product by developing an innovative fusion product. Potato chips weremade by a commercial processing variety K. Chipsona-2.Black carrot juice (cv. Pusa asita) obtained after various pre-treatments was used for infusion of anthocyanins at atmospheric pressure. The effect of degree of blanching; anthocyanin concentration and infusion period on the anthocyanin content in raw and microwave processed potato chips was determined. Blanching time, length of infusion time and concentration of anthocyanin in infusing medium ($p < 0.05$) was found to be the major factors influencing the infusion process. Prior blanching (85°C at 1min), significantly reduced the infusion time by 1.8 to 2 fold.Results suggest that, it is feasible to infuse anthocyanin content ranging from 200- 500 mg/kg, depending upon the functionality required in the end product. Colour attributes in terms of (RGB) 174, 56, 114 further confirms, strong purple colour. Infusion of anthocyanin and phenolics, increased antioxidant activity in potato chips and imparted α- glucosidase inhibitory activity seems an innovative way of transforming, high starchy, low antioxidant image of potato into a health product.

YSA - 02

Sensory and Nutritional Evaluation of Milk based Weaning Food

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The weaning period is crucial for the maintenance and continued growth and development of the child. Weaning foods should have good acceptability by both the mothers/care givers and the infants.

The main objective of the study was to formulate nutritional rich composite blend, based on locally available ingredients by blending with milk to produce a highly nutritious weaning food to reduce the malnourishment among. Four different treatments were prepared using the locally available (Wheat flour, Chickpea, Potato, Carrot, linseed and milk) ingredient namely T_1, T_2, T_3 and T_4 in different ratio. The different treatments were subjected to organoleptic analysis for testing various sensory attributes via Nine Point Hedonic Scale (Srilakshmi, 2007). Nutritional analysis was done by using standard method of AOAC (2005). Statistical techniques Anova and Critical Difference were used for analyzing the data. The result shows that T_2 was liked very much while T_1, T_3 and T_4 were moderately liked by the panel of judges. The result shows the significant ($P<0.05$) difference between the overall acceptability of all the treatments. Energy, Protein, fat, ash, Moisture, Carbohydrate, Iron and of formulated weaning foods was higher. Thus it was concluded that formulation of the milk-based weaning food is a good approach to alleviate the malnutrition associated with conventional stipulated cereal-based weaning flour mixtures given in liquid-gruel form.

YSA - 03

Isolation and Characterization of Volatile Compounds from Aromatic and Non-Aromatic Rice Cultivars (OryzasativaL.) of India

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Rice (OryzasativaL.) has become a major dietary component of people'sdietin many countriesand importance lies in its high consumption mainly in Asia and Africa and less in the European Union which together provides more than 1/5th of the calories consumed worldwide. This staple food also possesses the main source of calories and protein which provide 700 calories/day/person for about 3,000 million people of the world's population (Vlachos and Arvanitoyannis, 2008).

Aroma quality of rice is a major characteristic which increases the value of rice in international market (Nayaket al., 2002). Indian sub-continent is a home for aromatic rice diversity (Bisne and Sarawgi, 2008). Over the past 20 years, the demand of aromatic rice have dramatically increased for special purpose (Meullenetet al., 2001; Sha and Linscombe, 2004). India is the fourth major exporter of rice after Thailand, Vietnam and USA. Traditionally, many cultivars of aromatic and non-aromatic rice are grown by Indian farmers. These cultivars may have the global impact in international market likeKhaoHawm (fragrant rice, national pride of the Thailand), KDML 105, Jasmine and Siamati rice from Thailand; Nang Thom Cho Dao, Tam Xoan and Nep HoaVang from Vietnam; Della, Texamati and Kasmati from USA; Bengawan Solo from Indonesia; Miyakaori from Japan; Super Basmati, a premium variety from Pakistan; Sadri, Champa, Gerdeh from Iran;Chinigura, Kalijira, and Kataribhog from Bangladesh; and Bahra from Afganistan.

More than 300 aromatic rice verities have been documented so far. Compounds like hydrocarbons,

alcohols, aldehydes and esters have been identified from various cultivars of aromatic and non-aromatic rice. Yajimaet al. (1979) identified α-pyrrolidone as a key odorant in Katorimai (scented rice—O. sative japonica) and noted the presence of indole. Buttery et al. (1988) listed 64 volatile compounds known in rice and identified seven compounds with low odor thresholds: octanal, nonanal, (E)-2-nonenal, decanal, (E)-2-decenal, (E,E)-2,4-decadienal, and 2-acetyl-1-pyrroline (2-AP). The latter compound, 2-AP, is the major odorant contributor of scented or popcorn rice. Although present in most rice at the 1–10 ppb level, in scented rice it can be found at concentration levels in excess of 2 ppm (Petrovet al., 1996). Widjajaet al. (1996), in a comparative study of non-fragrant and fragrant rice, identified (E)-2-decenal, (E,E)-2,4-nonadienal, and (E,E)-2,4-decadienal as having a "waxy" aroma. These three lipid oxidation products are also found in glutinous or waxy rice and contribute to its distinctive odor (Grimm et al., 2000). A particular molecule i.e. 2-AP has been shown to be the predominant odour active compound in aromatic rice at concentrations of several hundred parts per billion (ppb) that emitting a popcorn-like aroma and is present in all parts of the rice plant except roots (Yoshihashiet al., 2002) and also present in non-aromatic rice (Buttery et al., 1983; Grimm et al., 2001; Park et al., 2010). However, chemical characterisations of volatile compounds were attempted only in few popular long-grain varieties. There are a number of small grain varieties and land races like Bindli (Indian variety) which are far more aromatic than the other popular varieties.

Based upon the literature available on chemistry, isolation, identification and quantification of volatile compounds in aromatic and non-aromatic rice cultivars varies significantly among themselves such as some are just a trace of aroma, some moderate while others are highly aromatic rice. The aroma strength with other biochemical and structural characteristics viz. excellent evaluations of the milling, physical, thermal, chemical, cooking quality and organoleptic etc. makes difference in aspects of economical values. Aroma strength is found to be the major characteristics among them imparting major sensory differences among the cultivars. Although a set of standards data on chemistry, isolation, identification and quantification of volatile compounds, biochemical and structural characteristics is available for different internationally recognized rice cultivars. There are extensive research works on extraction; identification and quantification of the volatile compounds that characterize rice aroma have been found.But,in India very few researches have conductedon the pregestigous and traditional cultivars of aromatic and non-aromatic rice have been completed. It is, therefore, considered that the indogenious cultivars of India need attention for excellent evaluations of aroma in order to enhance the accuracy and find out the optimum proportions for isolation and characterizations of major volatile compounds and their relative proportion that's responsible for pleasant smell of rice cultivars for improving quality in high yielding varieties.

Extraction of volatile compounds from rice has been studied by using different isolation techniques. The works of many researchers for details of each analytical technique, used as extraction method coupled with Gas chromatography–mass spectrometry (GC-MS) in the present study have been taken as they are: 1) Simultaneous distillation extraction (SDE), 2) Solid phase micro extraction

(SPME), and 3) Supercritical fluid extraction (SFE)with CO_2. Since, rice are characterized by certain unique features, discussed above, the present research work entitled "Isolation andCharacterization of Volatile Compounds from Aromatic and Non-aromatic Rice Cultivars (OryzasativaL.) of India" was undertaken with the specific objectives: 1) To study the physico-chemical, milling and nutritional characteristics of different aromatic and non-aromatic rice cultivars; 2) Selection and Standardization of extraction method(s) for volatile compounds from different aromatic and non-aromatic rice cultivars; and 3) To identify and quantify the extracted volatile compounds from aromatic and non-aromatic rice cultivars.

YSA - 04
Milk Derived Bioactive Peptides: Bioavailability and Transepithelial Transport

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Milk is one of the major source of bioactive peptides and most elaborate studied human foods. Bioactive peptides derived from milk can be exploited as future drugs and neutraceuticals. Bioactive peptides have been defined as specific protein fragments that have a positive impact on body functions or conditions and may ultimately infiuence health. Upon oral administration, bioactive peptides, may affect the major body systems. These beneficial health effects may be attributed to numerous known peptide sequences exhibiting including immunomodulatory and osteogenic activities. Osteoporosis is a systemic and silent skeletal disease which is characterized by low bone mass density (BMD) leading to increased risk of fracture. One of the future therapeutic approach involves supplementation with bioactive peptides.

The objective of work was to study bioavailability and transepithelial transport of the peptide under investigation (Peptide C: VLPVPQK, Casein derived) and β casomorphins as they could be exploited for treatment of bone related disorders like osteoporosis. Bradykinnin was taken as positive control. β casomorphin is one of the most important and extensively studied milk derived peptide peptide. The osteogenic potential of β casomorphins evoked an interest in their bioavailability and transepithelial transport related analysis as they could be exploited for treatment of bone related disorders like osteoporosis. Simillarly an osteogenic ACEinhibitory and antioxidative peptide was derived from casein hydrolysates (Peptide C). In order to make the study more validatory Bradykinin, which exhibits remarkable resistance to intestinal degradation and have already been extensively studied in terms of its bioavailability and transport was selected as a positive control.

The peptides used for present investigation were Peptide C (VLPVPQK), BCM-5 (YPFPG), Bradykinnin (RPPGFSPFR) (Technoconcept Pvt. Limited) Caco-2 cells were obtained from the NCCS pune. Cells were cultured in growth medium containing DMEM supplemented with 10% FBS, 2 mmol/L L-Glu and antibiotics (Penicillin 100 U/ml, Streptomycin 30 µg/ml, Amphotercine 25 µg/ml). They were incubated at 37°C in humidified atmosphere containing 5% CO2. The monolayer became

confluent 6-8 days after seeding $1x10^6$ cells/flasks($25cm^2$ flasks), and the cells were subcultured at split ratio of 1:3 by trypsinization (0.5% trypsin and 0.05% EDTA). The medium was changed every second day. The cells used in this study were at passages 35-45. The integrity of the cell layer was evaluated by microscopic examination and Phenol red test spectrophotometrically at 558 nm.

Transwell Permeable(corning) supports with smallest pore size of 0.4µm Polyester membrane 24mm insert, 6 welled polystyrene plates from Corning were used for peptide bioavailability and transport studies. According to the cell density of the culture suspension, 1ml of the cell suspension having 3×10^4 cells were added to the apical chamber of each well along with 1 ml of growth medium such that the total volume was 2 ml per well. Likewise, 2 ml of the growth medium was added to the basal chamber. The medium was changed every alternate day till usage. Culture attained confluence within four to six days and were kept for ten more days for differentiation.

After checking the leakage of phenol red through intercellular spaces the wells were given three washings with 2 ml HBSS on both apical and basal chambers. The concentration studied were 100, 200, 300, 400 and 500 µg/ml in respective wells for 60 minutes and for saturation time the final concentration of the solution on apical chamber was 400µg/ml in each well while the plate was incubated for different time period i.e. 0, 5, 10, 15, 30, 60 and 90min at 37°C, 5% CO_2. The integrity of the cells was again checked with phenol red test.

The final concentration of the solution on apical chamber was 300µg/ml for peptide C (saturation concentration) while 400µg/ml for BCM-5 and Bradykinnin . The plate was again incubated for 60 min at 37°C, 5% CO_2. 500 µl of supernatant was collected from both apical and basal chamber at 0 min while 1.5ml of supernatant was collected at the end of the experiment from both apical and basal chambers. The integrity of the cells was again checked with phenol red test.

After checking the Integrity of the transwell plate using the phenol red test, the wells were washed three times with 2 ml HBSS(sigma) on both apical and basal chambers. Finally each well was pre incubated with 2 ml HBSS/ HBSS with 0.05% DMSO, as required, on both apical and basal chamber for 30 min at 37°C, 5% CO_2. Except for control well, a portion of HBSS/HBSS with 0.05% DMSO (SRL) was replaced with peptide solution or peptide solution with inhibitor such that the final concentration of the peptide C was 400µg/ml on apical surface in each well (including one control well) and having 1µM wortmannin(sigma), 10 µM Gly-Pro(sigma) and 1 µg/ml cytochalsin D(sigma) in three different wells used for trans epithelial transport studies. The plate was again incubated for 90 min at 37°C, 5% CO_2, 500 µl of supernatant was collected from both apical and basal chamber at 0 min while 1.5ml of supernatant was collected at the end of the experiment from both apical and basal chambers. The integrity of the cells was again checked with phenol red test.

The supernatant collected from the apical and basal chamber were frozen and freeze dried (lyophilized) for making five to ten fold concentrated sample solution as due to a relatively low sensitivity of identification of the HPLC method using a liquid chromatography equipped with 2487 dual λ absorbance detector and a dosing loop with capacity of 20 µL, the samples prepared as mentioned above were analyzed by RP-HPLC. Standards for Peptide C (VLPVPQK), BCM-5 (YPFPG),

and Bradykinnin (RPPGFSPFR) were made from 40 µl stock solution of conc. 20mg/ml (400µg) following serial dilution of 1:2.

All results were expressed as mean values ± SEM and statistical significances were assessed using ANOVA. Differences were considered significant at $p < 0.05$. Analyses were performed using the GraphPad Prism v software (GraphPad Software Inc., San Diego, CA, USA).

Comparative analysis among β casomorphin-5, Bradykinin and Peptide C showed that bioavailability of hydrolysed osteogenic fragment of Peptide C was maximum (1.16%) followed by intact peptide C (1.07%) while it was minimum for intact BCM 5 (0.03%) and the main route of transepithelial transport for BCM 5 intact, broken and bradykinnin was observed to be transcytosis while for peptide C intact and broken, it was depicted to be either through PepT1 like transporter/ SOPT2 oligotransporter The significantly high bioavailability of the Osteogenic Peptide C establishes its importance as a neutraceutical while the extraordinary fact that the peptide is transported across the epithelium through receptor mediated transport despite being a heptapeptide evokes an interest in understanding other novel receptors (SOPT2) which might be involved in transports. Thus the studies will lead to future exploration with respect to product formation and better physiological availability.

YSA - 05

Process development for complementary food based on milk and cereals.

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Complementary food can be defined as nutritious preparation given to children from 6 months onwards to supply the vital nutrients required for growth and development. Nutritional deficiency during initial years of life leads to reduced activity in children.

1. To optimize the formulation and processing parameters for developing complementary food.
2. To characterize the developed complementary food for sensory, physicochemical and nutritional characteristics.

A blend of whey and skim milk in the ratio of 4:1 was standardized as a base for the complementary food. For production of pearl millet flour, grains were soaked, germinated, dried, devegetated, roasted and milled. The germination conditions were optimized based on reduction in phytic acid levels and increase in amylase activity during germination. After germination, roasting and milling was carried out to obtain the flour. Response Surface Methodology (RSM) based on Central

Composite Rotatable Design (CCRD) at five different levels was adopted for three variables viz. pearl millet flour, barley malt extract and maltodextrin to optimize the formulation for complementary food. A germination period of 48 h was found optimum, as it reduced 63.56% phytic acid level with corresponding amylase activity of 0.03 mg starch hydrolyzed per sec per g of pearl millet.Optimized product was prepared by mixing optimized levels of ingredients followed by heating at 80 ^{0}C for 15 min and drying in tray dryer and spray dryer. The tray dried complementary food contained 1.24, 12.82, 2.02, 0.86, 2.64 and 81.28 % of fat, protein, ash, crude fiber, moisture and carbohydrate by difference respectively and 1.06, 36.86 and 1.51 mg per 100 g of iron, calcium and zinc respectively. The corresponding values in the spray dried product were 0.96, 12.83, 2.09, 0.84, 2.57 and 81.55 % and 2.58, 38.56 and 1.40 mg per 100 g.

YSA - 06
Anti-senescence effect of milk derived bioactive peptide on aged fibroblast

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Aging is an inherently complex process that is manifested within an organism at genetic, molecular, cellular, organ, and system levels. Accumulation of molecular damage and increased molecular heterogeneity are the hallmarks of cellular aging. A progressive and irreversible accumulation of oxidative damage caused by ROS has impact on critical aspects of the aging process and contributes to impaired physiological function, increased incidence of disease, and a reduction in life span.The aim of present investigation is to find anti-senescence role of casein derived peptide VLPVPQKin fibroblasts.The Rat Dermal Fibroblasts (RDF) at passage p35 were cultured with and without the presence of the peptide at concentration (30-1000ng/ml) in starved condition (2%FBS). Various anti-aging effects of peptide VLPVPQK were observed in rat dermal fibroblasts such as a) reduction in age-related alteration in cell morphology from a thin, long and spindle shape to irregularly enlarged and flattened shape, b) 20-25% increase in cellular replicative lifespan, as measured by cumulative population doublings, c) 20-50% increase in intracellular antioxidative abilities including a significant increase in total protein content and d) induction in endogenous antioxidant enzymes Catalase, Superoxide dismutase and Glutathione peroxidase. The bioactive peptide VLPVPQK showed pronounced effect by inducing stress response pathways via oxidative response stress marker (Nrf2) on wound healing capacity of RDF as the healing was enhanced up to maximum known capacity.

YSA - 07

Detection of pig depot fat adulteration in pure ghee using ATR-FTIR Spectroscopy coupled with chemometric strategy

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Ghee (heat clarified milk fat) is one of the most important and complex component of human diet. The importance of milk fat lies in the nutrition, flavor, physical properties and economics it offers to the dairy and non-dairy food commodities. The higher price of ghee over the other edible fats and oils and its limited supply attracts the unscrupulous manufacturers to adulterate the same with cheaper oils and fats. The common class of adulterants encountered in ghee includes animal body fat, vegetable oils, hydrogenated oils/fats, interesterified fats, mineral oils and the mixture of these. The present study was aimed to detect adulteration of pure mixed ghee (containing equal quantities of pure cow ghee and pure buffalo ghee) with pig depot fat by employing Attenuated Total Reflectance- Fourier Transform Infra-red spectroscopy (ATR-FTIR) coupled with chemometric techniques. For this, laboratory prepared pure mixed ghee was spiked with pig depot fat (prepared in laboratory by dry rendering process) at a level of 3, 4, 5, 10 and 15 per cent so as to make the binary system comprising of pure ghee and pig depot fat as adulterant. The spectra of the samples were taken in the wavenumber range of 4000-500 cm^{-1}. Principal Component Analysis on the spectral data was conducted in the four selected ranges of the wavenumbers at 5% level of significance and the clusters of the samples were observed. Principal Component 1 and 2 contributed approximately >80 and <20 per cent, respectively for all the selected wavenumbers, while sum of variance as explained by Principal Component 1 and 2 was>95 per cent at all the selected wavenumbers.The separated clusters of pure ghee and spiked samples indicated the role of FTIR spectroscopy in detection of the presence of pig depot fat in pure mixed ghee at the selected wavenumber ranges. The Soft Independent Modeling of Class Analogy (SIMCA) approach was adopted at the selected wavelengths for predicting probable class membership among the pure ghee, ghee spiked with pig depot fat at different levels and pure pig depot fat.Class model using SIMCA revealed thatpure ghee and pig depot fat samples always classified into their respective classes with the classification efficiency of 100 %, while the spiked samples never classified themselves as the pure ghee and pig depot fat samples. It was observed that more than 91 % of test samples classified themselves into their respective class. The calibration model in the selected ranges of wavenumbers was constructed using Partial Least Square. PLS results revealed R^2closer

to unity (i.e. >0.98)in all the selected spectral ranges. This further signifies that actual and predicted values of analyte of interest (pig depot fat in our case) had better relationship vis-à-vis FTIR spectral data. The accuracy of the classification model could be justified on the basis of little difference between observed between RMSEC and RMSEV. The results indicated that pig depot fat could be detected even at the lowest level of the study i.e. 3 per cent on the selected wavenumber ranges. The study concludes that the method has great precision and accuracy and has the potential to address the menace of adulteration. ATR-FTIR at wavenumber range of 4000-500cm^{-1}wasemployed for detection of pig depot fat in pure mixed ghee. Separateclusters ofpure mixed ghee, spiked samples and pig depot were obtained using PCA. Class model using SIMCA revealed that almost 91per cent of test samples classified into their respective class. PLSat all the wavenumber range studied revealed R^2 values >0.98. Detection limit of pig depot fat was observed to be 3 per cent in pure mixed ghee.

YSA - 08

Cloning and Sequencing of Mucin Binding Proteins of Selected Indigenous Probiotic Lactobacilli

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The subject of this investigation are the major constituents of the human gastrointestinal microflora. They are among the most common genera in human colon and have been considered as key commensals in promoting host health by expressing a wide range of probiotic attributes and a host of other functional attributes as already described. As the outermost protective luminal layer, mucus is the first intestinal component or surface that lactobacilli are likely to contact before reaching the epithelial cells. Hence, their binding to mucus can have a substantial role in establishing the colonization of these organisms on the intestinal surface. The colonization of probiotic lactobacilli in the gut is likely to increase the transit time of the organism in the large intestine to express their health promoting function in the gut apart from minimizing the possibility of pathogens adherence on the receptor sites located in the gut through competitive exclusion. The colonization of probiotic organisms in the gut is mainly facilitated through the interaction of surface layer proteins such as Mucin binding (Mub), Collagen binding (Cnbp) and fibronectin binding proteins. Hence, the main purpose of this investigation was to explore the possibility of 'Mub' gene as a potential probiotic marker for the colonization attributes of indigenous probiotic lactobacilli. During the course of this investigation, two promising isolates of indigenous lactobacilli established previously as proven probiotic culture from the repository available in MBU Lab, DM Division based on strong probiotic attributes and colonization ability were selected as the subject of this project.

The identity of these two cultures as Lactobacillus plantarum Lp77 and Lp91 was reascertained by Genus and Species specific PCR. Both showed distinct 250bp and 248bp bands when subjected to Genus specific PCR assays using LBLMA1/R161 primer set and species specific PCR assay using Lpla2/Lpla3 primers specific for L. plantarum. The main focus of the investigation was to determine the entire nucleotide sequences of the 'Mub' gene (ORF) from two indigenous probiotic L plantarum strains Lp91 and Lp77 selected for the work on the basis of their strong probiotic and colonization potential. The first obvious step towards achieving this goal was to fish out the 'Mub' gene from the genomic DNA of the selected cultures by PCR cloning in pGEMT-Easy vector. Since the expected size of the 'Mub' gene predicted from the nucleotide sequence data available in the NCBI gene bank was around 6.66 kb in comparison to 3.015 kb size of the cloning pGEMT vector, three possible cloning strategies were designed to retrieve the nucleotide sequence of the entire 'Mub' gene in one, two and three steps. Since, attempts to clone the entire full length 'Mub' gene i.e. 6.66 kb PCR product were not successful, efforts were then directed to explore two cloning strategy by partitioning the gene sequence with the help of two primer pairs targeted against different regions in the 'Mub' gene. The primers used for this strategy were MubF1/R4483-4460 and F4152-4175/R6541-6491 or R6660 which were expected to produce amplicons of sizes 4.46 kb and 2.33 kb respectively. Chromosomal walking of 4.46 kb PCR product (Mub91) of Lp91 strain was carried out but 2.33 kb product was not being able to clone. Cloning and partial nucleotide sequencing of only 2.58 kb PCR product (Mub91F) deciphering 727bp nucleotides starting from N- terminal sequence has been achieved successfully through 3 steps of cloning with MubF1/mubN_R1.65 primers. The selected clones were got custom sequenced from Chromous Pvt. Ltd. The nucleotide sequencing of the selected clones was carried out using T7and SP6 primers. However, sequencing of PCR products sent for Chromosomal walking was done by designing overlapping primers based on the available sequences during each step and partial nucleotide sequences of Mub91 spanning from 1091-1485, 1605-1935, 2094-2766, 3422-3787 and 3824-4413 could be achieved. High degree of homology (89-100%) was observed between the test cultures and the sequences from the data base at nucleotide level. After putting together all the data that emerged from the PCR and cloning experiments related to 'Mub' gene with genomic DNA from the two selected cultures viz. L. plantarum Lp77 and Lp91 during this study, adequate amount of resource material could be generated for retrieving the desired nucleotide sequences for the important gene. Although, our attempts to clone the full length 'Mub' gene and the large sized 4.46 kb of the gene were not successful, chromosome walking of the PCR product was able to make up for the cloning failures. However, it would be appropriate to properly assemble all the truncated sequences into complete open reading frame for the 'Mub' gene in respect of the two indigenous probiotic strains of L. plantarum with the recombinant clones with partial 'Mub' inserts produced through this study could help future studies for further organization with analysis of the nucleotide sequences data. This is perhaps the first report where an initiation has been taken for the identification of MBP gene from the genomic DNA of two indigenous probiotic strains of Indian origin. In view of Mub protein's involvement in adherence of probiotics on epithelial cell surface lines of the gut, mucin binding

proteins could be one of the potential probiotic markers which can be explored for developing in vitro PCR based assays for screening of novel indigenous probiotics strains. Hence, to fulfill this objective, two sets of primers, namely MubD1_F87/ MubD1_R0.5 and MubN_F0.93/ MubN_R1.65 based on the available Lactobacillus 'Mub gene sequences were designed and used for screening of 'Mub' positive Lactobacillus isolates. In order to further widen the scope of these aforesaid primer based PCR assay, an attempt was made in this study to develop a multiplex assay by integrating the set of primers. Multiplexing of primer pair MubD1_F87/ MubD1_R0.5 with Genus specific primer pair LBLMA1/R161 resulted into concurrent amplification of 405bp and 250bp products respectively with template DNA of all 37 isolates. Bifidobacterium bifidum also gave a 405bp band but no 205bp band produced. Multiplexing of primer pair MubN_F0.93/ MubN_R1.65 with Genus specific primer pair LBLMA1/R161 resulted into concurrent amplification of 1.6kb and 250bp respectively with standard L. brevis and 22 isolates of L. plantarum species including Lb5276(standard) only. However, at this moment, the validity of our 'Mub' based PCR assay as a potential screening method for identification of 'Mub' positive lactobacilli cannot be substantiated due to non availability of any published literature exactly on these lines. The next part of this investigation centered around partial purification of the native 'Mub' protein extracted from the selected probiotic L. plantarum isolates (Lp9, Lp72, Lp77 and Lp91). The main purpose of this study was to identify the protein band on SDS-PAGE based on its mucin binding ability. This proteomic approach was contemplated not only to throw some light on functionality of the 'Mub' protein after characterization but also could provide a very useful resource material for developing a mucin based in vitro assay for screening of 'Mub' positive probiotics to corroborate PCR based assays developed previously. During this investigation, extraction of S- layer proteins was done mainly by two methods i.e. by LiCl and by Guanidine hydrochloride extraction. After extraction of S- layer proteins, dialysis was done and precipitated proteins were centrifuged and then lyophilized. The extracted proteins were then dissolved in PBS buffer (7.5pH) and then run for SDS- PAGE analysis. S-layer protein extraction with Guanidine hydrochloride from L. plantarum species, namely Lp91 resulted into good band formation when run on 7.5% SDS-PAGE gel and an expected 'Mub' protein was predicted after two layers of separating and stacking gel.

YSA - 09

Protective effects of casein derived peptide VLPVPQK against hydrogen peroxide-induced dysfunction in rat calvarial osteoblastic cells

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Oxidative stress is a crucial pathogenic factor in the development of bone related diseases such as osteoporosis. In the present study, we established an in vitro oxidative cell injury model induced by

hydrogen peroxide (H_2O_2) in rat calvarial osteoblastic cells to investigate the protective effect of casein derived bioactive peptide VLPVPQK (PEP) against H_2O_2-induced dysfunction and oxidative damage in rat calvarial osteoblastic cells. Osteoblasts were pretreated with PEP (50-200ng/ml) for 2, 7 and 14 or 21 days followed by treatment of 0.3mM H_2O_2 for 24 h, then some markers of osteoblast cell function and oxidative damage were examined. Our data demonstrated that pretreatment of osteoblast cells with PEP caused a significant ($P < 0.05$) increase in cell viability, alkaline phosphatase staining and activity and calcium mineralization in the presence of H_2O_2. In addition, PEP pretreatment significantly ($P < 0.05$) decreased intracellular reactive oxygen species (ROS), lipid peroxidation (MDA) and caspase-3 and-9 activities in the presence of H_2O_2. Moreover, pretreatment of osteoblasts with PEP significantly ($P < 0.05$) reversed the H_2O_2-induced decrease of superoxide dismutase activity, catalase activity and intracellular reduced glutathione level when compared with untreated cells. Altogether, our results demonstrated that PEP possess antioxidant activity and can protect osteoblasts against H_2O_2-induced cellular dysfunction and oxidative damage through reduction of intracellular production, MDA level and enhancement of antioxidant enzymes activities. These data also, suggest that PEP might be effective in providing protection against osteoporosis associated with oxidative stress.

YSA - 10

Standardization And Sensory Evaluation Of Fermented Food Prepared From Multigrain Flour Mixture

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Fermented foods are the important components of the diets of many parts of the world since time immemorial due to its benefits in providing high nutritive value, better organoleptic characteristics, shorter cooking time and prolonged shelf life. The aim of the study was to develop fermented food (Rawaldli) using multigrain flour mixtureand to assess its organoleptic and nutritional properties. Standard recipe (Rawaldli) was served as Control (T_0). Along with control; three variations of Rawaldliwere prepared by replacing wheat flour with different ratio of multigrain flour mixture which referred as T_1, T_2, T_3 and T_4 respectively. They were tested for different sensory attributes (Taste and Flavour, Colour and Appearance, Body and Texture and Overall Acceptability). A food composition table given by Gopalan, et.al, 2007 was used to determine the nutritional composition of Rawaldli. Appropriate statistical technique was opted for the analysis. The result revealed that the T_2 (8.22±0.81) was found most acceptable with regards to its sensory attributes followed by T_0(8.20±0.14), T_1(8.11±0.29), T_3 (7.44±0.54) and T_4 (6.66±0.81)respectively. Nutrients contentwas significantly increased in treatmentsas compared to control.Thus it can be concluded that value added fermented multigrain product has good organoleptic and nutritional quality.

YSA - 11

Versatile biological role of casein derived peptides in immunomodulation in mice and Nrf-2 mediated oxidative stress in human Caco-2 cell model

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Dietary proteins are known to carry a wide range of nutritional, functional and biological properties. During the last twenty years, the knowledge of bioactive peptides has steadily increased, and at present numerous peptides exhibiting various activities such as antithrombotic, anti-hypertension, immunomodulation, antioxidative, opiate, antimicrobial properties have been reported. These bioactive peptides are usually composed of 2-20 amino acids and become active only when they are released from the precursor protein during food processing, gastrointestinal passage, or in vitro enzymatic digestion. Many milk derived bioactive peptides reveal multi-functional properties, i.e., specific peptide sequences may initiate two or more different biological activities. In the current study, assessment of antioxidative and immunomodulatory potential of two buffalo casein derived peptides (hexa peptide and tri peptide) were carried out under in vitro and ex vivo conditions. These peptides derived from buffalo casein were selected based on the sequence alignment using clustalW analysis with antioxidative and immunomodulatory peptides from bovine casein available in the literature.

Antioxidative activity of the peptides was determined by using chemical and cellular methods. Three HAT (hydrogen atom transfer) based chemical methods such as ABTS, ORAC and linoleic acid model system were applied to assess the free radical scavenging property of peptides. Further, human intestinal epithelial cells (Caco-2) were used as a model system for the in vitro assessment of antioxidative potential of peptides against H_2O_2 induced oxidative stress. This has been carried out by investigating different parameters on Caco-2 cells. For assessing the toxic effects of peptides on viability, cells were seeded in a 96-well plate of 1×10^6 cells/well and incubated with the peptides different at concentrations (10ng,100ng,1µg,10µg,100µg and 1000µg/ml) in media for 24hr and then cell viability was determined by using MTT and neutral red uptake assay, while membrane integrity was assessed by LDH (lactate dehydrogenase) assay. Protective effect of peptides on cell viability against H_2O_2 induced oxidative stress (1.5mM H_2O_2 for 10hr) has also been analysed. Moreover, antioxidant status of the cells was investigated by measuring antioxidative enzymes such as catalase, SOD and Glutathione peroxidase and oxidative markers including nitric oxide, MDA and protein carbonyls. In addition to this, the results were further confirmed by assessing the peptide effect on of Nrf2, a transcription factor known to induce the expression of a variety of antioxidative enzymes. Further, these peptides were also evaluated for immunomodulation by measuring their influence on the proliferation of murine spleenocytes, the phagocytic activity of peritoneal macrophages and the levels of cytokine expression (TNF-α, IFN- γ, 1L-4, IL-10 and TGF-β) in murine spleen culture supernatant.

Both of the peptides used in this study showed an extraordinary ABTS free radical scavenging ability (84 and 82%) and oxygen radical absorption capacity (215 and 242 µMTEAC/mg protein) respectively. Besides this, these peptides also exhibited inhibitory activity towards linoleic acid peroxidation (11 and 7%) respectively. Where as, under invitro conditions, following 24hr extracellular supplementation of the synthetic peptides in the culture media significantly ($P<0.01$) abolished the H_2O_2 induced cell death without affecting cell viability and membrane integrity. Peptides showed significant ($P<0.001$) reducing response on MDA levels, a potent marker of lipid peroxidation and protein carbonyls, a marker of protein oxidation but had no effect on nitric oxide levels. Along with this, treatment with peptides were also found to have induced the levels of antioxidative enzymes such as catalase, SOD and Glutathione peroxidase in Caco-2 cells as compared to control. These results were further supported by induced Nrf-2 signalling through its activation and translocation from cytoplasm to the nucleus by the effect of peptides. Interestingly, these peptides also played an important role in the immunomodulation in mice through phagocytosis, spleenocyte proliferation and interleukin secretion. Phagocytosis rate was enhanced depending on the concentration of the peptide was used. At higher concentrations of peptide (10,100,1000 µg/ml) there was a significant ($P<0.001$) stimulatory effect on phagocytosis rate has been observed, while no such effect was noticed at lower concentrations (10,100,1000 ng/ml). Significant ($P<0.001$) suppressive effect on lymphocyte proliferation has been found at lower concentrations, but no such response was detected at higher concentrations. Moreover, peptides up-regulated the secretion of TNF-α, TGF-β and IL-4 in culture supernatant. Where as, in the case of IFN- γ and IL-10 levels, remarkable ($P<0.001$) decrease was noticed by peptides.

In conclusion, these findings suggest that, both hexa peptide and tri peptide derived from buffalo casein have the potential to lower the risk of reactive oxygen metabolites and also possess significant immunomodulating effects as a functional bioactive peptides.

YSA - 12
"NAVPITPTL" a noval osteogenic peptide derived from buffalo casein

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Osteoporosis is a skeletal disease identified by reduced bone mass and deterioration of bone architecture, as a consequence of which bone become fragile and susceptible to fractures. It is a global public health problem currently affecting more than 300 million people worldwide and 80% of people who suffer from osteoporosis are women. Various lines of therapies are being used for the treatment and/or management of osteoporosis such as hormonal replacement therapy, administration of antiresorptive and osteoanabolic agents; however most of them possess one or the other side effects. Hence, there is a need for alternative therapeutic agents, with bone remodeling capability, specific target of action and fewer side effects. An attractive alternative for

timely prevention and/or treatment of osteoporosis is to utilize bioactive peptides derived from various sources of protein. Knowledge on the role of bioactive peptides in health leads to the search of such components to alleviate adverse effects of osteoporosis. Epidemiological and interventional studies show that milk consumption in childhood and during adolescence is related to higher bone mineral density. Milk and milk products prevent the bone loss in pre- and post-menopausal women. In vitro osteogeneic nature of casein hydrolysates have been studied but the active component has not yet been demonstrated. So, there is need to investigate the anabolic effect of milk derived bioactive peptides on osteoblast differentiation. The aim of our study was to investigate the anabolic effect of milk derived bioactive peptide on osteoblast proliferation, osteoblast differentiation, bioavailability and their mode of action on differentiation. Pups were decapitated and the calvaria were harvested aseptically from loosely adherent connective tissue. Calvaria were minced in petriplate containing PBS with antibiotics. The minced tissue was treated with 0.1% collagenase and digested by incubating the contents in shaking water bath at 140 rpm at 37C for 10 minutes. Cells from Digest II to V were pooled and centrifuged at 1800 rpm at 4C for 5 min. Cell pellet was suspended in complete growth media. Calvaria cells were seeded at 8×10^4 cells per well in a 6 well plate with growth medium. The plates were incubated at 37C with 5% CO_2. After attachment, the cells were shifted to differentiation medium (50 µg/ml L-ascorbic acid, and 10 mM β-glycerophosphate) and treated with peptide (NAVPITPTL) and positive controls (BFP and IPP). After 7, 14 and 21 days of treatment, cells were harvested and total RNA was extracted from the cell pellets by single-step RNA isolation method using TRI™ Reagent. cDNA was synthesized from 1 µg of total RNA using the "RevertAid™ First strand cDNA synthesis kit" (Thermo scientific). The relative expression of alkaline phosphatase (ALP), osteocalcin (OCN) and collagen 1α (COL-1α) was analyzed by quantitative real time PCR using the ABI PRISM 7700 sequence detection system (Applied Biosystems). ALP activity was assessed on 7th, 14th and 21st day of osteoblast differentiation. ALP activity was measured calorimetrically by using p-nitrophenyl phosphate as a substrate. Cell lysate was incubated with buffered substrate for 15 min at 37C in a 96 well ELISA plate. The reaction was stopped by adding f 3N Sodium hydroxide. The amount of p-Nitrophenol liberated was measured by microplate reader at 405 nm against the reference wavelength of 630 nm (BioTek ELISA reader). Blank well was prepared by replacing cell lysate with distilled water. Total protein was estimated from each sample by BCA protein assay to normalize the obtained ALP activity. ALP staining was done with BCIP/NBT substrate solution, kept in dark at room temperature for 10 minutes. After staining, plates were photographed (NIKON D5200).The OCN levels were estimated in cell culture medium using a Rat Glu-Osteocalcin high Sensitive EIA Kit (Takara bio INC,Cat. MK 146).To assess the extracellular matrix mineral deposition in osteoblast differentiation, the cell monolayer was stained using alizarin red dye that forms Ca^{2+} salts in the matrix. Stain was extracted with 10% acetic acid and quantified by measuring absorbance at 405 using dual wavelength measuring system (BioTek ELISA reader). Caspase-3 and 9 activities were measured using caspase-3 and 9 colorimetric substrates. These assays are based on the spectrophotometric detection of the chromophore p-nitroanilide (pNA) after cleavage from the labeled substrate Ac-DEVD-pNA and Ac-LEHD-pNA for caspase-3 and caspase-9, respectively. Peptide induced downstream signaling molecule

phosphorylation in osteoblast differentiation was identified by immuno-cytochemistry and immunobloting. Transwell permeable supports were used for peptide transport studies. After ensuring 95–100% confluency of the flask, cells were trypsinized and seeded at the density of $3x10^5$ cells per well on a transwell. The medium was changed every alternate day till usage. The integrity of Caco-2 monolayeron transwell was checked before adding peptide in upper chamber.After one hour incubation, supernatant from the lower chamber collected, lyophilized and later subjected to LC-MS/MS.

The peptide (NAVPITPTL) induced osteoblast proliferation significantly ($P<0.05$) compared to control at 10 to 60 ng/ml concentration by both MTT method and cdk2/cycline expression. The marker genes (ALP, OCN & COL-1α) expression were significantly ($P<0.001$) upregulated in the presence of the peptide at three intervals (7st, 14st and 21st day). Also, the peptide significantly ($P<0.01$) induced alkaline phosphatase activity and mineral deposition in comparison to the control. It was also observed that the peptide significantly induced osteocalcin level in osteoblast cells at three intervals (7st, 14st and 21st day). No effect was observed on apoptosis indicators viz. Caspase 3 and 9 activities in all the treatment groups thereby ruling out any cytotoxic effect. Treatment of osteoblasts with inhibitors of Akt and Erk along with the peptide showed that all the three differentiation marker genes (ALP, OCN & COL-1) expression significantly decreased with Akt inhibitor treatment. Likewise, ALP activity and staining significantly decreased with Akt inhibitor treatment while the Erk inhibitor did not show any negative effect. Akt inhibitor treatment caused significantly decrease in mineral deposition and osteocalcin levels whereas Erk inhibitor treatment did not show any effect. The peptide induced osteoblast differentiation through Akt (protein kinase B) phosphorylation detected by immunocytochemistry and immunobloting. Transepithelial transport study using Caco-2 transwell model showed that the peptide transported through Caco-2 cells in intact from. The present study concludes that the casein derived peptide, stimulate the osteoblast proliferation as well as its differentiation. It induces osteoblast differentiation by phosphorylating Akt downstream signaling molecule. Transpeithelial transport of the peptide showed that it is bioaccessable in intact form through Caco-2 cells. Based on in vitro studies, we can conclude that the peptide- NAVPITPTL has osteogenic potential and may be used for the therapy/prevention of osteoporosis. However, in vivo studies are still warranted for validating osteogeneic effect of the peptide for its application in osteoporosis therapy/prevention.

YSA - 13

Impact of proteolytic Lactobacilli on Antimicrobial Activity, Antioxidative Activity andACE-inhibitory activity and release of bioactive peptides during fermentation of milk

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Lactic acid bacteria (LAB) are having GRAS and applied in fermented foods deliberately. LAB exist everywhere and were used to mean "milk-souring organisms". LAB are having a strong proteolytic

system and produce different proteolytic enzymes like proteases, peptidases, amino peptidases, etc. Duringfermentation, milk cannot supply all essential amino acids required for LAB growth in free form;therefore, LAB have developed ability to degrade milk proteins, mainly caseins, by their proteolyticsystem producing initially peptides and then amino acids needed for their growth. These peptides have several health beneficial properties like antimicrobial activity, antioxidative activity, ACE inhibitory activity etc.

1. To estimate the Antimicrobial Activity, Antioxidative activity and ACE inhibitory activity of the fermented milk
2. To evaluate the ability of releasing peptides during fermentation of milk

L. helveticus MTCC 5463 was added at the rate of 1% to ferment milk under optimized growth conditions (Incubation time: 12 h at temperature 37^{0}C). Proteolytic activity was measured through OPA method and pepX activity was determined (Hatiet al., 2013). Antimicrobial Activity, Antioxidative activity and ACE inhibitory activity were also analysed following Donkoret al., (2012) method. Peptides were isolated, purified by RP-HPLC method and sequenced by the MALDI-TOF analysis (Garcia et al., 2013). In this study, L. helveticus MTCC 5463 (V3) exhibited highest proteolytic activity and pepX activity after 12 h of incubation and also showed 75% inhibition of oxidative free radicals through ABTS method compared to L. rhamnosusNS6 and L. rhamnosusNS4. In case of ACE inhibitory activity, 60% inhibition was found by restricting the hippuric acid formation. Antimicrobial activity was observed against S. aureus and E.coli. During fermentation, L. helveticus MTCC 5463 produced peptides which were purified through RP-HPLC and sequenced in MALDI-TOF analysis. It was found that IPP and VPP rich amino acids were predominant in the sequence and could be responsible for ACE inhibitory activity. L. helveticus MTCC 5463 showed the highest proteolytic activity, pepX activity, antioxidative activity, antimicrobial activity and ACE inhibitory activity compared to NS4 and NS6 cultures. It also released the peptides during fermentation and produced peptides which are rich in IPP and VPP. However, L. helveticus MTCC 5463 could be explored aspotential functional cultures having antioxidative and ACE inhibitory activities and also used for the preparation of functional fermented milk products.

YSA - 14
Development of hypocholesterolemic processed cheese spread

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In recent years, consumers have begun to look at food not only as a source of energy but also for the health benefits. Cardiovascular diseases are the foremost cause of death in the world as well as in India, accounting for 25-30% of all deaths. In India in the past five decades, rate of coronary heart

disease among urban populations has risen from 4 to 11%. It is estimated that almost 60% of world's cardiac patients are in India. So, the most commonly used functional ingredients in foods are to reduce serum cholesterol levels for good cardiovascular health. Butter, the traditional spread for bread, is now avoided due to poor spreadability, high saturated fat and cholesterol content, whereas, the annual growth rate of cheese production in India is 10-15% and ~90% cheese is consumed as processed cheese and processed cheese spread. Processed cheese spread (PCS) contains not only that protein and fat are in pre-digested form, also it contains calcium, phosphorus, riboflavin and other vitamins in a concentrated form and contains health beneficial bioactive peptides, conjugated linoleic acid and contains a lower amount of fat and higher amount of protein compared to any low fat table spread. Hence, PCS can provide nutritionally superior spread for bread and it can be incorporated with functional ingredients viz., inulin, phytosterols and -3 fatty acid (-3 FA) which have cholesterol lowering effect.

In view of the above justification, the present study has been designed with the objectives: 1. Optimization of the levels of inulin, phytosterols and ω-3 FA in processed cheese spread; 2. Extension of the shelf life of the developed functional processed cheese spreads; 3. Evaluation of the hypocholesterolemic effect of the functional processed cheese spreads by using rat model, and 4. Estimation of the production cost of the developed product; 5. Evaluation of the acceptability of the developed product through consumer acceptance study.

For the manufacture of PCS a blend of Cheddar cheese (25% old and 75% young) was taken in cheese processing vessel. Calculated amount of water, salt and emulsifier were added to maintain the final composition of control processed cheese spread as moisture – 58%, salt – 2% and tri-sodium citrate – 2.5% and heated with continuous stirring and scraping of the surface with a wooden ladle. When the mass become semi solid and homogeneous, functional ingredients viz. inulin, phytosterols and fi -3 FA were added and mixed thoroughly. The content was heated to 85°C for 3-5 min and the hot product was filled immediately into 50 ml sterile high density poly-ethylene sample container. The PCS was allowed to cool to the room temperature and kept at refrigeration (4±1°C) thereafter.

In the present investigation, optimization of the level of the three functional ingredients in combination (range – inulin: 4-8%, phytosterols: 2-4% and -3 FA: 2-4%) was carried out using Central Composite Rotatory Design of Response Surface Methodology and the addition level of inulin, phytosterols and -3 FA were optimized at 4, 2 and 4% level, respectively. Effect of inulin, phytosterols and ω-3 FA in linear, interactive and quadratic term on different physico-chemical (moisture, $a_{w,}$ titratable acidity and pH), textural (firmness, work of shear, stickiness and work of adhesion) and sensory (flavour, body and texture, colour and appearance, spreadability) attributes were studied.

As compared to control product in the developed Functional Processed Cheese Spread (FPCS), moisture, protein, salt and ash percentage reduced from 58.2 to 51.0, 17.4 to 15.0, 2.0 to 1.8 and 3.4 to 3.2, respectively; however, fat percentage increased slightly from 19 to 22, whereas the developed product contained significant amount of dietary fiber (3.2%), phytosterols (1.7%) and ω-

3 FA (2.02%). The addition of functional ingredients in cheese spread increased total unsaturated fatty acid (from 7.21 to 9.35%). From the Scanning Electron Micrograph of FPCS, it has been observed that in the protein matrix, inulin (diameter 4-10 µm), phytosterols (diameter 100-230 µm), ω-3 FA (diameter 11-12 µm) and milk fat globule (diameter 18-60 µm) were uniformly distributed.

To extend the shelf life of developed product it was prepared with (FPCSN) and without bio-preservative nisin (FPCS) (400 IU/g cheese) along with control cheese spread (without functional ingredient) was prepared with (CPCSN) and without nisin (CPCS) and stored at refrigerated condition (4±1°C) for six months. They were evaluated at every 15 days of interval for its different microbiological [standard plate count (SPC), coliform, anaerobic spore forming bacteria, yeast and mold], physico-chemical [moisture, a_w, titratable acidity, pH, tyrosine value (proteolysis), free fatty acid value (FFA) (hydrolysis of lipids), thiobarbituric acid value (TBA) (oxidative deterioration), colour], textural [firmness, work of shear, stickiness, work of adhesion] and sensorial attributes [flavour, body and texture, colour and appearance and spreadability]. In FPCS, SPC decreased up to 75th day, and thereafter up to 90th day it increased. The coliform was absent in all nisin and without nisin treated cheese spread samples. In FPCS, the anaerobic spore count decreased up to 60th day, but from 75thday onwards, it again increased. Like CPCSN, anaerobic spore count was not detected in FPCSN. In FPCS and FPCSN, yeast and mold count decreased significantly ($p<0.05$) up to 15th and 45th day, respectively, but it increased from 45th and 60th day onwards, respectively. In FPCSN, yeast and mold count was lower as compared to FPCS. The $a_{w,}$ titratable acidity, tyrosine value, FFA value, TBA value and b* value of FPCS and FPCSN increased with increased storage period. All the textural parameters decreased in both FPCS and FPCSN with increased storage period. It was observed that total sensory score of FPCS and FPCSN was significantly ($p<0.01$) decreased from 90th day onwards as compared to 1st day. The FPCSN had higher total sensory score as compared to FPCS throughout the storage period; however, all the samples were acceptable on sensory characteristics throughout the storage period of six months.

To validate the hypocholesterolemic effect of the developed product, it was fed to hypercholesterolemic rats and it was observed that the FPCS had significant ($p<0.05$) serum total cholesterol, low density lipoprotein cholesterol, Atherogenic index and triglycerides lowering effect in hypercholesterolemic rats. Due to cholesterol enriched diet feeding, the liver, spleen and heart weight of rats increased; whereas feeding FPCS reduced those organs' weight significantly ($p<0.05$). It was estimated (January, 2012) that production cost of the CPCSN and FPCSN were Rs. 20.16 and 36.04/100 g, respectively. For consumer acceptance study, the FPCS was served to 107 people. Most of the consumers (97%) liked FPCS taste wise and of that maximum people (61%) graded the product as 'Excellent'. Majority of the consumers (40%) found the FPCS as 'Similar' with conventional spread and majority of the people (37%) wanted to use it weekly which is quite similar to the consumption frequency of normal spread. Analyzing the data related to consumer acceptance study using ^{2} test revealed that higher education leads to critically evaluate the product and also make health beneficial awareness of functional foods. Therefore, the developed product may have a good market potential with respect to sensory qualities, shelf life, cost and especially with respect to its hypocholesterolemic benefit.

YSA - 15

Characterization of oil and nutrient content of Yemen Fenugreek seed

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Fenugreek (Trigonella foenum-graecum L.), belongs to the subfamily papilionacae of the family Leguminosae (bean family, Fabaceae). The plant is an aromatic herbaceous annual also it is widely cultivated in Mediterranean countries and Asia. It is believed to have originated in south-eastern Europe or south-western Asian countries (Parthasarathy et al., 2008).

Yields can be significant increase in quantity and quality through the suitable management of cultivation, irrigation and harvesting. In this context, fenugreek (Trigonella foenum graecum L.), an annual legume, is extensively cultivated in most regions of the world for its medicinal value (Petropoulos, 2002).

Fenugreek can be a very useful legume crop for incorporation into short-term rotation and for hay and silage for livestock feed, for fixation of nitrogen in soil and its fertility, and etc (Sadeghzadeh-Ahari et al., 2009). Fenugreek seeds have been known and valued as medicinal material from very early times. Fenugreek as a chemurgic crop has a wide use for industrial purposes. Its seeds are considered to be of commercial interest as a source of a steroid diosgenin, which is of importance to the pharmaceutical industry (Mehrafarin et al., 2010). Nowadays, fenugreek is widely cultivated as a drug plant. The mucilaginous seeds are reputed to have many medicinal virtues, as a tonic, emollient, carminative, demulcent, diuretic, astringent emmenagogue, expectorant, restorative, aphrodisiac and vermifugal properties and were used to cure mouth ulcers, chapped lips and stomach irritation (Duke, 1986).

Fenugreek seed contains 45-60% carbohydrates, mainly mucilaginous fiber (galactomannans), 20-30% proteins high in lysine and tryptophan, 5 - 10% fixed oils (lipids), pyridine alkaloids, mainly trigonelline (0.2 - 0.38%), choline (0.5%), gentianine and carpaine, the flavonoids apigenin, luteolin, orientin, quercetin, vitexin and isovitexin, free amino acids, such as 4-hydroxyisoleucine (0.09%), arginine, histidine and lysine, calcium and iron, saponins (0.6 - 1.7%), glycosides yielding steroidal sapogenins on hydrolysis (diosgenin, yamogenin, tigogenin, neotigogenin), cholesterol and sitosterol, vitamins A, B1, C and nicotinic acid and 0.015% volatile oils (n-alkanes and

sesquiterpenes) (Mehrafarin et al., 2010). The seeds are reported to have restorative and nutritive properties (Khosla et al 1995). Fenugreek seeds (F.S.) are used in remedies for diabetes and hypercholesterolaemia in Indian, Arabic and Chinese medicine (Kaviarasan et al., 2006). Sample was procured from the local market in IBB city, Republic of Yemen and the Analysis was done in lab of Department of food science and nutrition king Saud University, Saudi Arabia. Moisture, crude protein, crude fat, crude fiber, and ash were determined according to the (AOAC, 1995)

Specific gravity, Refracctive index, Viscosity, Total Acidity, Saponification Number, Iodine number, peroxide value were analysis according to (AOAC, 1995). Thiobarbituric Acid (TBA) (Tarladgls et al, 1964) Oil samples extracted from 5g seed samples were methylated with 14% boron trifluoride (BF_3, BDH-Company) in methanol (Foglia et al., 1993). Analysis of the fatty acids was carried out with a GLC-Varian 6000 gas chromatograph with Flame Ionization Detector (FID), 2m length, 0.32cm internal diameter stainless steel column, packed with 15% OV-275, chrome P/AW/80-100 mesh stationary phase which operated at 180°C, injection temperature 230°C, detector temperature 250°C with carrier-gas (Helium) at a flow rate of 25mL/min, hydrogen flow 30mL/min, and air flow 300mL/min. Identification of the fatty acid methyl esters was carried out by comparison of their retention times with that of the standards (Polyscience Corporation, Kit number 61 CX) and the quantities were calculated from the area obtained by the LKB 2200 recorded integrator.

Chemical composition of Fenugreek is given in Table 1. The results indicated that moisture 8.91%, fat 5.69%, protein 14.81%, fiber 12.97%, ash 3.53% and carbohydrate 54.09 %. So the seed of Fenugreek contain high amount of protein and fiber that will be benefit to the human nutrition. (Kochhar et al., 2006) and (El Nasri and El Tinay 2007) reported that fat, protein, and fiber content of fenugreek seeds ranged from 6.53% to 7.1%, 24.4% to 25.8%, and 6.28% to 9.3%, respectively. and also (Al-Jasass, F and Al-Jasass, M. 2012) found the moisture 7.71 %, fat 4.51%, protein 12.91%, fiber 13.14%, ash 4.23% and carbohydrate 57.5%.

Table (1) Composition of Fenugreek seed

Analysis	**Means ± SD**
Moisture	8.91± 0.30
Crude fat	5.69 ± 0.08
Crude protein	14.81 ± 0.20
Crude fiber	12.97 ± 0.10
Ash	3.53 ± 0.05
Total carbohydrate	54.09 ± 0.43

The Physical and chemical characterization of Fenugreek seed oil reported in (Table 2, 3) Specific density 0.920, Refractive index1.471, Viscosity 4.000, Total Acidity 0.337, Saponification Number 177.443, Iodine Number 130.938 , peroxide value 8.030 and TBA 0.48.

Table (2) Physical analysis of the Fenugreek seed oil

Analysis	Mean ± SD
Specific density	0.920±0.010
Refractive index	1.471±0.001
Viscosity	4.000±0.060

Table (3) Chemical analysis of the Fenugreek seed oil

Analysis	Mean ± SD
Total Acidity as oleic acid	0.337±0.055
Sponafication Number	177.443±0.320
Iodine Number	130.938±1.227
Peroxide value	8.030 ±0.236
TBA	0.481± 0.012

Fatty acids composition of fenugreek seed oils are presented in Table 4. The major fatty acids were found Linoleic Acid C18:2 (34.59%) also it contains (28.284%) from linolenic acid. Also the unsaturated fatty acid and saturated fatty acid were (84.083%, 15.917%)

Table (4) Fatty acids composition of Fenugreek seed oil

Fatty acid	Amount %
palmitic acid C16:0	12.44
Stearic Acid C18:0	0.166
Oleic Acid C18:1	20.416
Linoleic Acid C18:2	34.59
linolenic acid C18:3	28.284
Arachidic acid C20:0	1.697
Gadoleic acid C20:1	0.793
Behenic acid C22:0	1.614
TSF	15.917
TUSF	84.083

From the results of this study, it could be concluded that the fenugreek under investigation contain appreciable amounts of nutrients which may serve as beneficial health sources if consumed regularly and can be used as food supplements for edible oils, these data indicate that fenugreek may provide a meaningful level of protein, fat and fiber when consumed in a variety of foods.

YSA - 16

Nutritional profiling of Kadamba (Neolamarckiacadamba) fruit and product development

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Neolamarckiacadambais one of the economically important trees, which is being exploited for paper, pulp and wood industry, however its food uses are not popular. It is commonly known as the kadamba, which is widely distributed in tropical and subtropical regions and consumed by tribal folks.

In folk medicine, different parts of N. cadamba are used in the treatment of various ailments.In the present investigation, nutritional profiling of freshripe fruits of N.cadamba was done. Further,process conditions were standardized for nectar preparation and its quality was evaluated.The proximate composition and mineral analysis of fruit showed that it is rich in minerals containing Fe(28.297mg), Ca(1.24g), Mg(71.04mg), Zn (11.05 mg),Cr(2.362mg) and Cu (4.19mg) per 100g of the edible portion. The nectar developed fromN. cadambaripe fruit was found to contain 36.67 mg of ascorbic acid and 1.45 µg total carotenoids per 100 mL indicating its good antioxidant potential. The nectar was found to be microbiologically safe to consume andsensoriallyacceptable. This study showed the possibilities of processing ofN. cadambafruit into value added products like nectar beverage.

YSA - 17

Preparation of nutraceutically enriched jaggery with addition of Amla and optimization of its process

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Jaggery (gur) is a traditional sweetener prepared from Sugarcane juice. It is a hardy crop survives well in even in adverse condition as compared to other crops commonly grown in the country. India produces 70 % of the total jaggery of the world (Singh et al., 2009). Jaggery is a concentrated product of cane juice without separation of the molasses and crystals and can vary from golden brown to dark brown in colour. It contains up to 50 % sucrose, 20% invert sugars and 20% moisture and the remainder made up of other insoluble matter such as wood ash, proteins and bagasse fibers. In Indian, Maharashtra is the largest producer and consumer of jaggery. At present, 24.5% of the cane produced in India is being utilized for producing jaggery (Rao et al., 2007). The Muzaffarnagar District in Uttar Pradesh has the largest jaggery market in the world, followed by Anakapalli in the Visakhapatnam District in Andhra Pradesh. The Kolhapur district in western Maharashtra is also famous for its variety of jaggery. Gur is consumed mostly by the rural population in India which is a natural mixture of sugar and molasses and now-a-days trend is picking up in urban area at a high speed with awareness of its benefit to the people. Gur can be defining as a honey brown coloured raw lump of sugar. It contains all the minerals and vitamins present in sugarcane juice and that is why it is known as healthiest sugar in the world. The usage of Jaggery has become very high in the recent days and per capita consumption of Gur & Khandsari (5kg/annum) in India. The reason for the increase in demand of Jaggery is health consciousness in the people and the increase in number of Diabetic patients. Sugar production system requires a mix up of chemicals like sulphure-dioxide, lime, phosphoric-acid, formic-acid and bleaching agents, and that is why all the contents of sugarcane cannot be found in sugar, where as Gur has all the contents and even the scientists have proved that all the essential vitamins and minerals are missing from sugar as compared to Gur.

Nutrition composition of Jaggery vary in terms of sucrose (65-85%), reducing sugars (10-15%), proteins (0.4g), fats (0.1g), total minerals (0.6-1.0mg), calcium (8.0mg), phosphorus (4.0mg), iron (11.0mg), moisture (3-10%), energy (383Kcal) per 100 g (Singh, 1999). The Amla or Neelikkai (Phyllanthus Embilca) contains is very high amount of Vitamin C that is twenty times higher than Vitamin C present in orange in juice. One Amla is equitant to 3 to 4 time in the size of an Oranges. It is bonded with tannins that protect it from being destroyed by heat or light. Sour in tastes and used in both form i.e. dried and fresh. Water content in fresh Amla is 91.4 along with mineral matter, 0.7; fiber, 3.4; calorie,96 (energy); protein, 0.9; fat, 0.1; carbohydrate,6.9g; calcium, 34; iron, 1.2; vitamin B-1, 0.02; vitamin B-2, 0.08, vitamin C 463 mg. /100gms. It is a powerful antioxidant agent and help in improvement and maintenance of active day to day life. Repair the tissues, helpful in skin disorder, break down of bone, clear pimples and acne, hair growth, hair pigmentation, prevents dandruff etc. Traditionally several jaggery based value added products are made with addition of amla such as berfi, laddo, murabba, candy and other products are jaggery chocolates, jaggery-groundnut, jaggery-pineapple, jaggery-carrot-cake, jaggery-rice-potato, vermicelli-sasame-jaggery-ladoo, jaggery-rice, organic jaggery, jaggery dosa, jaggery cake. These products are area and season specific with low durability. An attempt was made to develop amla added jaggery with longer durability. Steps involved in awla based jaggery preparation were cutting of canes, removal of tops and roots, extraction of juice from the sugarcane with help of cane crusher, extracted sugar cane juice is feed to the vessel and boiling of extracted juice in to a kadaha. Add amla powder 10:1 ratio prior to becoming juice in a semisolid paste and then add small quantity of sodium carbonate as a reducing agent for making quality Jaggery balls. After stirring well until the juice becomes a semisolid paste, the paste is feed to iron tray with the help of a long wood stick, at one end which contains a flat block they stir well again in the tray, until more thickening comes. Wet cloth is used to make balls or different blocks are used to give the desire shape. So, it can be concluded that jaggery industry has been one of the most ancient and important rural-based cottage industries in the country. It provides jobs to the unemployed rural people in their vicinity with minimum capital investment. It is cheaper than white sugar. It also have higher medicinal and nutritional values and easily available to the rural people. Jaggery addition with amla power in 10:1 ratio before becoming juice in a semisolid paste and converting into different shape and size with help of steel frame will further improve the quality of jaggery.

YSA - 18

Development of A Small Scale Ohmic Heater for on farm Processing of Fruits and Vegetables: A Prospective to Strengthen the Indian Farmer

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India's varying agro-climatic diversity enables production of almost every fruit and vegetable. Indian agricultural is known to be an economical backbone of our country. India ranks top in production of

most of the food products and is also a largest producer of the milk. But due to unavailability of processing aids at the production catchments, post harvest losses of 5.8 to 18% in fruits and vegetables, 2.8 to 10.1% in oilseeds, 0.8% in milk, 2.9 to 6.9 in fisheries and 3.9 to 6.1 in cereals and pulses occurs in our country. At farm level, tomato, grapes, guava, mango, litchi and other fruits and vegetables undergo a big loss due to improper storage and transport facilities, lack of processing knowledge or unavailability of consumer market during production season. These losses increases rapidly in hilly area, so the states whose better known for production of large range of perishable fruits like Uttarakhand and Himachal Pradesh suffers huge amount of post harvest losses. Therefore in order to reduce these losses, to strengthen the Indian farmers economic status, to assure the sustainable security of fruits and vegetables and to fulfill the per capita requirement of various food products, it is great need to develop some simple and easy food processing technologies for farmers to use in the production catchment itself. Keeping these issues in mind the objective of present investigation was to develop a small scale ohmic heater for on farm processing of fruits and vegetables which would be helpful for strengthening the Indian farmers. Ohmic heating which is also called as Joule heating, electrical resistance heating or electro conductive heating is advanced and novel food processing technology and now regarded as a "Green technology" in the area of food processing industry. The principle of ohmic heating is very simple and based on passage of alternating electric current through the liquid particulates foods with primary purpose of heating them. The heating is occurs in the form of internal energy generation within the food material. It is generally used to process the liquid particulate food. Presence of liquid cause electric current to flow from the food and present of particulates create electrical resistance to flow. This phenomenon causes conversion of electric current in to heat directly in to the product without causing thermal damage to products quality parameters. This technology has wide range of applications in food processing area which includes pasteurization, sterilization, oil extraction, juice extraction, rice bran stabilization, concentration, blanching, cooking, thawing etc and it does not involve any nutritive losses of produce because of internal energy generation. A mild electroporation mechanism may occur during ohmic heating operating at low frequency (50–60 Hz) which allows electrical charges to build up and form pores across cell walls causing effective cell wall degradation which suggest its usefulness for extracting food components. The development ohmic heater is simple and economical. All the accessories require for its developed are easily available. This devise can be of any size and shape and can be batch as well as continuous type. A pair of stainless steel electrode with specific gap between them may be the heart of ohmic heater. The processing chamber can be made of easily available non-conducting materials like wood, PVC pipes, glass, perspex sheet etc. If operating parameters like voltage gradient, current, wattage, holding temperature, holding time etc are optimized for particular product in the laboratories then it is very simple device to use by farmers in the production catchments. Keeping above points in mind two ohmic heaters, one with square and another with cylindrical geometry have been developed by using perspex sheet and PVC pipe respectively in the development laboratory of Department of Post Harvest Process and Food Engineering, GBPUAT, Pantnagar. These heaters was designed and fabricated on the basis of Indian house hold electric supply of 203V so that it can be used by every

farmer in each part of the country. These devices are tested for development of ginger paste and enzymatic assisted aqueous extraction of mustard oil respectively. In the very first study the quality characteristics of ohmically heated ginger paste in terms of pH, total soluble solids (TSS), colour and microbial count were evaluated. The data was planed using full factorial design with three replications. The independent variables selected were voltage gradient (5-13 v/cm), salt level (0-2 %) and KMS treatment (0 and 0.2 %). The results indicate that pH and TSS of ginger paste ranges from 4.16 to 4.20 respectively and were significantly influenced by salt level. Colour of ginger paste in terms of L*, a* and b* values was highly influenced by KMS addition. Microbial count was found to be negligible because of internal energy generation. The ginger paste produced by ohmic heating is comparable with commercial ginger pastes available in market in terms of colour, microbial count and pH with possessing natural taste and flavour. In this case the ginger paste was heated at high temperature for short time (HTST) like in pasteurization of milk which cause destruction of microorganisms and at the same time maintains the quality of the ginger paste. In the second study circular ohmic heater is tested against oil yield from mustard seeds. Properly cleaned mustard seeds were converted in to mustard slurry by adding sufficient amount of water in the ratio of 1:3 (solid to water). This slurry was treated with pectinase enzyme from at 3% concentration and incubated for 4 hours at optimized condition of pH and temperature. After drawing the mustard slurry from incubator it was ohmically heated at a temperature of 70, 80 and 90°C at voltage gradient of 9, 12 and 15 v/cm for holding time of 2, 4 and 6 minutes. Oil from the slurry was separated by centrifugation at 7000 rpm for 5 minutes. Ohmic heating when combine with enzymatic assisted oil extraction, can produce high quality oil free from any organic solvent residue with up to 80% oil yield. In this case ohmic heating was used particularly for disintegration of oil globules and breaking of their cell wall by electroporation mechanism. Hence the cell wall which is difficult to break by enzymes is disintegrated with the help of electroporation by ohmically heating which helps to easy release of oil from oil globule.

YSA - 19
Development of functional yogurt using Aloe-Vera

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Functional yogurt, an innovative functional dairy food refers to the incorporation of aloe-vera extract to promote better health. The presence of functional compound in the food has multiple metabolic activities allowing for beneficial effects in preventing several diseases and target tissues. Functional food components are usually found in multiple forms such as glycosylated, esterified, thiolyated, or hydroxylated. However, probiotics, conjugated linolenic acid, long-chain omega-3 and polyunsaturated fatty acid are most commonly found in animal products such as milk, fermented milk products. Yogurt is made with a variety of ingredients including milk, skimmed milk powder,

bacterial cultures (L. delbrueckii, L. lactis and L. acidophilus) and aloe vera extract. The process parameters like incubation temperature, total solids, starter culture were optimized based on the incubation time and quality of the developed functional yogurt. The process parameters like temperature (41 and 43°C), total solids (21, 23 and 25 %), starter cultures (L.delbrueckii, L.lactis, L.acidophilus, 2 and 2.5 %) and functional component aloe- vera (0.5, 1 and 1.5 %) were changed and observed in different trials. The optimized process parameters viz were 4 hours incubation time, 43°C Incubation temperature, 23 % Total Solids, 1.0 % Aloe vera and 2.0 % Starter cultures (L.lactis: L.acidophilus (1:1). The physico-chemical quality parameters to achieve the desired quality of the product are hardness; firmness, cohesiveness, consistency and the index of viscosity of functional yogurt were found to be 10.5 g, 69.97 g, -17.29 g, 366.29 g mm, -5.89 g mm respectively. The pH and the titratable acidity were found to be 4.59 and 0.96, respectively. The microbial analysis revealed that the functional yogurt had a shelf life of 12 days under refrigerated condition with overall acceptability of 7. Functional foods present great promise for future developments in human nutrition. Yogurts are certainly common among the most promising products in this category of food product. Yogurt has many functional and nutraceutical values. In such way, Bioactive Yogurt, a new approach to still enhances the therapeutic values of yogurt.

YSA - 20

Optimization of ohmic assisted hot air drying of Rohu (Labeo rohita) Fish

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Food is a nourishing matter that people or animals eat or drink in order to sustain life and growth so it is necessary eats good quality food. In processing of food there is needed to prevent, reduce and eliminate infestation, microbial growth or toxin production by microbes to save the customer from the risk. For this purpose food safety during handling, preparation, and storage of food is necessary to prevent food-borne illness and minimize or avoid possible health hazard. Microbial inactivation, product safety and quality are the main issue of food processing and preservation viz drying, pasteurization, canning, sterilization, cooking, blanching and evaporation. In conventional thermal processing there is significant product quality damage due to slow conduction and convection heat transfer. Ohmic heating is a novel thermal food processing operation in which electric currents are passed through electric conductive foods with the prime function of heating. The heating occurs in the form of internal energy generation within the material as electrical energy is directly converted or dissipated into thermal heat with negligible heat loss. It does not require any external heating system and heat volumetrically the entire mass so it maintains quality of the product. Conduction, convection and other loss are negligible as compare to other conventional heating method which make this system energy efficient because 90% of the electrical energy is converted into heat which is rapid and reasonably uniform. it does not require heat transfer surface so it also minimizes

the fouling risk on heat transfer surface and burning of the food product, which result in minimal mechanical damage and better retention quality of nutrients and vitamin. Fishery sector is basically divided into marine and fresh water fishery which encompasses growing, transforming, or manufacturing. Many challenges are faced during production, distribution and marketing. Most of the seafood products are sold in their raw form. During production low yields and outdated harvesting technologies degrade its qualities, value and acceptance level. One of the biggest challenges faced by this sector is the value addition and fish processing, quality control and technologies are poorly developed. Traditional fish processing methods such as sun drying and smoking are widely used resulting in considerable post-harvest losses for example insect and microorganism attacks. With respect to marine fishes there is less work done on processing of cold water fishes. There is need to research in processing of fresh water fishes.

Fish is one of the most important sources of animal protein which is of high quality and contains many other nutrients for the maintenance of healthy body. It has a great potential for industry application. Present study was conducted for ohmic heating of fresh water Rohu (Labeo rohita) with the objective of Optimization of process parameters for ohmic heating and fish powder with the different level of independent variables of voltage (80, 90 & 100 V) and salt concentration (0, 2 & 4 %) and hot air dryer temperature (55,65 &75C) with constant weight 150g and analyzed the behavior of electrical conductivity and time required to heat the fish for optimizing the process conditions and to maintain the quality using response surface methodology. In this study, the response surface method and experimental design were applied for optimization of independent variables to dry the fish. Box-Benkhen design, with, 12 factorial points and 5 replicates at the centre point were used to build a model for predicting and optimizing drying process parameters. The mathematical model equations were developed by using Design-Expert 8.0.6.software for drying. Fishes were beheaded by knife then washed with 1% brine solution and cooked at different voltage and salt level combination in ohmic heater then cooked fish was transferred to hot air dryer for complete removal of moisture with hot air dryer temperature at 55°, 65° and 75C. For drying it was spread on flat hot air dryer at a thickness of thin layer. The dried fish was ground, packed & stored. For quality analysis proximate composition (protein, fat, moisture, ash and carbohydrate) were determined for studying the effect of process variables on quality parameters. It was observed that as higher the salt concentration the faster the heating time ie. time can be reduced by adding salt. Electrical conductivity changes with temperature and voltage gradient was statistically significant on ohmic hating. It was concluded that ohmic heating can improve the water release during hot air drying of fish due to effect of the electric field on the cell structure. OH induces an increment in the water release from food matrix due to elctro-poration effect induced by electric field applied. Using OH during a short time can be useful to reduce significantly the drying time. Salt level and voltage affect ohmic heating This revealed that ohmic assisted hot air drying is good technique to preserve fish for long time and adding value to raw fish, which can be further used for fortification, making soup other ready to eat product etc. This technique is not only helpful for fish processing and storage but up-gradation of the fish may also be achieved. This can help to reduce nutritional deficiency and can appropriately utilize the surplus of fish production.

YSA - 21

Physico-chemical changes during development of Mallika mango (Mangifera indica L.) fruits

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In Mallika mango fruit moisture, total soluble solids, acidity, ascorbic acid, reducing and non-reducing sugars, total sugars and starch were estimated from developing stage (42 days) to maturity. The average fruit weight and specific gravity were estimated at the harvest maturity (upto 112 days after fruit set). There was an increase in fruit weight with the concomitant increase in fruit size. The moisture content decreased as the fruits proceeded towards senescence with a reverse trend in case of specific gravity which increased till harvest. The immature fruits were perceived to be acidic, and rich in vitamin-C, but with the advancement in maturity there was a considerable decrease in acidity and vitamin-C. The decline in acidity and vitamin-C remained a continuous phenomenon till the senescence of fruits. Total soluble solids increased consistently increased with advancement in maturity and rapidly enhanced till the senescence of the fruits. Reducing and non-reducing sugars increased until harvest. After an initial decrease in total sugars, in Mallika, it increased till maturity and ripening. Reducing and total sugars slightly decreased at senescent stage, while non-reducing sugars minutely increased at senescent stage of fruits. The accumulation of starch was found to be low at the earlier stages of development of fruits but during later stages its accumulation drastically increased and this increase continued till maturity. However, there was a decline in starch content of fruit with the advancement in ripening.

YSA - 22

Shelf-life Enhancement of Raisin Bar by Modified Atmospheric Packaging

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Raisin bar was prepared by raisins, almonds and melon seeds and peanut butter. It was formulated by 35% raisins, 30% almonds, 25% melon seeds, 10% peanut butter and 320 ppm sodium benzoate. It was prepared without additional sugar and artificial flavour. Raisin bar was packaged under modified atmospheric conditions of (40% CO_2+60% N_2, 60% CO_2+40% N_2, 80%CO_2 +20% N_2). Packaged sample were kept at different temperature of 10 ^{0}C, 20 ^{0}C, 30 ^{0}C for 180 days and control

sample was packed under normal atmospheric conditions and stored at same temperature for the same period of time. These samples were evaluated for any changes in sensory attributes also examined for insects and microbial spoilage. The results clearly indicated that MAP condition of 80% CO_2+ 20% N_2 at temperature 10 ^{0}C was most appropriate condition to preserve raisin bar for 150 days without any spoilage. In nutshell, High concentration of CO_2 in MAP along with 320 ppm sodium benzoate at low temperature is more effective to enhance the shelf life of raisin bar.

YSA - 23

Development of Mango Slices Rich, Stabilizwer Free and Low Cholesterol Yoghurt with the Help of Microfluidization

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Yoghurt is most common probiotic, fermented milk product having several health beneficial properties. Among several brands of fruit flavoured yoghurt, mango flavor is very popular in Indian market. In most of the mango flavoured yoghurt, mango pulp is used instead of mango slices. Mango slices get settle down due to absorption of moisture from yoghurt and therefore gives mushy taste. Also to make low fat yoghurt, manufacturers add stabilizers for achieving desired texture and consistency similar to that of high fat yoghurt. However, due to health consciousness among the consumer, they do not prefer food containing stabilizers. Keeping this in consideration the objectives of the study was to develop yoghurt from microfluidized low cholesterol milk without adding stabilizers. Further, we tried to retain mango slices over the surface of yoghurt. Such yoghurt could be a best alternative for health conscious consumers. Microfluidization is an advanced homogenization method forming fine emulsions. In this study, toned milk was passed through microfluidizer at two different pressures 15000 and 22000 psi and checked the cholesterol level of milk by HPLC then 1-2 mm mango slices were added in the cultured milk followed by setting at refrigeration temperature. We found that yoghurt prepared from milk passed through 22000 psi pressure, had better retention of mango slices over the surface with excellent setting characteristics, low cholesterol and delicious mouth feel. These results has confirmed with the help of rheology test, FTIR, color test and sensory test. This study may be helpful for dairy industries as well as human health.

YSA - 24

Exploitation and optimization of fermentation parameters for pullulanase production by rhizospheric fungi

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Among the various starch-degrading enzymes, Pullulanase (EC 3.2.1.41) is a well-known starch-debranching enzyme, which catalyzes hydrolysis of the α-1, 6 glycosidic linkages in pullulan and amylopectin, and the α- and β-limit dextrins of amylopectin. This enzyme can be used to hydrolise starch for the production of glucose, fructose, maltose syrups, cyclodextrins, and amylose, in conjunction with or without α-amylase, β-amylase, glucoamylase, or cyclodextrin glucosyltransferase, which could dramatically increase the yield of sugars and reduce the reaction time. Recently, pullulanase has been used as a processing aid for the production of fuel ethanol, low-calorie beers, resistant starch, maltotriose, etc. with the increasing commercial interest in potential industrial applications, pullulanase production has drawn extensive attention in recent years. Although, Pullulanase was first isolated from a culture of Klebsiella pneumonia, until now, many microorganisms, including mesophiles, thermophiles, and hyperthermophiles, have been identified as pullulanase producers, and numerous pullulanases have been identified and characterized. However, there are very few reports on fungi producing pullulanase are there. In this context the present study was undertaken to exploit fungi producing pullulanase and to optimize its fermentation parameters.

A total of forty fungal isolates were obtained from rhizospheric soil of mustard plant out of which eight isolates showed pullulanase activity and from them 4 isolates showed degradation efficiency above 50% which were subjected to secondary screening for pullulanase production using submerged (SMF) and solid state fermentation (SSF). The crude extract (SSF) of isolate BN-8 showed maximum pullulanase activity (16.292 U/ml) while BN-26, BN-5, and BN-9 showed activity of 6.29, 8.150, 10.18 U/ml respectively however in case of SMF of these isolates showed comparatively less enzyme activity and protein concentration. As BN-8 showed highest enzyme activity therefore it was selected for further studies. Among the different carbon sources tested, rice bran and wheat bran was more preferred for extracellular pullulanase production. There were no difference for pullulanase production between yeast extract and peptone. Maximum Pullulanase activity of BN-8 was observed at pH 6 and at a temperature of 45°C. The results of the present study are promising, however further studies are required so that these organisms may prove to be in important step towards the development of industrial Pullulanase for the production of fuel ethanol, low-calorie beers, resistant starch etc.

Fungi were isolated from rhizosphere soil of mustard using standard Pour Plate method. The cultures were screened for their Pullulanase activity on Pullulan agar media. The cultures were point inoculated on Pullulan agar and after 5days of incubation was flooded with iodine. Degradation efficiency of all the pullulanase producers isolates was calculated using the formula (H-C)/C (%). The five days old culture is used for both preparation of mother culture and spore suspension. The fermentation media contained (g/L): 28; KH_2PO_4, 19.6; $(NH_4)_2SO_4$, 4.2; $MgSO_4.7H_2O$, 0.07; $FeSO_4$.7H20, 0.021; $MnSO_4.7H_2O$, 0.019; $MnSO_4.7H_2O$, 0.028; $CaCl_2$, 7; yeast extract, pH 6.5. However pullulan is used as carbon source for the SMF and rice bran, wheat bran, saw dust and coconut coir dust for SSF. In the SSF the substrates were moistened with the above salt solution in 1:1 ratio. The inoculums size in SMF is 10% and in SSF the media is supplied with 1 mL of spore suspension. In SSF the fermentation process is carried out for 7 days at room temperature (28-30°C) with a frequent mixing in every 24 hrs. The crude enzyme extract was prepared by extracting the fermented substrates in 25 mL 0f 1 M phosphate buffer (7.0 pH) followed by filtration and centrifugation. Submerged fermentation is carried out in a 250 mL capacity Erlenmeyer flask at 250 rpm and 30°C temperature for seven days. The culture broth was centrifuged at 4°C, 8000 rpm for 20 min. The collected supernatant was used as crude enzyme extract for the determination of enzyme activity. The crude enzyme activity was assayed by measuring the reducing sugar released from 1% pullulan in the 1 M phosphate buffer and protein concentration was determined by Lowry's method.

Pullulanase is an important enzyme in starch processing which is used on a large scale in glucose and maltose syrup industries. In recent times, the agricultural wastes rich in polysaccharides can be processed to useful from the sucrose and glucose instant of dumping. Pullulanase has been used in some industries like glucose and maltose syrup production, baking and cyclodextrin production recently. In future pullulanase enzyme can be widely used in industries if we find this enzyme with high stability and activity. In this context, 40 fungal isolates were obtained from rhizospheric soil. The primary screening of these fungal isolates on pullulan agar showed that 8 isolates have pullulytic ability by forming zone of transparent, and 4 isolates showed degradation efficiency above 50%.

These 4 isolates were subjected to secondary screening under submerged and solid state fermentation. The crude extract of solid SSF of isolate BN-8 showed maximum pullulanase activity (16.292 U/ml) while that of BN-26, BN-5, and BN-9 showed activity of 6.29, 8.150, 10.18 U/ml respectively. These results are comparable with the previous studies on fungi. The culture filtrate of these isolates in submerged fermentation showed comparatively less enzyme activity as well protein concentration. As BN-8 showed highest enzyme activity therefore it was selected for further studies. Among the different carbon sources tested, rice bran and wheat bran was more preferred for extracellular pullulanase production.

There were no difference for pullulanase production between yeast extract and peptone. A pH range from 4 to 7.5 was used to study the effect of pH on pullulanase activity. Pullulanase activity of BN-8 reached its maximum at pH 6; this value was similar to that of pullulanase from bacterial

sources. The optimum temperature for pullulanase activity was 45°C. Earlier, the optimum temperature for the pullulanase of various thermophilic bacteria has been reported between 70 and 90°C. From the present study it can be concluded that the fungi from the rhizospheric soil of mustard plant have a potential to produce pullulanase. The most promising isolate BN-8gives maximum enzyme activity of 16.292 U/mL at pH 6 and 45°C temperature which was produced at pH 6.5 and 30°C temperature . This may be an important source of enzyme for industrial application in food processing. It is a first report of rhizospheric fungi producing pullulanase.

YSA - 25
Screening of Ashwagandha Root Extracts for the Maximum Functional Components

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Withaniasomnifera (Family.Solanaceae) is a herbal drug from the Indian system of medicine and commonly known as Ashwagandha. Ashwagandha has anti-infective, antitumor, anti-stress, antioxidant, mind-boosting, rejuvenating, immunomodulatory and anti-ageing properties. It contains flavonoids and withanolides. The antioxidant effect is due to natural antioxidants, superoxide dismutase, catalase and glutathione peroxidase.The roots of Ashwagandhahave a lot of functionally important active constituents that are helpful in tumor treatment, immunomodulation, memory enhancing capacities, neuroprotective power etc. Thus this work was undertaken with the objective to find out the best solvent to extract the maximum functional components from the root of Ashwagandha.It has anti-stress, adaptogenic, aphrodisiac, sedative, diuretic, antispasmodic, germicidal, antinflammatory action. It is a nervine tonic. It enhances immunity and endurance. It is a natural nutrient for insomnia. It is good hypnotic in alcoholism. It stimulates thyroid activity. It enhances anti-peroxidation of liver.

In the present study, the most effective solvent (among ethanol, water, methanol and acetone) for extracting the major antioxidant compounds especially polyphenolicsfrom Ashwagandha root using various in vitro tests including 1, 1-diphenyl-2-picryl-hydrazil (DPPH) free radical scavenging, metal ion chelating, hydrogen peroxide scavenging, superoxide anion radical scavenging, and ferric thiocyanate reducing ability were identified. Total solids were determined by drying different solvent extracts of Ashwagandha root at 100 °C in hot air oven. The oven drying was done in triplicate to find out accurate result. Antiradical activity was determined by antioxidants of Ashwagandha root extract against two radicals DPPH and ABTS (2, 2- Azinobis- 3- ethylene benzoline-6 sulphonic acid). The percentage inhibitions of these two radicals were directly proportional to the presence of antioxidants in the extracts of different solvents.

Highest yield was obtained in Ethanol extract of Ashwagandha as 0.28 mg/g of Ashwagandharoot.Ethanol extract of Ashwagandha root was having the highest anti-oxidant activity as it showed near about 80.00% DPPH inhibition at 2mg/ml concentration and 21.52% ABTS inhibition. Maximum antioxidant activity was achieved by Ethanolic extract of Ashwagandha root extract i.e., 21.52 % ABTS inhibition. Antioxidant activity depends on the presence of amount of total polyphenolic compounds. Highest extractability of polyphenolic compounds was achieved by ethanol, which showed maximum antiradical activity also. Phenolic components are present in huge amount in Ashwagandha root. Ethanolic extract of Ashwagandha root exhibited highest phenolic content i.e. 58.77 mg /100 g of dry sample in terms of gallic acid equivalent.Acetone and methanol have different capacity for the extraction of polyphenolic substances.Variations were justified by the well-known tendency of phenols to combine themselves through polymerization reactions; due to the more significant area of charge delocalization, oligomers exerted a higher antiradical activity than the original monomers. Ethanolic extract of Withaniasomnifera (EEWS) had significant ($p<0.01$) (DPPH) free radical scavenging (82%), metal ion chelating (78.88%), hydrogen peroxide scavenging (91.36%), superoxide anion radical scavenging (67.66%) and significant ($p<0.05$) ferric thiocyanate reducing activities.

A significant ($p<0.01$) decrease in the concentration of DPPH radical was observed due to the scavenging ability of the Ethanolic extract of Withaniasomnifera and standards. The standards used were BHA, BHT α-tocopherol and l- ascorbic acid. The scavenging effect of the Ethanolic extract of Withaniasomnifera and standards on the DPPH radical decreased in the order of Ethanolic extract of Withaniasomnifera> BHA > l-ascorbic acid > BHT > α tocopherol and were 82, 65, 63, 62 and 61% at the concentration of 50 µg/ml, respectively, which were statistically significant ($p<0.01$) compared to the control. Free radical scavenging activity increased with increasing concentration. The formation of Fe^{2+}ferrozine complex is not completed in the presence of Ethanolic extract of Withaniasomnifera and standards which indicate that Ethanolic extract of Withaniasomnifera chelate the iron. The absorbance of Fe^{2+}ferrozine complex was dose dependent and linearly decreased (from 25 to 50 µg/ml). The difference between Ethanolic extract of Withaniasomnifera and the control was statistically significant ($p<0.01$). The percentage of metal chelating capacity of 50 µg/ml concentration of Ethanolic extract of Withaniasomnifera, α-tocopherol, l- ascorbic acid, BHA and BHT were found to be 78.88, 61.92, 70.02, 76.82 and 64.62 %, respectively.The metal scavenging effect of Ethanolic extract of Withaniasomnifera and standards decreased in the order of Ethanolic extract of Withaniasomnifera> BHA > l-ascorbic acid > BHT > α-tocopherol. 25 µg/ml Ethanolic extract of Withaniasomnifera had strong H_2O_2 scavenging activity in comparison with the same doses of BHA, BHT, l- ascorbic acid and α-tocopherol. The percentage of H_2O_2 scavenging activity by same concentration (25 µg/ml) of Ethanolic extract of Withaniasomnifera, BHA, BHT, l-ascorbic acid and α-tocopherol were found to be 91.36, 90.1, 72.56, 83.65 and 72.28 % respectively, which were statistically significantly different ($p<0.01$) compared to the control. These results showed that Ethanolic extract of Withaniasomnifera had effective H_2O_2 scavenging activity and it was in the following order: Ethanolic extract of Withaniasomnifera> BHA > l-ascorbic acid > BHT > α-tocopherol.

Percentage inhibition of superoxide radical generation at 25 µg/ml concentration of Ethanolic extract of Withaniasomnifera was determined and compared with same doses of BHA, BHT, α-tocopherol and l- ascorbic acid. Ethanolic extract of Withaniasomnifera had strong superoxide radical scavenging activity comparable to that of BHA but lesser than BHT, α-tocopherol and l-ascorbic acid. The percentage inhibition of superoxide generation by 25 µg/ml concentration of Ethanolic extract of Withaniasomnifera was found to be 67.66 % whereas of BHT, α-tocopherol, l-ascorbic acid, BHA were found to be 81.56, 73.14, 70.21 and 68.83 %, respectively, which were statistically significant ($p<0.01$) from the control. Superoxide radical scavenging activity of these samples followed the order: BHT > α-tocopherol> l- ascorbic acid > BHA >Ethanolic extract of Withaniasomnifera. The reducing power of Ethanolic extract of Withaniasomnifera increased with increasing concentration. All the concentration of Ethanolic extract of Withaniasomnifera showed higher activities than BHT, α-tocopherol and l-ascorbic acid and these differences were statistically significant ($p<0.05$). Ethanolic extract of Withaniasomnifera and BHA had statistically similar reducing power ($p>0.05$). Reducing power of Ethanolic extract of Withaniasomnifera and standard compounds followed the order: BHA >Ethanolic extract of Withaniasomnifera> α-tocopherol> l-ascorbic acid > BHT.

Percentage inhibition of superoxide radical generation at 25 µg/ml concentration of Ethanolic extract of Withaniasomnifera was determined and compared with same doses of BHA, BHT, α-tocopherol and l- ascorbic acid. Ethanolic extract of Withaniasomnifera had strong superoxide radical scavenging activity comparable to that of BHA but lesser than BHT, α-tocopherol and l-ascorbic acid. When the functional activities of extracts obtained were compared, Ethanol extracts showed the highest values in all four solvents except for DPPH Inhibition. Ethanol extracts showed maximum antioxidant activities and phenolic compounds whereas acetone showed maximum percentage of DPPH Inhibition. Yet acetone Ashwagandha root extracts possessed high functional properties in terms of percentage of DPPH Inhibition, it cannot be incorporated into any food product as it is toxic in nature. Ethanol extracts exhibited highest functional properties than any other solvent extracts and were comparable with standard antioxidants viz. BHA, BHT, Ascorbic acid and α-Tocopherol.

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Concentric Encapsulation of β-carotene and Ω-fatty acids using novel encapsulant complex

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Carotenoids, the most commonly available pigments in nature include β-carotene, lycopene, lutein, and zeaxanthin, etc. are good sources of antioxidants and acts as precursors of vitamin A. Among

carotenoids, β-carotene has the highest pro-vitamin A activity;is reported to be beneficial for human health disorders such as cardiovascular disease, macular degeneration and cataracts; and is the most widely used as a natural colourant in the food, pharma and cosmetic industry. However, insolubility in water and rapid degradation during processing and storage reduces the dispersibility and bioavailability of β-carotene during gastro-intestinal passage.

Poly-unsaturated fatty acids (PUFA) especially ω-3 (linolenic acid) and ω-6 (linoleic acid) is a precursor of Eicosapentaenoic Acid, (EPA) and Docosahexaenoic Acid (DHA), which reportedly controls various metabolites responsible for vital biological functions. One of the major problems associated with oils rich in PUFA is their susceptibility to hydrolytic and oxidative rancidity leading to the development of free fatty acids; and objectionable odours and/or flavours.

A suitable strategy therefore, needs to be developed to overcome the drawbacks of β-carotene and PUFA and ensure their effective delivery and bioavailability among the consumers. One such strategy is encapsulation of the target materials (β-carotene and PUFA) within a suitable wall matrix which in addition to providing a barrier to pro-oxidant compounds and effectively limiting the extent degradation also increases the stability and shelf life of the product being encapsulated; facilitate the manipulation of the product and control its liberation in an adequate rate, time and space; and improves the handling properties of sticky materials.

The most prevalent wall matrices used by the industry presently include maltodextrin, gelatine, alginate, etc. which are simple carriers and have no additional nutritional or nutraceutical value of its own. Hence, an effort was made to find a suitable novel encapsulant combination which would in addition to effectively encapsulate the active ingredients (β-carotene and PUFA) also has some nutritional/nutraceutical properties of its own which can be beneficial to the consumer.

The present study investigates the extraction of β-carotene from ripe bitter gourd pericarp using supercritical CO_2, produce solid lipid nanoparticles composed of PUFA (rice bran oil and flaxseed oil), stabilized by layer of gum arabic using high pressure homogenization and subsequently encapsulate the developed nanoparticles with a suitable combination of jackfruit seed polysaccharide and whey protein isolate using spray drying.

In the present study, β-carotene was extracted from the pericarp of ripe bitter gourd which is a by-product of the seed industry using supercritical CO_2. In order to increase the extractability of β-carotene pericarp of ripe bitter gourd was subjected to enzymatic treatment (2% of 167 U/g pectinase enzyme in citrate buffer pH 5.0) prior to drying. The enzyme treated and dried pericarp was used to extract β-carotene using supercritical CO_2using five levels each of pressure (150, 225, 300, 375 & 450 bars), flow rate (15, 25, 35, 45 & 55 ml/min.), temperature (50, 60, 70, 80 & 90°C) and time of extraction (45, 90, 135, 180 & 225 min.). Experiments were conducted using central composite rotatable design (CCRD) of response surface methodology (RSM). The process conditions for supercritical CO_2 extraction were optimized based maximum recovery of β-carotene.

β-carotene extracted using the optimum conditions was used to formulate solid lipid nanoparticles with rice bran oil and flaxseed oil using high pressure homogenization. The experimental variables

included pressure (25000, 30000, 35000, 40000 & 45000 psi), oil: β-carotene (1:1, 1:2, 1:3, 1:4 & 1:5) and number of cycles (1, 2, 3, 4 & 5).Experiments were conducted using central composite rotatable design (CCRD) of response surface methodology (RSM) and the process optimized based on average particle size, polydispersity index (PI) – a measure of the stability of the emulsion, zeta potential, entrapment efficiency, β-carotene, γ-oryzanol, and fatty acid constituent. Additionally surface characterization of the nanoparticles obtained using optimized conditions using transmission electron microscopy (TEM).

The nanoparticles obtained at the optimum conditions separately using rice bran oil (RBO) and flaxseed oil (FSO) were mixed with a combination of jackfruit seed polysaccharide and whey protein isolate (1:1)and spray dried at inlet temperature of 150±2°C and the outlet temperature of 60±2°C.The final TSS of the feed max was maintained at 25°Brix. Dried materials were characterized for its particle size distribution, β-carotene, γ-oryzanol, encapsulation efficiency, fatty acids constituents morphologically characteristics was analysed using scanning electron microscopy (SEM). Spray dried materials were also investigated for their in-vitro release kinetics in simulated gastric fluid (SGF, 1.2 pH) and intestinal fluid (SIF, 7.4).Accelerated storage studies have also been undertaken to evaluate its shelf life under ambient and refrigerated conditions.

β-carotene content in the pericarp of ripe bitter gourd was found to be 7.63 mg/100g. Enzymatic digestion increased it to 9.72mg/100g (an increase of 21.05%). The digested material was lyophilized and used for the extraction of β-carotene with supercritical CO_2. β-carotene yields varies from 14.87 to 84.77% at different process parameter combinations. A combination of 690C temperature, 393 bar pressure, 37 ml/min flow rate of supercritical CO_2 for a period of 190 min. was found to be optimum since it resulted in an extraction yield of 90.12%. Extraction yields were significantly affected by pressure, temperature and extraction time. Flow rate however, was found to have a non-significant effect on extraction yields.

Extracted β-carotene was used for the formulation of solid lipid nanoparticles along with rice bran oil (RBO) and flaxseed oil (FSO) using high pressure homogenization. Nanoparticles obtained under different operating conditions using RBO & FSO were found to have particle sizes varying from 102.33 to 431.36 nm and 94.37 to 384.12 nm; PI values 0.247 to 0.587 and 0.219 to 0.689; zeta potential 7.6 to 86.4 mV and 10.5 to 97.8 mV; β-carotene contents 0.161 to 0.653 g/100mL and 0.156 to 0.635 g/100ml; □-6 fatty acid contents 45.17 to 66.14% and 9.83 to 15.02%; □-9 fatty acid contents 25.89 to 32.11% and 15.07 and 20.11%; and β-carotene entrapment efficiencies 75.12 to 98.55% and 72.28 to 97.45% respectively.

Additionally, nanoparticles having RBO was evaluated for its □-6 fatty acid retention which varied between 65.58 to 96.03% and γ-oryzanol retention which varied between 62.68 to 95.37%. Nanoparticles having FSO was evaluated for its □-3 fatty acid retention which ranged from 64.46 to 98.34%.

The optimum conditions for formulation of solid lipid nanoparticles of β-carotene using RBO were found to be 37200 psi pressure, ratio of RBO & β-carotene 1:4 and 3 cycles. The same for

formulation using FSO were 33450 psi, 1:3 & 4 respectively. TEM analysis of solid lipid nanoparticles revealed perfect entrapment of β-carotene within RBO & FSO spheres.

Solid lipid nanoparticles of β-carotene in RBO had a particle size of 158.05 nm, PI 0.34, zeta potential 52.07mV, β-carotene content 0.53 g/100ml and β-carotene entrapment efficiency of 86.58%. The same for the nanoparticles of β-carotene in RBO were 127.58 nm, 0.32, 82.19 mV, 0.38 g/100ml and 86.57% respectively.

Both the emulsion containing solid lipid nanoparticles of β-carotene & RBO and β-carotene & FSO were added with encapsulants (jackfruit seed polysaccharide and whey protein isolate at 1:1 ratio) and spray dried at pre-optimized conditions. The spray dried materials having β-carotene & RBO were found to have an average particle size of 6.65µm; β-carotene, γ-oryzanol content & □-6 fatty acid of 1.96g/100g, 0.35g/100g & 58.42%; and β-carotene & γ-oryzanol encapsulation efficiencies of 94.43% & 93.48%. However the entrapment efficiency of □-6 fatty acid was 97.23%. The values for spray dried materials having β-carotene & FSO were particle size of 4.34µm; β-carotene content of 1.49g/100g; □-3 fatty 44.34% and β-carotene encapsulation efficiencies of 96.68% and entrapment efficiency of □-3 fatty acid of 94.27% respectively.

Scanning electron microscopy analysis of spray dried material containing β-carotene-FSO nanoparticle revealed spherical shape having a rough surface with large projections and undulations. The ones having β-carotene-RBO nanoparticle however were found to be spherical with smooth surface. In vitro release studies of both the encapsulates under 1.2 & 7.4 pH revealed that the release of β-carotene in acidic medium higher than in the neutral pH 7.4 (55.52 and 37.16% for FSO & 47.23 and 31.54% RBO. Accelerated storage study indicated that the encapsulated materials can be safely stored for six months in air tight amber coloured containers without any significant loss of its active ingredients.

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A study on the potential role of aloe vera (Aloe Barbadensis) as a natural antimicrobial agent in vegetables juice blend

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The demand for food with extended shelf-life, lower level of harmful chemical preservatives and absence of risk causing food borne infection have made food processors, food safety researchers, and regulatory agencies to focus on exploring naturally occurring preservatives having negative side effects on human health. The use of natural antimicrobial compounds, especially extracted from plants, as food preservatives are nowadays drawing attention widely, since plant matrices possesses antimicrobial natural products to protect themselves from microbial infection and deterioration. Aloe vera is one such versatile medicinal plant known for antimicrobial activities

against different types of microbes, including food borne pathogens. However potential use of aloe vera products often involves some types of processing that may be detrimental to the active ingredients in aloe vera. So it was justified to consider developing products incorporating untreated, fresh aloe vera juice.

Keeping in view of these facts an attempt was made to investigate the present study with following objectives-

1. To prepare and optimize a juice blend by incorporating Karela (Bitter gourd) juice into Lawki (Bottle gourd) juice at varying proportions.
2. To prepare Lawki Karela-Aloe vera (LKA) juice blend by incorporating aloe vera juice in optimized Lawki-Karela (LK) juice blend
3. To compare the microbial load of juice blend with aloe vera juice and without aloe vera juice kept at ambient and refrigeration temperature.
4. To determine shelf life of both juice blends in order to explore potential applicability of aloe vera juice in food industries as a natural food preservative

For the preparation of juice blends, Lawki juice, Karela juice and Aloe vera juice was extracted separately. Five types of Lawki-Karela (LK) juice blends each of 150 ml were prepared by combining Lawki and Karela juice in different proportions. Through sensory evaluation best combination was optimized. Thirty ml of optimized Lawki-Karela juice blend (LK) was then replaced by equivalent amount of aloe- vera juice to have Lawki Karela - Aloe vera (LKA) juice blend. Sensory evaluation of different LK juice blends and comparison of sensory attributes of optimized LK juice blend and LKA juice blend was done by a panel comprising of 15 semi trained judges drawn from faculty members, Ph D scholars and post graduate students of Department of Foods and Nutrition. Panelists were asked to rate blends on the basis of their tolerability to bitterness of different juice blends. Nine Point Hedonic rating scale and Score card method as described by Amerine et al., (1965) were used for sensory evaluation of juice blends. Role of aloe vera as natural anti-microbial agent was studied by evaluating microbiological characteristic i.e. Total Plate Count (TPC), Total Coliform Count (TCC) and Yeast and Mould Count (YMC) of LK and LKA juice blend kept at ambient temperature and refrigeration temperature on 0 day (fresh), 1st, 2nd, 3rd and 7th day. TCC and YMC of the juices was determined by using standard plate count method as given by APHA (1984) while TPC of juices was determined by using standard plate count method as given by Busta et al., (1976).

Data on organoleptic evaluation of LK juice blends revealed that color, appearance and consistency of blend having Lawki and Karela juice in ratio 120:30 scored highest. While blend 135:15 scored highest for Taste and flavor. On nine point hedonic scale blends having Lawki and Karela juice in the ratio of 135:15 and 120:30 were rated as liked slightly by 38.66 per cent and 35.86 per cent panelists respectively. Further increment in the level of Karela juice level resulted in rating of blends as disliked slightly. Since both120:30 and 135:15 LK blend scored equal rate but because of therapeutic importance of Karela juice, the blend 120:30 having more Karela juice was choosen over 135:15 for further incorporation of aloe vera juice. The mean sensory scores for colour, appearance, flavour, taste, consistency and overall acceptability of aloe vera incorporated LKA juice

blend showed no significant difference with LK juice blend. Also, both LK and LKA juice blends were rated as liked slightly by penalists. The storage study showed that TPC, TCC and YMC of LK juice and LKA juice blend kept at room temperature and refrigeration temperature increased consecutively from first day to third day. Total plate count (cfu / ml) of fresh LK and LKA juice blend was found to be 5.6×10^1 and 3.5×10^1 respectively while Total coliform count (TCC) of LK and LKA juice was found to be 8.5×10^1 cfu / ml and 4.6×10^1 cfu / ml respectively on 0 day of storage. The yeast and mold count of fresh LK and aloe vera incorporated LKA juice blend was observed as 2.54×10^1 and 2.34×10^1 respectively. The result showed that LKA juice blend had lower TPC, TCC and YMC as compared to LK juice blend even on 0 day of storage. Data pertaining to juice blends kept at ambient and refrigeration temperature showed that during the entire storage period TPC, TCC and YMC of the LKA juice blend having aloe vera juice was lower than LK juice blend. This might be due to anti microbial activity of aloe vera juice which checked the activities of micro organisms. The TPC, TCC and YMC of LK and LKA juice kept at ambient temperature was found to be higher than the LK and LKA juice blend kept at refrigeration temperature on 3rd day of storage thus showing effectiveness of storage at low temperature. The microbial load of LK and LKA juice blend kept at ambient temperature on first day and also the microbial load of LK and LKA juice blend kept at refrigeration temperature on second day of storage was found to be within permissible limits. So on the basis of microbial studies, the shelf life of LK juice and LKA juice blend was found one day at ambient temperature while 2 days at refrigeration temperature.

Conclusion: Based on the study conducted, it can be concluded that incorporation of aloe vera juice to Lawki-Karela juice blend brought no significant changes in the organoleptic characteristics of juice blends. Further, the study also showed anti-microbial activity of aloe vera juice by limiting the growth of micro-organisms during storage period. Thus effectively extending the shelf life of products. In fact Aloe vera can be considered as a convenient and safe natural alternative to synthetic anti-microbial agent in food processing industry.

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Role of curcumin as a food supplement for prevention against blood cancer

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Hippocrates was a great visionary when he stated "Let food be thy medicine and medicine be thy food." Dietary supplements do not directly help in treating or cure from a disease however their supplementation may prevent from the early symptoms of the disease and also help in giving a better quality of life. A proper food composition can help in prevention from diseases like cancer suggesting the importance of nutraceuticals, which is a term used to describe any ingredient derived from food sources that can provide extra health benefits along with their basic nutritional

values. Cancer has a lower incidence rate in Indian population, where people consume a spice rich food. Different spices consumed by Indian population have a variety of roles like flavoring agents, colorants, and preservatives. However, plant derived foods are always looked for role in lowering the risk of diseases and the increasing evidence suggests their role in inhibiting the process of tumorigenesis or cancer development per se. In this study, we have explored role of curcumin in improving treatment outcome in cancer patients. Curcumin, an alkaloid is an active ingredient of turmeric known to possess potent anti-inflammatory effects. Cancer is a disease started by a pro inflammatory microenvironment and curcumin anti-inflammatory effects might play a protective role against cancer progression. Leukemia is one of the most common childhood malignancies affecting normal blood cell development, with a peak incidence level in children between the ages of 3-6 years. We have analyzed the anti cancerous effect of curcumin on leukemia cell lines and have attempted to find the key pathway involved. We have also studied its interaction with a leukemia drug doxorubicin.

To investigate the anti cancerous effect of curcumin as a food supplement and further to study its effect on drug used in treatment.

Two leukemia cell line RS4;11 and REH were grown in RPMI-1640 (Gibco (Grand Island, NY, USA), supplemented with 10% fetal bovine serum (Gibco (Grand Island, NY, USA), 1% antibiotic (Himedia, Mumbai, India) in a 5% CO_2 incubator at 37^{0}C.

Five thousand cells per well (200µl/well) were cultured in 96-well plates and then treated with 10 to 100 µM of curcumin (Sigma Chemical Co., St. Louis, MO, USA) for 24 h. Cell cytotoxicity was assessed by MTT Cell Assay Kit (Himedia, India) as per manufacturer's protocol. Yellow colored water soluble Tetrazolium dye 3-[4, 5-dimethylthiazol-2-yl]-2, 5-diphenyl tetrazolium bromide (MTT) reduced to formazan crystals was dissolved in DMSO (Sigma Aldrich, USA). Absorbance was recorded at 570nm on a microplate reader (BioRad, USA). The percentage of cell viability was calculated using the formula: Cell viability (%) = OD of treated/OD of control×100.

Annexin V/propidium iodide assay was performed to calculate apoptotic cells as per manufacturer's protocol (Invitrogen, Molecular Probes, USA). Cells were seeded in 5 ml media in 6-well plates and treated with curcumin (10µM and 20µM) for 24 hours. A total of 10,000 events were acquired and analyzed by flow cytometry (BD, San Diego, USA). After staining, different cell populations are easily distinguished in the scatter plot using a flow cytometer.

Cells treated with curcumin alone or combined with doxorubicin were collected after 24 h treatment and washed twice with PBS. Protein was isolated from the cell lysate. Equal quantity of protein (20~30 µg) was used for western blot analysis. Approximately equal amounts of protein were loaded in each lane of 10% SDS-PAGE gels. Resolved protein was later electrophoretically transferred onto PVDF membranes (Millipore, USA). PVDF membranes were blocked with 5% non-fat milk powder in TBST containing 0.5% Tween-20. After blocking, PVDF membranes were incubated with anti PARP-1 antibody (Cell Signaling) and anti GAPDH (Imgenex, India) for overnight at 4ºC. Membranes were further incubated with their respective secondary antibodies conjugated

to ALP for 2h. After this membranes were exposed to BCIP/NBT solution (Amersco, USA).

Curcumin and doxorubicin both at dose lower than their IC50 values were used for co treatment and the combined effect was analyzed through MTT assay.

Curcumin treatment resulted in cell death in leukemia cell lines with a half maximal inhibitory concentration (IC50) ranging between 10μM to 20μM. Curcumin induced a dose- dependent decrease in cell viability in a 24 hour treatment. The result suggests that curcumin has a cytotoxic role. Annexin V/ PI apoptosis assay also show rise in apoptotic cell population after curcumin treatment. PARP-1 is the downstream substrate of caspase family and is a hallmark mediator of the apoptotis. It was found that curcumin cleaves PARP-1 forming 116 and 89kD bands which suggests caspases pathway mediated apoptosis after 24 h treatment (10 and 20μ M). PARP-1, cleavage thereby confirms apoptosis. Doxorubicin is age old chemotherapeutic drug known to induce apoptosis in various malignancies. IC50 dose was calculated using MTT assay. 5nM IC50 dose and a dose lower than IC50 value 2.5nM was chosen. 10μM curcumin and 5nM doxorubicin induced apoptosis as evident by PARP-1 cleavage. When given simultaneously, a 2.5nM doxorubicin and 10μM curcumin induced a higher level of apoptosis. With a gradual increase in 89kD fragment of PARP-1, increased level of apoptosis was also observed dose dependently which suggests enhanced level of apoptosis when curcumin was supplemented with doxorubicin in cell culture. Our results show that curcumin is an effective anti cancerous agent with chemo preventive role against blood related malignancies. It also enhances the treatment efficacy of chemotherapeutic drugs. We state that adding curcumin as a food supplement could be an effective strategy for a better life style. Our study highlights the use of nutraceuticals for disease prevention.

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Feeding Terminalia arjuna Roxb. bark acetone extract to rats attenuated type-II diabetic complications by blocking oxidative stress and DNA damage

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Type-II diabetes mellitus is a common metabolic disorder or syndrome of today's worldwide society and it is predicted that by 2025 India will have >60 million diabetic population or one in five diabetic patients in the world will be an Indian. The use of synthetic drugs like glemipiride, metformin for the treatment of diabetes is cost effective and possesses side effects. Thus, there is a strong urge of effective and low cost herbal preparation with least side effects for diabetes management. So, in the present study Terminalia arjuna bark extract was tested for its protective effect on type-II diabetes mellitus. The acetone extract of T. arjuna bark was prepared by soaking dry bark with acetone (1:4 w/v) for 48 hrs and then dry powder were prepared and estimated for tannin, alkaloid content and antioxidant power. Sixty wistar rats fed with standard chow were grouped in six groups i.e. Group I- nondiabetic; Group II- diabetic control; Group III- diabetic rats fed with 250mg/kg body

weight (BW) bark extract; Group IV- diabetic rats fed with 500mg/kg BW bark extract; Group V- diabetic rats fed with glimepiride at a concentration of 2mg/kg BW and Group VI- nondiabetic bark fed runner group. Rats of group II to V were artificially induced to type-II diabetes by feeding 21% fructose with standard chow for four weeks followed by IP injection of STZ (40mg/kg BW). Diabetic rats fed with T. arjuna bark for 4and 8 weeks were tested for its effect on blood glucose level, plasma insulin level, insulin resistance index (HOMA), oxidative stress in liver and kidney (Superoxide dismutase; Catalase; Reduced glutathione; Lipid peroxidation, TBARS), oxidative stress induced DNA damage in blood lymphocyte and relative gene expression of diabetic markers like glycogen synthase (gs), phospho-enolpyruvate carboxykinase (pepck), glucose-6-phosphatase (g6pase), vascular endothelial growth factor (vegf) in hepatic tissue. Parameters like blood glucose level, plasma insulin level, HOMA and oxidative stress were significantly ($p<0.05$) decreased in diabetic rats by feeding bark extract (group III, IV) or glimepiride (group V) for 8 weeks. DNA damage in diabetic rats were attenuated by feeding bark extract or glimepiride. mRNA abundance of pepck, g6pase and vegf genes were significantly increased in diabetic control rats (group II) which were restored to normal in rats fed with bark extract or glemipiride. Whereas mRNA levels of glycogen synthase (gs) was found to be equal in all groups of rats. In future, purified biologically active compound from T. arjuna Roxb. bark acetone extract could be a good target for development of safe alternative therapeutic agent in the pharmacological management of type-II diabetes mellitus.

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Assessment of Dietary Intake of Chronic Kidney Disease Patients in Tertiary Hospital Setup in Eastern India

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In adequate dietary intake of energy and protein is recognized as a leading cause of the development of malnutrition in Chronic Kidney Disease (CKD). Protein Energy Wasting (PEW) is common among patients with Chronic Kidney Disease (CKD). In adults, the presence of PEW is one of the strongest predictors of morbidity and mortality. Protein energy wasting leads to other infections which lead to morbidity and mortality of the patients. The objective was "to assess the of Dietary Intake of Chronic Kidney Disease Patients in Tertiary Hospital Setup In Eastern India".

Hospital based cross sectional study designed was adopted for the study. This study was conducted at the department of Nephrology Institute of Medical Sciences, Banaras Hindu University, and Varanasi. 175 patients of chronic kidney disease attending OPD of the nephrology department first time were considered as subjects of the study. After taking Consent from the non dialysed patients they were interviewed regarding their socio demographic characteristics. Weight and age was

recorded to measure the glomerular filtration rate (GFR). For dietary assessment five day diet diary method was used. Anthropometric assessment was done to assess nutrition status of these patents.

General characteristics of non-dialyzed CKD patients had been assessed by interview technique using pretested and predesigned interview schedule. As much as 57.9% male and 48.2 % female CKD subjects were from stage IV and 18.5 % male and 46.4 % female subjects were from stage V CKD. Overall only 2.3 % subjects were from stage II, 15.4 % were from stage III 54.9 % from stage IV and 27.4 % from stage V respectively. Out of total 175 study subjects 119 (68%) were male and 56 (32%) were female indicating sex ratio of 2:1. Slightly more than half (52.6%) patients were of higher age group i.e.45–65 years followed by 21.7% more than 65 years and 16% patients were also younger i.e. between ages 25 – 44 years and 9.0% below the age of 24 years. Ninety seven (55.4%) cases were from rural background and rest from urban area. Urban population comprises of nearly 30% of total population and more presentation of urban cases is indicating access of this health care service, their awareness to the disease and preferential utilization of expertise of this hospital. Of total 175 cases 18.3% were from service class by occupation, 16% were farmers and 10.9% were businessman. Out of 56 females, 44 (78.6%) were primarily engaged in domestic work. Majority (87.4%) subjects were married. One hundred and two (58.3%) subjects were from nuclear family. In case of 96 (54.9%) subjects family size was > 6; obviously more families are expected to be from nuclear. Fifty eight (33.9%) subjects belonged to very low plus lower middle SES category; corresponding value for rural and urban areas were 48.5% and, 14.1% respectively. As much as 7.2% subjects from rural areas and 19.2% subjects from urban area were from high SES. The presentation of lesser cases from lower and upper class is probably low incidence or poor reporting due to financial constraints among poor and low incidence and utilizing services from private sector among rich. As much as 40.6% subjects were occasionally non vegetarian in nature. While, 33.7%, 23.4% and 2.3% subject were vegetarian. non vegetarian and eggitarian, respectively. As much as 72% study subjects had irregular meal timing. Average calorie intake of study subjects was 1006.1 ± 415.16 Kcal /day and it was less than RDA for Indians. Protein fat and carbohydrates intake were 57.1%, 87.2% and 46.8 % of respective RDA. Average calorie intake of the study subjects was 1006.1 ± 415.16 Kcal/d which was 43.4 % of the RDA for CKD. Average calcium intake was 546.86 ± 390.19 mg/d which was 91.1% of the RDA.

In comparison to RDA iron, vitamin A and Vitamin C intakes were 60.1%, 39.5% and 94.4%, respectively. In case of 69.9% 49.1% and 41.1% subjects calorie protein and fat intake was 50% less than the RDA. As much as 49.7%, 17.1% and 66.3% subjects had calorie, protein and fat intake less than 50% of the RDA for CKD patients.

This study shows that the majority of CKD patient are malnourished and they shows the sign of protein energy wasting.

CKD, PEW, RDA, SES, GFR.

YSA - 31

Biofortification in modern rice cultivars: Strategies to mitigate nutritional deficiency in human being

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Rice is cultivated annually in an area of 159.40 million hectares with global production of 696.3 million tonnes. Most of the global rice growing area is concentrated in the Asian countries (88.95%) with 90.40% share to the global rice production. Rice provides 20 per cent of World's dietary energy supply compared to 19% and 5% of wheat and maize, respectively as rice is solely taken in food by millions of people. Average annual consumption of rice per person is 71-83 kilogram (Kg) with daily intake of 194-227 grams which provides 32-52% and 25-44% of energy and protein dietary requirements of human. Rice grain consists of the hull (awn + lemma + palea + sterile glumes + rachila) and the caryopsis or brown rice. The brown rice is the edible fraction of the rice grain. Dietary fibre, minerals and B vitamins viz., thiamin, riboflavin and niacin are highest in bran portion and lowest in the aleuronic layer.

Milled rice or white rice (rice endosperm) is rich in carbohydrates and contain fair amount of digestible protein but, it lacks some of the most vital micronutrients viz., vitamins A, C, D and minerals (Fe and Zn). However, iron (Fe) deficiency is a serious problem in countries such as Asia, Africa and the Pacific. The main contributors to health problems is deficiency in iron which can reduce children's cognitive function and increase risks during child birth, which can affect immune function, leaving people vulnerable to disease. Anemia is common disease in indian children due to several reasons, but nutritional deficiency was reported to be most common reason for Anemia. According to National Family Health Survey (NFHS) in 2005-06, 79% of the children in india were found to be anemic.While diversifying diets and supplementing with micronutrients, enriching the foods people regularly eat with essential vitamins and minerals that their diet often lack can help alleviate the problem. They are not adequate in covering the total population. Biofortifying rice is a cost-effective, wide reaching and sustainable way communities can get greater nutritional value from the foods they eat.

The strategy of Fe biofortification by generating cultivars that efficiently mobilize uptake and translocate Fe to the edible parts. While, classical breeding is able to modify the contents of

inhibitors of Fe absorption, Transgenic approaches have focused on enhanced Fe uptake from soil to the edible parts. Earlier expression of the iron storage protein, ferritin, in rice using an endosperm specific promoter resulted in increase in the iron concentration in the transgenic seeds. Few of them of Fe and Zn genes/ QTLs namely, ZIP genes have been frequently identified on chromosome 3 and 4, respectively. However, further over expression of ferritin did not result in additional increase in iron concentration. The conventionally bred cultivars like BPT 5204, MTU 7029, HUR 105, CR Dhan 701, Rajlakshmi, etc. are deficient in iron content (< 6 ppm/ 100 g seed). For identification of potential donors, more than 200 varieties and germplasm have been tested for iron content and identified some of them as potential donors. The identified potential donors are Kalanamak, Karjat-4, Chittimuthyalu, Kanchan, Ranvir Basmati and several wild Indica germplasm with < 33.5 to 13.3 ppm/ 100 g rice. These donors have been used in conventinal and molecular breeding programme to develop high iron content lines at ICAR-CRRI, Cuttack.

In MABB programme, markers which are closely linked to the target genes was used during backcross generations to select plants possessing these target genes and markers polymorphic between donor and recurrent parent were used to select plants that have maximum contribution from the recurrent parent genome. Introgression of iron (Fe) controlling genes/ QTLs, the donor parent viz., Kalanamak, Karjat-4, Chittimuthyalu, Kanchan and Ranvir Basmati have been used to introgress iron responsible genes through conventional breeding or marker assisted backcross breeding (MABB) technique in conventionally bred iron deficient popular cultivars used as a recurrent parent. In this study, further increase in Fe concentration is aimed by enhancing the uptake and transport of iron via ferric iron chelator, mugineic acid. These representative lines were selected based on the iron concentration in upolished, polished and ferritin accumualtion in the seeds. These lines were grown in both iron-sufficient condition and iron-deficient conditions. Improved lines of these popular cultivars expressing both ferritin and mugineic acid biosynthetic genes showed signs of iron-deficiency tolerance in iron-deficient conditions. The iron concentration in polished seeds was increased as compared to that in pyramided lines grown in normal and iron-deficient soil. These results shows that the introduction of the ferritin gene and mugineic acid biosynthetic genes effectively increased the seed iron level without causing deficiency under iron-deficient conditions.

YSA - 32
Development and Evaluation of Sugar Free Fruit Jam

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The present experiment involve the preparation of sugar free fruit jam i.e. mix fruit jam, guava jam, papaya jam and to study their calorific value along with the other related parameters like total soluble solid, acidity, ascorbic acid, pectin content and shelf life of the jam. These parameters were

measure against the control (guava jam containing sugar without preservative) and other three sugar free jam was added with preservative. All the above parameter was determined in fresh and after 30 days, 60 days, 90 days, to till 120 days of storage period. The calorific value was found to be maximum in papaya jam (125 Kcal/100gm) and minimum in mixed fruit jam (115 Kcal). Similarly the total soluble solid (TSS) was found to be maximum in mix fruit jam (67.8 ^{0}Brix) and minimum in papaya jam (64 ^{0}Brix). The ascorbic acid and the pectin content were maximum in mixed fruit jam (34.84 mg/100 gm & 1.254/100 gm) and minimum in papaya jam (29.639 mg/100 gm & 0.917 mg/100 gm) respectively. The acidity percentage of all the three jam was in the standard range. The shelf life of the jam was found to be 120 days as determined on the basis of microbial count. The microbial count of mix jam was (14.6 Cfu/gm) than of guava jam (18.03 Cfu/gm) and maximum for papaya jam (24.0 Cfu/gm). On the basis of results the sugar free mixed fruit jam was found to be best as compare to other sugar free jam. The mixed fruit jam having the highest values of TSS, acidity, ascorbic acid, pectin content as well as low calorific value and least microbial count. In respect of over all acceptability and taste it was superior to other sugar free jam. However all the three jam has significant nutritive value with low calorific value can be specially used for the diabetic patient.

YSA - 33

Study of Nutritonal Loss at Different Time period in Canned Edible Mushrooms (Agaricus bisporus and Pleurotus sajor caju)

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Canning is a technique by which the mushrooms can be stored for a longer period, up to about one year and most of the international trade in mushrooms is done in this form. The effects of canning on the chemical composition of edible mushrooms (Agaricus bisporus and Pleurotus sajor caju) were investigated. Samples were analyzed for proximate constituents at different time period (Fresh and after 4, 8, 12 months). It was found that value of carbohydrate, fat and protein content dwindling. Nevertheless it is the best method for marketing and transportation of mushrooms to far off places, consequently it is recommended for non -burgeoning areas and off season of burgeoning areas. Mushrooms are an excellent source of several essential amino acids, vitamins (B2, niacin and folates) and minerals (Shivhare et al., 2004). Button mushroom contributes more than 85 % of the total mushroom production (Arora et al., 2013a, Arora and Upadhyaya, 2014). Owing to its attractive taste, aroma and nutritional values, mushrooms are valuable components of the diet (Brodziak and Majchrzak 1984, Manzi et al., 1999, Mattila et al., 2001, Karmanska et al., 2002, Czapski 2003, Vetter 2003). Sanchez (2010) reported that Pleurotus spp. is the second largest next to Agaricus bisporus in the world market. Mushrooms are highly perishable and get spoiled very soon therefore increased productions of mushroom demands proper processing to increase shelf life and marketability. Button and oyster mushrooms being high in moisture and delicate in texture cannot

be stored for more than 24 and 48 hours respectively at the ambient conditions prevailing in the tropics. The consumption of mushrooms throughout the year, particularly of species harvested in natural habitats, is made possible through the use of appropriate processing methods (Arora, et al., 2013b). The proper quality of mushroom products can be obtained by eliminating or inhibiting adverse changes in the colour and texture of mushroom (Czapski and Szudyga 2000). Long-term preservation methods such as canning can make the availability of mushroom of good quality throughout the year. In order to produce good quality canned mushrooms, these should be processed as soon as possible after the harvest (Arora et al., 2013c). Coskuner and Ozdemir (2000) explored the possibilities of using EDTA as browning inhibitor as well as to control spoilage during storage and canning operations. Proposed work is based on the theme to find out the nutritional status in canned edible mushrooms, when kept for about one year. Fresh samples of Button and oyster mushroom (A. bisporous and P. sajor caju) were collected from the Department of Plant Pathology, Chandra Shekhar Azad university of Agriculture and Technology, Kanpur. For canning, samples undergo following steps like sorting, washing with tap water, trimming, chemical washing with 0.4% KMS (Potassium meta bisulphite) solution, blanching in 2% sodium chloride solution and then filling into cans containing 4% Brine and 0.1% citric acid. Then after sterilization at 115°C for 30 min, it is stored in cool and dry Place, as recommended by Arora (2014). The results of change in nutrient content in button and oyster mushroom, after 4 months, 8 months and 12 months of canning of mushroom samples are expressed in the table 1, 2 and graphical representation of the same is expressed in the figure 1, 2 respectively. All the values are recorded on dry weight basis and obtained values were subjected to standard deviation, which showed the values to be within the limit of 5 percent. The carbohydrate content of fresh Button and oyster mushrooms were 47.6% and 54.9% respectively which decreases gradually and at the 12th month the value lowered to 37.0% and 44.1% respectively and value of protein decreases to 25.9% and 22.3% from 35.2% and 30.1% and mean while fat of the fresh mushrooms were 2.1% and 2.5% decreases to 1.4% and 1.3% in canned mushroom during storage.

Table 1: Biochemical analysis of canned button mushroom.

Months/Nutrients(%)	Fresh	4	8	12
Carbohydrate	47.6	38.8	37.1	37.0
Protein	35.2	27.6	26.2	25.9
Fat	2.1	1.6	1.4	1.4

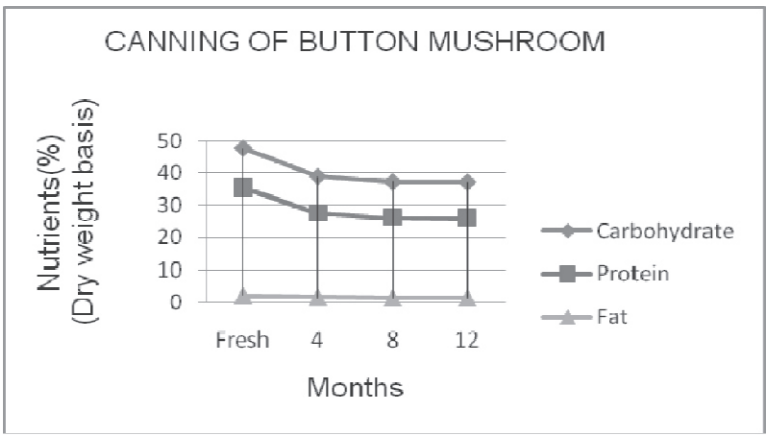

Figure 1: Graph showing effect of canning on the nutritional values of Button Mushroom at different time period.

Table 2: Biochemical analysis of canned Oyster mushroom.

Months/Nutrients(%)	Fresh	4	8	12
Carbohydrate	54.9	46.2	44.0	44.1
Protein	30.1	23.4	22.6	22.3
Fat	2.5	1.8	1.7	1.3

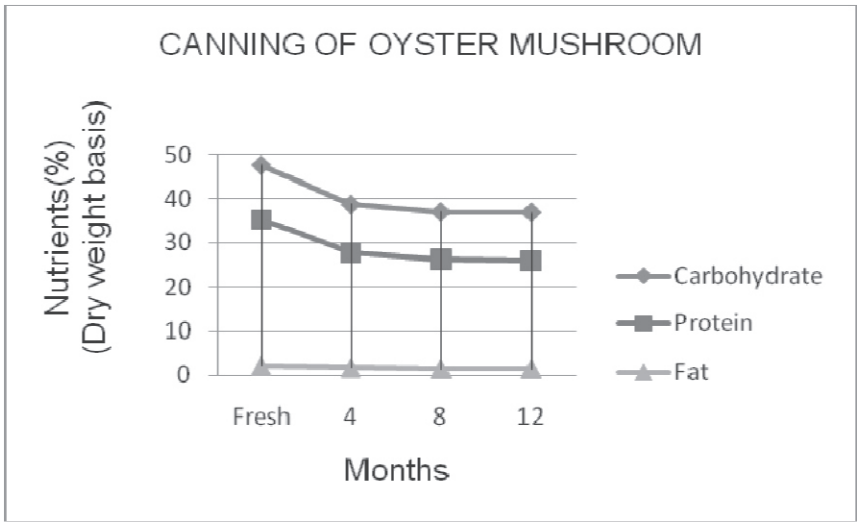

Figure 2: Graph showing effect of canning on the nutritional values of Oyster Mushroom at different time period.

All the while canning of both the mushrooms (Agaricus bisporus and Pleurotus sajor caju) it is recorded that the nutritional values (carbohydrate, fat and protein content) dwindling. Neverthless it is the best method for marketing and transportation of mushrooms to far off places, consequently it is recommended for non-burgeoning areas and off season of burgeoning areas.

Poster Presentations

Recent Advances in Food Processing & Food Biotechnology

Section - A

International Conference on Recent Advances in Food Processing and Biotechnology - Centre of Food Science and Technology, I. Ag. Sc., BHU, Varanasi - April 5-6, 2016

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Abstracts
FPB - 01 to FPB - 71

FPB - 01
Utilization of pineapple waste for development of vinegar

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Utilization of waste generated in fruits and vegetables processing industry is one of the challenging tasks to perform. There is a huge amount of waste which is generated in industries during processing like peeling, cutting, coring of fruits and vegetable. This huge amount of waste need to be utilizing in a manner that it can have some commercial value. During canning of pineapple in industries their occur 44-45% of waste which include the outer scaly peel of the fruit and 5% hard core. Utilization of pineapple waste for development of vinegar.Pineapple fruit (Ananas comosus) peelings and cores were taken from the canning industry. The peelings were washed adequately for removal of adherent dust and other foreign matter. Pineapple peelings dipped in sugar and water solution is taken in a wide mouth jar. The mouth of jar was covered with muslin cloth and kept at the ambient temperature for 2-3weeks for fermentation. During second week the smell of vinegar with a fruity tinge start coming from the jar.The prepared vinegar was tested for, pH by using digital pH meter, total sugar by using an automatic refractometer in ^{0}Brix titratable acidity and Vitamin C. The pH of the vinegar decreases from first to 21st day of the vinegar production i.e. increase in acetic acid content. The total sugar content showed no significant change. Titratable acidity and Vitamin C content also increased during fermentation period.The prepared vinegar was tested for, pH by using digital pH meter, total sugar by using an automatic refractometer in ^{0}Brix titratable acidity and Vitamin C. The pH of the vinegar decreases from first to 21st day of the vinegar production i.e. increase in acetic acid content. The total sugar content showed no significant change. Titratable acidity and Vitamin C content also increased during fermentation period.

FPB - 02
In silico characterization and structural modeling of Trichoderma cellulases relevant to food processing

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Cellulases are one of the most important industrial enzymes capturing 15% of the total global market. Cellulosic biomass degraded by cellulases offers attractive alternative for sugar which can be further processed as raw material for generation of various value added products like bioethanol, organic acids, free sugars, antibiotic and animal feeds. Microbial cellulases play an important role in

food and feeding processing industries as an integral part of macerating enzyme complex (cellulose, xylanase and pectinase), used particularly for extraction and clarification of fruit and vegetable juices and are also employed in fermented foods and feeds for improving nutritional quality and digestibility. Synergistic and cooperative action of differential components of microbial cellulases favors the enhanced release of simple sugars thus found potential application in alcoholic beverages.Trichoderma, a well known biocontrol fungus produces and secretes very efficient cocktail of cellulases acting as "green catalysts" catalyzing the degradation of lignocellulosic biomass for bioprocessing of food and feed derivatives. However, the commercial exploitation of these green catalysts is greatly challenged due to lower stability and high cost of enzymes and requires several other desirable factors including thermostability, wide pH range action, non-metal ion dependency, fast reaction rate, wide substrates utilization, high catalytic efficiency against crystalline cellulose and resistance against shear forces. Many approaches have been put forward to accommodate these features including r-DNA technology, protein engineering and improving thermo stability by incorporation of disulphide bonds. Of these rational proteins engineering design is better approach where proteins can be engineered computationally by adjusting the required amino acid substitutions and the effect can be simulated prior to wet lab studies. The molecular model of predicted proteins with improved function and stabilities can be evaluated both qualitatively and quantitatively.Protein sequences from different species of Trichoderma relevant to different cellulase complex were retrieved from UniProt server and these multiple sequences were aligned using Clustal W. Homologous similar sequence searches relevant to these proteins were made using PDBsum advanced search. The 3D model available for similar proteins from different organisms were selected as template and employed to predict the probable model using Discovery Studio Client 3.0. Protein structure assessment was done on the basis of various parameters including protein-protein interaction, suitable energy distribution, probable helical content and percentage allowable and disallowable region using RAMPAGE. The physiochemical properties of cellulases were predicted using Prot Pram tools and the high aliphatic index reveals the thermo stability whereas low GRAVY index shows their better interaction with water The quantitative and qualitative studies of the generated models were performed by using VADAR and ERRAT. and finally best model were used for structural classification.The secondary structure for the best model was predicted by SOPMA and cores were taken from the canning industry. The peelings were washed adequately for removal of adherent dust and other foreign matter. Pineapple peelings dipped in sugar and water solution is taken in a wide mouth jar. The mouth of jar was covered with muslin cloth and kept at the ambient temperature for 2-3weeks for fermentation. During second week the smell of vinegar with a fruity tinge start coming from the jar.

FPB - 03

Increasing the coding potential of bacterium E.coli to allow genetic incorporation of additional "unnatural" amino acids into proteins

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Protein engineering has become an extensively used tool in many fields which allow us to study protein functions and characterize proteins using range of available biophysical methods. With the genetic code expansion, it is now possible to incorporate functional groups and other properties in the proteins which are naturally not present. Site specific incorporation of unnatural amino acid (uAA) is widely used in protein engineering. However, incorporation of multiple uAAs remains a significant challenge. Tunability of protein expression for multiple uAAs incorporation using orthogonal ribosome remains another important challenge. In this study we try to investigate the role of inducible promoter in tunability of protein expression using orthogonal ribosome and orthogonal ribosome binding sites along with tRNA/amino acyl RNA synthetase pair. Six different o-RBS were designed based on the work of Rackham and Chin (Nat. Chem. Biol. 1 (3), 159-166) during the study on an inducible promoter. 4 best fit o-RBS were selected after screening experiment. Expression of protein incorporating uAA was done with orthogonal ribosome. Unfortunately, the experiment failed. Further analysis on failure concluded that the functionality of orthogonal ribosome was lost due to some unexplained reason.

FPB - 04

Effects of daily short time exposure of UV-A on the silkworm Bombyx Mori

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Effect of daily short time exposure of UV –A in silkworm Bombyx Mori. In the present study the growth of various development stages of the mulberry silkworm was studied because it depends on healthy larval growth.Mulberry silk worm larvae were taken from the regional sericulture center Varanasi and test was performed on 270 larvae and in each trial 70 larvae were taken together. UV-A was used as illumination source and treatment was done for half an hour a day. Measurement of weight of larvae was done from each chamber each day. Food consumption pattern and growth rate was correlated including the effect of UV-A.Food consumption reduced slightly on UV-A treatment which reduced from 2.27 gm to 1.43 g. Growth of larvae however increased in group 3 where maximum weight was determined to be 2.16 g. Assimilation rate also decreased and was found to reduce to maximum in group 3. The rate of metabolism also decreased drastically to 0.29g/

larva in group 3. Similarly UV-A treatment showed that cocoon number decreased drastically in group 3 while control showed increase with feeding and time. Shell ratio also decreased and was found to be 19.2 in comparison to 20.6 and 20.4 in group 1 and 2, respectively.

FPB - 05

Antioxidative activity, β-Glucosidase activity and biotransformation of Isoflavones during fermentation of Soy milkusingpotential Lactobacilli

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Isoflavones are present in soy milk in the form of β-glucosides. Isoflavones, naturally occurring phytoestrogens in soymilk, lowers the incidence of osteoporosis, menopausal hormonal disorders and cardiovascular diseases. For the bioavailability and metabolism of isoflavones, they must be hydrolyzed from biologically inactive -glucosides forms to aglycones. -galactosidase hydrolyze the oligosaccharides in soy milk. Lactic acid bacteria produce -galactosidase enzymes during fermentation of soy milk and reduce the oligosaccharides level to prevent the flatulence in intestines. Lactobacilli are also found to possess endogenous -glucosidase which plays significant role in biotransformation of isoflavones.Soy isoflavones in fermented soy milk has been shown to exhibit antioxidant effects both in vitro and in vivo. Isoflavones in aglycones form have direct free radical quenching ability, with genistein and daidzein being particularly effective.Fermentation of soy milk was carried out under optimum growth conditions (Inoculum level @1.0%; incubation temp: 37°C and incubation periods: 24 h). EightLactobacilli cultures were grown in soy milk mediumunder optimized growth conditions.Out ofeightLactobacillicultures,L. rhamnosus NS4 showed highest □-glucosidase activity of 0.93 U/ml, followed by L. helveticus V3 of 0.91 U/ml andL. bulgaricus 09 also produced considerable amount of -glucosidase activity of 0.27 U/ml and lowest activity was found in case of S. thermophilus MD2 of 0.03 U/ml. Similarly, NS4 and V3exhibitedmaximum bioconversion of isoflavones from glycones to aglycones form upto 47.81% and 45.47% after24 h of incubation compared to unfermented soy milk.V3 also showed highest antioxidative activity (85%) compared to other Lactobacilli cultures. NS4 and V3 also produced highest amount of -galactosidase enzymes and also utilized maximum oligosaccharides after 24hrs of fermentation. However, NS4 and V3 could be the most prominent Lactobacillus cultures for the production of fermented functional soy foods.

FPB - 06

Extraction of Natural Colorant Lutein from Chlorella vulgaris using Ultrasound Assisted Solvent Extraction Technology

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Microalgae are most primitive and the fastest growing autotrophs on the earth, which require 90% less water, land and fertilizer compared to other terrestrial plant for growth. Natural products derived from microalgae include pigments, glycerol, fatty acids, esters, polysaccharides and other essential nutrients which have been used as technological adjuvenents and additives in cosmetic, pharmaceutical and food industries. Commercial exploitation of microalgae for carotenoids comprises mainly chlorophycean genera among which Chlorella sp. is the most dominant genus worldwide.The prominent carotenoid present in Chlorella vulgaris biomass is lutein. Primarily lutein is used as a natural colorant due to its orange-red colour. It is not only an important natural food colourant and additive but also an effective stimulant of the immune response, hampering cataract and atherosclerotic development. In the present study, lutein is extracted using ultrasound assisted solvent extraction technology.The Chlorella biomass were exposed to various temperatures (40-60 ºC), kept for various time (5-35 min), and subjected to different sonicator amplitude (40-100%).The extracts were then evaluated for total lutein content using high performance liquid chromatography at 445 nm wavelength with variable wavelength detector. At optimized conditions ultrasound assisted extraction yielded 5.51 mg luteinfrom 100 g Chlorella vulgaris biomass. It can be interpreted from the above finding that ultrasound assisted extraction is superior to conventional extraction technique as it has yielded more lutein content than the conventionally used extraction technologies.

FPB - 07

Food Biotechnology: Evolution, Techniques, Challenges for industry, regulators and consumers

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The current connotation of food biotechnology is Genetically Modified Organism (GMO), or Genetically Engineered (GE), among others is a food product developed through the genetic modification of a plant, animal, or microorganism in a laboratory by scientists. To date most modifications to crop plants have benefited producers. Crops have been engineered to decrease

pesticide and herbicide usage, protect against stressors, enhance yields and extend shelf life. Beyond the environmental benefits of decreased pesticide and herbicide application, consumers stand to benefit by development of food crops with increased nutritional value, medicinal properties, enhanced taste and aesthetic appeal. This document summarizes general scientific concepts, safety issues, and regulations relating to food biotechnology. Nutrition scientists and other animal biologists need a balanced understanding of the issues to participate in this assessment. Before a genetically engineered crop is introduced into commerce it must pass regulatory scrutiny by as many as four different federal regulatory bodies to ensure a safe food supply and minimize the risk to the environment. Key areas for more research are evaluation of the nutritional benefits of new crops, further investigation of the environmental impact, and development of better techniques to identify and track genetically engineered products. Both the public and scientific communities are evaluating their stance on the use of biotechnology for food production.

FPB - 08
Biotechnological strategies for improving the nutritional quality of fruits

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India is the second largest producer of fruits after China, with a production of 44.04 million tonnes of fruits from an area of 3.72 million hectare. In spite of being a major producer of fruits, the per capita availability of fruits is lower (107 gms per day) than the recommended level (120 gms per day). The major constraint attributing to lower availability is due to various post harvest losses (estimated to be 18-24%) mainly because of fungal decays and poor management strategies during the different stages of marketing. The present day problems like population increase, water shortages, climate change, and high perishability due to postharvest decays leading to short shelf-life of fruits need to be addressed at the earliest. The alarming hazardous side effects caused by the use of synthetic chemicals to combact post harvest decays has shifted the paradigm towards using more environment friendly and a greener technology to reduce the losses as well as to ensure better retention of nutritional quality and overall safety in the fruit industry. In spite of decades of research towards developing promising biocontrol product(s) for post harvest losses in fruits, the possibility still remains vague. The recent advances in biotechnology can be utilised to develop fruits with improved quality and shelf-life as the ability to maintain the quality of stored fruits during postharvest storage is highly related to the physiological, biochemical, and molecular traits of the plant from which they derive. The recombinant DNA technology can be used to delay ripening in fruits to ensure a flexibility in marketing and supplying the consumers with good quality products. It is evident that these strategies have immense potential to enhance the yield as well as quality and

shelf-life of fruits to meet the rising demands but the current debates and complexities surrounding the registration and the commercialization of genetically modified fruits should be addressed by engaging the various stakeholders in the industry (policy makers, private sectors, agriculturalists, biotechnologists, scientists, extension agents, farmers, and the general public) for policy formulations, seed embodiments, and products development.

FPB - 09
Effect of processing techniques on nutritional composition and antioxidant activity of pumpkin seed

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Pumpkin seeds are considered as high-energy source because embryo dry materials consist of 40 to 50% lipids and 30 to 37% proteins. In addition, pumpkin seeds are also rich in minerals, □-carotene and antioxidants.To analyze the nutritional composition and antioxidant properties of pumpkin seed.Seeds were separated from the fruit and washed. They were dried at 50 °C in Hot air oven. Whole dried seeds were manually peeled to remove the kernels. The seeds were roasted at a temperature of 125°C for 20 min. The soaking of the seeds was done for 24 hrs, germination at 37°C for 48 hrs, boiling at 100 ± 2 °C for 10 min and then finally dried at 50 °C. The raw and processed samples were finely powdered and analyzed for their chemical composition like crude protein, crude fat, crude fiber, moisture and ash using standard methods. They were also analyzed for mineral content, total phenolics, tannin content and antioxidant activity.Germination shows significant effect on the nutritional content when compared with soaking, boiling and roasting. There was minor change in case of ash content and fiber content. The fat content increases with roasting while other processes showed slight decrease. Total phenolic content and antioxidant activity also increases significantly during soaking and germination but decreases due to roasting and boiling. Tannin content shows slight increase with roasting while decreases with other processes. Thus processing leads to various desirable changes in the seed flour.

FPB - 10
Hurdle Technology for Food Preservation

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Hurdle technology, also called combined processes, combined methods, combination preservation, combination techniques, or barrier technologywas developed several years ago as a new theory for

the production of stable, nutritious, safe, tasty and economical foods. It promotes the effective use of combinations of different preservation techniques ('hurdles') to achieve multi-target, mild but reliable preservation effects. Previously hurdle technology was used empirically without much knowledge of the appropriate principles. The intelligent application of hurdle technology has become more prevalent now, because the principles of major preservative factors for foods (e.g., temperature, pH, a_w, Eh), and their interactions, became better known. Recently, the effect of food preservation methods on the physiology and behaviour of microorganisms in foods, i.e. their homeostasis, metabolic exhaustion, stress reactions are taken into account and the new idea of multi-target food preservation emerged. The microbial stability and safety of most traditional and novel foods is based on a combination of several factors (hurdles), which should not be overcome by the microorganisms present. Preservative factors functioning as hurdles can disturb one or more of the homeostasis mechanisms, thereby blockingmicroorganisms from multiplying and causing them to remain inactive or even die. However, emphasis is placed on the homeostasis, metabolic exhaustion, and stress reactions of microorganisms related to hurdle technology, and the prospects of the future goal of a multi-target preservation of foods.

FPB - 11

Two Component Signaling System Regulated Cell Wall Surface Anchor Protein and Secretory Lipases are Involved in Cationic Antimicrobial Peptide Mediated Biofilm Formation in Enterococcus Faecalis

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Enterococcus faecalis is a gram positive opportunistic pathogen known to form biofilms that greatly enhances its virulence and pose threat to food safety. Evidences of diminished action of cationic antimicrobial peptides (CAMPs) on biofilms indicates biofilm formation as one of the mechanism of resistance acquisition against CAMPs. As biofilm matures it progresses from a thin homogenous structure to a thicker more heterogenous form that acts as a diffusion barrier for the CAMPs. Despite of the extensive investigations, many environmental and genetic factors associated with biofilm formation are still unknown. Our aim was to correlate the biofilm forming ability of E.faecalis with resistance to CAMPs and identification of the corresponding genes involved. Dose dependent nisin resistant variants of E.faecalis were selected and both the wild type and nisin resistant variants were further challenged with different concentrations of human neutophil defensin HNP-1. Biofilm formation was studied in 96 well plate using crystal violet based method. We found a sharp increase in biofilm production in nisin resistant variants and HNP-1 challenged strains as compared to the wild type bacteria. Elevated biofilm index of nisin resistant variants was preserved even after challenging them with high concentration of HNP-1. However it fell back to the level of wild type when challenged with low concentration of HNP-1. qPCR analysis of the genes corresponding to

thecell wall surface anchor protein (EF3314), secretory lipase (Ef3060) and sensor histidine kinase (EF1820) shows parallel correspondence with biofilm formation. In summary, biofilm formation is a complex process that requires intracellular signaling through two component system and modulation of set of genes in response to environmental cues.

FPB - 12
Strategies to Reduce Post Harvest Losses

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Postharvest loss can be defined as the degradation in both quantity and quality of a food production from harvest to consumption. Quality losses include those that affect the nutrient/caloric composition, the acceptability, and the edibility of a given product. Today, one of the main global challenges is how to ensure food security for a world growing population whilst ensuring long-term sustainable development. Qualitative losses (such as loss of caloric and nutritive value, loss of acceptability by consumers, and loss of edibility) are more difficult to measure than quantitative losses of fresh fruits and vegetables. Poor infrastructure for storage, processing and marketing in many countries of the region contributes to a high proportion of waste, which average between 10 and 40%.Different strategies are adopted at different stages like handling, sorting, packaging, transportation, storage, etc. Postharvest losses vary greatly among commodities and production areas and seasons. Minimizing postharvest losses of horticultural perishables is a very effective way of reducing the area needed for production and increasing food availability. Therefore, reducing post harvest losses clearly complements other efforts to enhance food security through improved farm-level productivity. Techniques to reduce food losses require cultural and economic adaption. This is so because all food losses occur at a particular socio-cultural environment. The issue of food losses is of high importance in the efforts to combat hunger, raise income and improve food security in the world's developing countries.

FPB - 13
Biosensor: an advanced analytical tool for Detection of food borne Pathogenic bacteria

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Food safety is a complex global health issue that has an impact on all segments of society, from the general public to government, industry, and academia. Hence detection of food borne pathogenic bacteria is becoming more important to find out the solution for prevention and recognition of

problems related to the health and safety. It can be done either by conventional methods, or by rapid methods. Conventional methods such as colony count by plating techniques or biochemical characterization methods etc.,requires incubation periods of at least 18 to 24 hours or more. Thesetechniques are by nature labour intensive and time consuming andmay sometimes create confusion among the strains and species themselves, and sometimes,may provide a false result also.Therefore recently many researchers are focusing on the rapid methods which are sensitive and reliable. Biosensors are innovative tools for the detection of food borne pathogens. Biosensors are devices that are easy to use without any special training, and yield results with sensitivity and selectivity, which are comparable to the culture-based methods.Biosensors play a part not only in the field of food safety but environmental quality, medicine etc. This review paper focused on the various types of biosensors and their applications in food pathogen identification with its future perspective for the development of new ideas in the field of research.

FPB - 14
EPS: The Potential Molecules

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Extracellular polymeric substances (EPS) produced by microorganisms are a complex mixture of biopolymers primarily consisting of polysaccharides, as well as proteins, nucleic acids, lipids and humic substances. EPS make up the intercellular space of microbial aggregates and form the structure and architecture of the biofilm matrix. A biofilm is any group of microorganism in which cells stick to each other on a surface. The presence of biofilms is very common in food industry because of their ability to attach and grow on foods and food-contact surfaces under favourable conditions. The key functions of EPS comprise the mediation of the initial attachment of cells to different substrata and protection against environmental stress and dehydration. These attached cells are embedded within a self-produced matrix of extracellular polymeric substances (EPS). The extracellular polymeric substance, which is also referred as slime is a polymeric accumulation generally composed of extracellular DNA, proteins, and polysaccharides. The proportion of EPS in biofilms can comprise between approximately 50-90% of the total organic matter The interest has been increased now in exploring valuable EPS due to its various industrial applications, and hence attention on EPS-producing biofilm-forming bacteria has also been greatly enhanced. The wide structural, physical and rheological diversity and other unique properties of EPS produced by biofilm-forming bacteria make it industrially and biotechnologically important. EPS has already been widely used as bioflocculants, bioabsorbents, encapsulating materials, heavy metal removing agents, drug delivery agents, ion exchange resins, and a natural immunomodulator. In addition, the distinct biophysicochemical properties of bacterial EPS proves its importance in the food industry as viscosifying, stabilizing, emulsifying, antioxidant and antibiofilm agents.

FPB - 15

The effect of processing on the Anti -nutritional Factors of jackfruit seeds and preparation of seed flour

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Anti-nutritional factors are naturally occurring compounds, that are present in human foods which cause anti-nutritional effects and anti-physiological effects such as impaired reproductive function or reduced immune competence or substance which reduce feeding intake in human and restrict the nutrient availability to the body. Jackfruit is a largest fruit in the world belongs to moracae family found in more rural area rather than urban areas, known as poor man's fruit. Seeds are underutilized and important part of the jackfruit found 10 to 15 per cent of total fruit, having lots of nutritional quality but some anti-nutrients (trypsin, tannins, phytic acids etc.) are also found which may cause the inhibitory activities on the bioavailability of nutrients such as protein, iron, calcium etc. Keeping this in mind the present study was done; seeds were collected from the local market of Jalalpur block district Ambedkarnagar (Uttar Pradesh). Seeds were washed and lye peeled and processed by processing methods (Drying, roasting, baking, boiling and combination of boiling, drying and baking) to analyse the effects of processing's on anti-nutritional factors of jackfruit seeds and preparation of seed flour. The results revealed that combination of processing methods had higher reduction of anti-nutrients in jackfruit seed flour. Unprocessed jackfruit seed flour contains 28.60 TUI trypsin inhibitor, 1.28 mg tannin, and 4.11mg phytic acid in 100grams flour. Whereas processed seed flour in combination methods, anti-nutrient content was found nil in trypsin inhibitor, tannin 0.05 mg and phytic acid 0.09 mg per 100 gram of flou

FPB - 16

Effect of Food Processing on Nutritional Value of Food Product's

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Food processing is the set of method and techniques used to transform raw ingredients into food for consumption by human. Food processing often takes clean, harvested or slaughtered and butchered component and uses these to produce attractive and marketable food products. Food products is nessesory is being done at every step before cooking. In some particular processes that expose foods to high level of heat, light and oxygen cause the greatest nutrient loss. Nutrient can also be to "washed out" of food by fluid that are introduced a cooking processes. For example, boiling a potato can caused much of the potato's' B and C vitamins to migrate to the boiling water. Nutrients may be

lost during cooking in two ways. First by degradation which can occur by destruction or by other chemical changes such as oxidation and secondly by leaching into the cooking medium. Vitamins are susceptible to both processes, while minerals are affected only by leaching. Free amino-acids could also be leached or may react with sugars to form complexes. The percentage loss will depend partly on the cooking temperature and on whether the food is prepared by boiling, backing or roasting. Many study proven that water soluble vitamins are easily loosed during cooking and processing.Objective of this study is to know the effect of processing on food products and how's we can minimize the nutrient loss. Purposive random sampling is being used in this study.

FPB - 17
Development of Laccase Biosensor against Caffeine over Concentration Range

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To develop a Laccase biosensor for the estimation of caffeine in solution.To isolate desired strain and its immobilization on cellophane membrane.To optimize the construction and operations of a prototype biosensor.Caffeine, theophylline, theobromine, gelatin, glutaraldehyde and Para chloro mercuri benzoic acid (Ultra Pure), Analytical grade, dinitro phenyl hydrazine, polyvinyl alcohol and polyvinyl pyrrolidone. Dehydrated nutrient agar and nutrient broth (AR). Microbe(eg. Pseudomonas alcaligenes), Modified nutrient broth containing peptone, beef extract, yeast extract, sodium chloride and caffeine adjusted to pH 7.2 to obtain biomass.Laccase can be immobilized on the surface of a working electrode (e.g., carbon paste electrode, polymer-modified electrode etc.). Thus, formed biosensor can be utilized for selective amperometric determination of phenolic compounds such as catechol and caffeic acid etc. among interfering analytes.The biosensor can also be prepared from using biomass such as some bacteria that contains enzymes selective for analytes.Immobilized membrane will be place on the tip of the DO probe and bubbled continuously. Initially, the electrode kept in the sample-cell containing buffer may be polarized for 1 h. Then 100µL of the sample containing caffeine (0.1%, w/v) will be injected and the decrease in DO with time may be recorded.

FPB - 18
Development of Syrup from Artificial Sweetener for Preparation of Sugar free Traditional Sweet

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Sweeteners are food additives that used to improve and enhance the taste of foods. There are mainly two types of sweetener, natural sweetener and artificial sweetener. The artificial

Sweeteners may also be called as high-intensity, or non-nutritive sweeteners, which can replace sugar while providing few or no calories.Optimization of syrups by using response surface methodology for the preparation low calorie product. 2. To study the physical and sensory characteristics of syrups prepared by using artificial sweeteners.Sugar substitute namely stevia, maltitol and sucralose were used in preparation of syrup, the syrup was optimized for the preparation of Gulab jamun. The syrups were studied for threshold, time intensity, viscosity and electronic tongue.For sugar, Stevia, sucralose and maltitol the syrups threshold level was found in geometric and arithmetic series 0.47, 0.5, 0.027, 0.031, 0.0065, 0.006 and 1.83, 1.78 respectively. Time intensity results showed that after first 10 seconds intensity increases and then a clear decline in the values of syrup intensity was observed as time increased. Highest sweetness level was found at Blend- 10 after 60 seconds. Viscosity changes at the shear rates of 0-200s^{-1}. Viscosity decreases with the increases of shear rate. Blend 10 has the highest viscosity from other Blends. The intensity of sweetness of blend syrup was done by using of e-tongue. The DFA pattern showed that all samples were different with respect to their taste profile indicated by clusters formed.

FPB - 19

Biofilm forming antimicrobial peptide resistant E.faecalis shows sugar specific biofilm pattern

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Enterococcus faecalis is an important global cause of nosocomial infections, being increasingly associated with urinary tract infections, endocarditis, catheter-related infections, surgical wound infections, and central nervous system infections. Infection-derived isolates of E. faecalis have been shown to form biofilms in vitro, indicating biofilms as a virulence determinant. Emergence of antimicrobial peptide resistant E.faecalisfurther imposed a great threat to human health.These resistant E. faecalis are often isolated from biofilms on the surfaces of various indwelling medical devices associated with chronic infection.E. faecalis forms complex biofilms by a process that is sensitive to environmental conditions.Despite of the various environmental and genetic factors proposed for biofilm formation a little bit is known about the effect of different sugars on biofilm production by the wild type and antimicrobial peptide resistant bacteria.Therefore, we examined the effect of different sugars i.e. glucose, mannose and fructose on E.faecalis and its nisin resistant variants. Biofilms of E.faecalisin different conditions were developed on polystyrene, flat bottom 96 well plate and determined using crystal violet stain method.We found an increased biofilm production in nisin resistant variants of E.faecalis as compared to the wild type. The biofilm production of the wild type bacteria also increases in presence of all the three type of sugars upon passaging whereas the biofilm formation in nisin resistant variants shows sugar specificity, i.e. biofilm production increases when passaged in fructose and decreases when passaged in mannose. Sugar concentration also shows significant effect on biofilm index.

FPB - 20
Recent Advances in the Applications of Ultrasounds in Food Industry

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The traditional methods are known to lower the level and bioavailability of nutrients and reducing organoleptic acceptability. Continuous demand for minimally processed foods has led the food industry towards significant alterations in the traditional processing methods. Ultrasonics is one of the rapidly emerging techniques, which minimize processing, enhance quality and ensure the safety of food products. Developed during World War I in London by Prof. Langevin, it finds its application in quality control of fresh vegetables and fruits, in both preand post-harvest stages, cheese processing, commercial cooking oils, bread and cereal products, bulk and emulsified fat-based products, detection of adulteration, studying food composition and for assessment of aggregation state, size and protein type.With 200 kPapressure and 30°Ctemperature, ultrasound of frequency 20 kHz reduces the D valueby up to 90% for a range of microorganisms. Ultrasound ranging from 20 - 100 KHz is extremely useful in crystallization process. Mano-sonication treatment at 500 kPa for 12 min proves sufficient to inactivate over 99% of the spores.It's wide spread applicability in heat-sensitive foods is because it retains sensory, nutritional and functional characteristics alongwith enhanced shelf life and microbial safety.Ultrasonication singly or in combination with other methods decreases the processing temperature and time, or both, in pasteurization of liquid foods like milk, wine, and juices.Ultrasound reduces the time required for glutaraldehydesterilization at 25° C from 3 h to just 30 min at pH8.0. Use of ultrasounds by selecting appropriate amplitude, power, intensity, temperature, pressure and time, is crucial to obtain desired product. The limitations of this technology include generation of free radicals and development of some off-flavors. Therefore, in an era of increasing health consciousness, the application of ultrasounds holds a lot of promise for future application in food processing industry.

FPB - 21
Nutritional Assessment and Product Development by Using Green papaya, Flaxseed and Maize Flour to Promote the Traditional Food

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Traditional food system in the developing countries are changing under the influence of globalization and marketed as health foods, functional foods, therapeutic foods, nutraceutical

foods, changes in life style, and the shifting from traditional food habits to commercial fast foods, the production and consumption of traditional food is in decline. The purpose of this study may contribute significantly in overcoming protein deficiency, vitamin A deficiency, and calcium deficiency deficiencies disease in developing countries like India. Green papaya, flaxseed and maize flour have contained vitamin A, omega3-fatty acid, protein and high calcium.To study the nutritive value of prepared products from green papaya, flax seed and maize flour.Maize flour and flax seed flour were prepared by oven drying from dry seeds. Green papaya was used as a crushed raw form. Traditional foods such as mix roti and khasta kachori were prepared using green papaya, flax seed and maize flour in different ratio of (50:45:5), (50:40:10), (50:35:15), (50:30:20) respectively. These products were analyzed for its nutritive value.Nutritional assessment of prepared products revealed that IV (50:30:20) incorporated sample of mix roti and khasta kachori contained high amount of protein, carbohydrate, and fat, moderate amount of crude fiber and ash, IV (50:30:20) incorporated sample of mix roti and khasta kachori contained sufficient amount of vitamin A and calcium.The study suggested that to achieve some medicinal properties such as promote skin protection, promote lungs health, good for eye, promote kidney function increasing the flow of urine etc and these food could be applied in various food system as an excellent functional food with highly antioxidant properties.

FPB - 22
Biotechnology Applications and Their Role in Food Processing Industry

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Biotechnology is the use of living systems and organisms to develop or make useful products, or any technological applications that uses biological systems, living organisms or derivatives thereof, to make or modify products or processes for specific use. Depending on the tools and applications, it often overlaps with the fields of bioengineering and biomedical engineering. Some of the applications include the use of microbial inoculants to enhance properties such as the taste, aroma, shelf-life, texture and nutritional value of foods, the use of micro-organisms and their enzymes to bring about desirable changes in food, the application of fermentation processes in the production of microbial cultures, enzymes, flavours, fragrances, food additives and a range of other high valued-added products; the use of all these modern technologies for food-safety monitoring through the detection of pathogenic bacteria food and mycotoxin detection.Objectives for the study were potential of Biotechnology, applicability in food processing and safety issues related to the application of Biotechnology.Work of different workers were critically reviewed in this study to understand the impact of Biotechnology in the food industry with above mentioned objectives.Results showed that market forces have been the major drivers of change in the food sector of developing countries. Development of efficient technologies based processes for food

processing and safety for consumers. However, its adoption is dependent on several factors that include capacity-building in technical and regulatory areas, policy formulation, regulatory frameworks and regional networks.

FPB - 23
Colorimetric pH sensing film for checking freshness in Meat and Dairy Industry

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Freshness is an important factor influencing colour, taste, flavour etc of product. The acceptability of product is dependent on best before date butthe spoilage of product can occur prior expiry date due to contamination or improper processing. Colorimetric pH sensing film will help consumers to know freshness of product. There is high correlation between pH and spoilage. Due to microbial fermentation or enzymatic action pH reduction occurs which can be used as an indicator for safety of consumption. The pH sensing film uses indicator dye which changes color when exposed to different pH condition. This dye is immobilized in a film by using various materials eg. Chitosan. The dye used can be natural (eg. anthocyanin) or artificial, the leaching percentage of the dye is high at lower pH. This leaching can be toxic but can be prevented by use of quaternary ammonium salt or material that creates a hydrophobic film. Research has been carried out for the use of anthocyanin based film in meat industry, bromocresol green (BCG) with cellulose acetate for monitoring fish spoilage which indicates color change with pH variation. Methylene blue reduction test is used for estimation of milk spoilage.Further research can be done to incorporate the dye in immobilized film for evaluating degree of spoilage. Similarly, pH sensing film can be further designed for its compatibility with packaging material thus giving a direct reading for the freshness of product.

FPB - 24
Advance Methods in Prevention of Enzymatic Browning

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Enzymatic browning is a biochemical reaction which has gained its importance because of losses occurring due to undesirable changes in organoleptic properties and nutritional value to some extent. It is the consequence of oxidation of phenolic compounds by certain enzymes. Thoseenzymes are polyphenol oxidase (PPO), peroxidase (POD) and phenylalanine ammonia lyase (PAL). Currently, industry applies some physical and chemical methods like blanching, chemical dips (Antioxidants, sequesterants, firming and acidifying agents) etc. for prevention of enzymatic browning. These methods have some disadvantages viz.,chemical residues, loss of nutritional

quality, etc. Hence some advance techniques such as use of High hydrostatic pressure, Pulse electric field, Gamma radiations, Reduced temperature, Modified atmospheric conditions and antisense RNA techniques are being introduced to control enzymatic browning. These are non-thermal processes and hence cause minimal damage to the product. They may be used along with conventional method or individually.The results obtained from these various techniques are found to be promising in dealing with enzymatic browning yet further research should be carried out for its practical and economical utilization by industry.

FPB - 25

Effect of Surfactants and Inducers on Increased Uricase production under Submerged Fermentations (SMF) by Bacillus cereus

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Uricase is a clinical enzyme used for oxidation of uric acid crystals in gout disease. The present study aimed to increase the suitable surfactant mediated uricase production upon induction by different concentrations of inducers. The efficiency of Bacillus cereus to produce extracellular uricase enzyme were studied in uric acid containing agar plates. Among the studied inducers, uric acid was appear to be the potential inducer for uricase production under submerged fermentations (SMF) which induced 19.41 U/ml uricase in medium containing 2.0 g/L of uric acid, however further increase in the uric acid concentration decreased uricase production could be due to substrate inhibition. The physical parameters including agitation speed (rpm) and time-duration (h) of uricase production were optimized and found to produce optimum uricase at 150 rpm in 26 h of SMF. Among the studied surfactants, nonionic surfactant Polyvinyl alcohol (PVA) have shown remarkably increase in uricase production of 31.58 U/ml which was 61 % increased under optimized conditions in SMF. The stability of produced uricase was found at PH.

FPB - 26

Study on the drying kinetics of the Bathua leaves and it's incorporation for the preparation of Instant Bathua Raita Powder Mix

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Bathua (Chenopodium album Linn; family: Chenopodiaceae) is cultivated in gardens and agricultural land and it is distributed all over South East Asia. The leaves are rich in potassium and vitamin C and iron and carotene . However being a seasonal crop studies were carried out to preserve it for usage throughout the year on industrial scale.The drying of the bathua was done at five different temperatures namely 50, 55, 60, 65, 70°C. All the five dried samples were produced and then were

tested for the levels of beta-carotene and iron and the best powder was selected for the preparation of / incorporation in conventional foods like Instant Bathua raita powder mix. It was found out that the powder dried at a temperature of 65ºC had high and satisfactory amounts of nutrients in it..The final product were judged on the basis of sensory attributes and overall acceptability. In Instant bathua raita powder mix , the ingredients i.e. curd powder, bathua powder, black salt, roasted cumin seeds powder (finely grinded) were blended in various ratios to check the best sample. The drying of curd with the combination of microwave and tray drier gave best results with a yield of 12% as compared to the yield of 9.6 % in case of tray drier. Instant bathua-raita powder mix made by the incorporation of the varying ratio of ingredients was tested for overall acceptability and the best sample was chosen. On the proximate analysis of the instant bathua- raita powder mix it was found that it contained 10% fat, 10% moisture, 1.6% ash, 5 g of protein and held an appreciable shelf life.

FPB - 27
Production of Cyclodextrins by Cyclodextrin Gluconotransferase and its application in Foods

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Cyclodextrin (CD) glucanotransferase (CGTase,1,4--D-glucan:1, 4--D glucopyranosyl transferase, cyclizing, EC 2.4.1.19) is an enzyme capable of hydrolyze starch and related substrates into cyclodextrins (CDs) possessing a hydrophilic outside and hydrophobic central cavity. Cyclodextrins are homogeneous cyclic nonreducing oligosaccharides in which from 6-12 glucose units joint by means of an -1, 4- glycosidic bonds. Most of the bacterial CGTase produce mainly -CD, -CD and a trace amount -CD consisting of six, seven or eight glucose units, respectively. The bacterial CGTase is a multifunctional enzyme and produced by a variety of bacteria such as Bacillus macerans, B.megaterium, Klebsiella oxytoca, Micrococcus sp. and B.circulans. Production of CGTase is influenced by various culture conditions such as nature and concentration of carbon source, nitrogen source, pH, temperature, and agitation speed. The cyclodextrins (CDs) is the most important product because of they are semi synthetic products, produced from a photosynthetic natural material, starch, by a relatively simple enzymatic conversion. Cyclodextrins are widely utilized in food, pharmaceutical, chemical, cosmetics and agriculture industries because of their ability to form inclusion complexes. Cyclodextrins are used in food formulations for flavour protection or flavour delivery. They form inclusion complexes with a variety of molecules including fats, flavours and colour. The artificial and natural flavours are volatile oils or liquids and complexation with cyclodextrins provides an alternative to the conventional encapsulation technologies used for flavour protection. Using - cyclodextrins are used to remove cholesterol from dairy products such as milk cream, butter and eggs. Emulsions of cream butter can be stabilised with - cyclodextrin.

FPB - 28

Value Addition to Solid Vegetable Residue for Production of Industrially Important Enzyme

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Garden pea peel which is a solid vegetable residue can be utilized for the production of an industrially important enzyme - Glucoamylase. Vegetable residues such as pea peel are very cheap, easy to utilize and annually available. Here in this study, Aspergillus niger which is a filamentous rapid growing fungus was used for Glucoamylase production by using pea peel as a substrate in the solid state fermentation.Glucoamylase production by Aspergillus niger in solid-state fermentation was optimized using response surface methodology and was also characterized by pH, Temperature, Metal ion activation/inhibition and kinetic studies. The variables evaluated were temperature, amount of substrate and time of fermentation.Glucoamylase production gave highest value which occurred by using pH range of 5.4–6.2, the enzyme was found to be very stable at pH 3.8. Glucoamylase maintained its activity to 85% when incubated at 30-50° C for 30min, at 60° C for 40min, and at 70C for 30min. Activation of the enzyme was done by metal ions Fe^{2+}, Cu^{2+}, Mg^{2+}, and Pb^{2+}; and inhibition studies with ions Ca^{2+}, Hg^{2+}, Na^{+}, K^{+}, Ba^{2+}, Zn^{2+}. Mn^{2+}; Fe^{2+} showed activation of the enzyme in form of sulphate salt but at the same time it showed inhibition in chloride salt form. K_M and V_{max} for Glucoamylase was found to be 0.387 and 3.503×10^{-05} U/mL/min respectively using different concentrations of starch. Glycogen used increased the K_M by 2.585 and the K_I was found to be 0.631. EDX analysis on pea peel showed presence of C, N, and O in 12.53, 29.9, and 55.27% of atomic weights respectively; trace elements were present.

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Effect of climate and nutritional variation on specialised secondary metabolite and pathway gene expression in Curcuma longa L

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Curcuma longa L.., a spice and medicinal plant is widely used for its bioactive phytochemicals like curcumin, leaf and rhizome essential oil. Curcumin has potent anti-inflammatory, anti carcinogenic and antioxidant properties. Climate and nutritional variation is a major concern in controlling plant growth and productivity. In the present study, turmeric plant was cultivated at nine agroclimatic regions to study the effect of climate and nutrition on curcumin and its pathway gene expression.Soil samples were collected from all the experimental zones and nutrients like nitrogen (N), phosphorous (P) and potassium (K) were analysed. Estimation of curcumin was done following

the standard (American spice trade Association) ASTA method. Gene expression analysis for curcumin content was analysed and validated through quantitative polymerase chain reaction (q-PCR) analysis.Percentage of curcumin varied from 1.4 to 5% across all the zones. Expression of curcumin synthase was highly influenced by environmental factors like temperature, rainfall, humidity and soil quality. The result was further supported by the increase and decrease in expression of curcumin synthase. Thus proper nutritional management and selection of growing locations could be used for improvement of curcumin production.

FPB - 30
Studies on Preparation of Non Dairy Cheese Analogue

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Cheeses are found in almost all cultures throughout the world and cheese is one of our oldest food items. Cheese is the product obtained by draining after the coagulation of milk with milk coagulating agent, under the influence of harmless bacterial cultures, from which part of the moisture has been removed by cutting, cooking and pressing, which has been shaped in a mould and then ripened by holding it for some time at suitable temperatures and humidity.Cheese analogues are usually defined as the products made by blending of individual constituents, including non-dairy fats or proteins to produce a cheese-like product to meet specific requirements. Cheese analogues are being used increasingly due to their cost-effectiveness, attributable to the simplicity of their manufacture and the replacement of selected milk ingredients by cheaper vegetable products.In this study, Non dairy Cheese analogue were prepared using Soya milk and coconut milk blend, rennet enzyme, salt, stabilizer (Sodium phosphate), preservative (Calcium propionate) and final optimized products were judged for appearance, colour, flavour, texture and taste. Soymilk and coconut milk were mixed together at different ratio of 90:10, 80:20, 70:30, 60: 40, and 50:50 respectively for the preparation of cheese analogue. The sample having formulation 50:50 of soymilk and coconut milk was found best in terms of texture, colour & flavour. This sample had moisture content-57.34%, acidity-0.21%, Ash-1.5%, Protein-13.37%, Fat-27.10%, Crude fibre-0.55%.

FPB - 31
Kluyveromyces marxianus as food microbial systems for improved -galactosidase production using whey as substrate

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β-Galactosidaseis broadly applied in the preparation of lactose-hydrolyzedproducts for lactose-

intolerant or lactase-deficient people.Additionally, products obtainedfrom Dairy yeast are generally recognized as safe (GRAS status) forhuman consumption, which is critical for food related application. However, because galactosidaseis too expensive to be discarded after a single usageit must be immobilized to allow reuse after batch reactions.Whey is a valuable byproduct of the dairy industry which has prospects of using as source of various valuable industrial products.The lactose present in whey is considered as environmental pollutant and its utilization for food grade beta galactosidase production using Kluyveromyces marxianusmay be useful for food and dairy industry. The dairy yeast K. marxianus have the ability to utilize the lactose as the major carbon source for the production of enzyme.The yeast enzyme has anear neutral optimum pH (6.0–7.0) and therefore has a broader range ofapplications, particularly in the hydrolysis of milk and sweet whey(derived from hard cheese manufacturing).Five strains of K.marxianuswere screened for the production of the □-galactosidase using whey. Strain MTCC-1389 using various parameters were optimized for the production of enzyme. The effect of inoculum on the production of the enzyme was carried out using different inoculum level of 2-10% and a maximum activity of 1.32 IU mg^{-1} dry weight using 6% of inoculum level was obtained .The maximum □-galactosidase activity of 1.74 IU mg^{-1} dry weight was achieved in whey using all parameters optimization of K. marxianus MTCC 1389. □-galactosidase was further immobilized on chitosan macroparticles and exhibited excellent functional activity at 35 °C. It was able to hydrolyze 89% of lactose present in concentrated whey and further retained its 89% of the enzymatic activity after 15 cycles of reuse. So the strain showing maximum production of □-galactosidase enzymes along with immobilization willbe helpful in hydrolyzing the lactose with a greater industrial importance.

FPB - 32

Development and validation of simultaneous high performance chromatographic method for the quantitative determination of alpha- and beta- asarone in Acoruscalamus Linn. extract

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Acoruscalamus Linn. (AC) root has long been used as food ingredient for neurotonic by making to be tea. It was also pharmacologically used to be sedative and its major compound are alpha-asarone and beta-asarone. However, there are many validated methods for determination of alpha- and/or beta-asarone but there are no report of both asarone from the AC extract. Thus the purpose of routine quality control, a simple rapid and reliable quantitative HPLC method to determine alpha- and beta-asarone in ethanolic extract of AC was developed and validated.Roots of AC were macerated with 95% ethanol to obtain the ethanolic extract. A quantitative HPLC method was developed using C18 column and isocratic mobile phase. The method was validated according to ICH guideline on

selectivity, linearity and range, accuracy, precision, limit of detection (LOD), limit of quantitation (LOQ)and stability of standard solution.Alpha- and beta-asarone were separated within 14minutes along a C18-column using isocratic mobile phase of acetonitrile and 0.1%acetic acid (45:55). LOD and LOQ of both compounds were 0.05 µg/mL and 0.5µg/mL,respectively.The coefficient of determination (r^2) of both standard curves were more than 0.999 within the linear range of 1 – 100 µg/mL. Recovery were within the range of 95% – 102% for alpha-asarone and 97% -105% for beta-asarone. Within-and between-run precisions showed as relative standard deviation were all below 4.0%. The standard solutions were stable in autosampler for 24 hours. By the conclusion, this condition could be used to determine both form of asarone in AC extract or health products which composed with AC.The developed HPLC method of AC extract in this research showed that it is simple and high performance for determination ofalpha-asarone and beta asarone with good linearity, high precision, accuracy, satisfy LOD and LOQ. Thusthis method should be useful for quantitative analysis of alpha- and beta-asarone from AC extract.

FPB - 33
Food Biotechnology: A modern tool for improved food products

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Food biotechnology is an umbrella term covering a vast variety of processes for using living organisms—such as plants, animals, microbes, or any part of these organisms—to develop new or improved food products. It includes the newer forms of food biotechnology that offer a faster and more precise means to develop food products. Today, in the arena of food, the primary goals of food biotechnology are to provide a more abundant, less expensive, and a more nutritious food supply in order to address the needs of our growing global population. Food biotechnology is being used to improve nutrition, enhance food safety and quality, and protect food crops and animals from diseases that would otherwise threaten our stable, affordable, and wholesome food supply. Food biotechnology techniques include the joining of two pieces of DNA from different organisms leading to a single piece of DNA. Individual "specific" genes are transferred from one organism to another in order to improve the nutrient levels of a food, for example, such as fortifying a fruit or vegetable. Modern techniques are much faster and more precise. It is possible to quickly transfer a specific gene of interest rather than waiting on the random shuffling of genes over several generations. Cotton, squash, and papaya are the examples of commodities in which food biotechnology is used to reduce pesticide use, increase profitability through greater yield, and ultimately reduce the cost of commodities at the consumer level. Examples of foods developed through biotechnology to increase the levels of nutrients or to address a health concern include oils, such as canola, in which the levels of nutritionally essential fatty acids are increased, varieties of wheat that do not contain gluten, and potatoes (protein), and lettuce (iron). Food Biotechnology has a role to play in ensuring that safe and abundant food can be produced on existing farm land to meet the increasing needs of the world's growing population.

FPB - 34
Biosensor: A vigilant device for Myco-toxins in Food processing industry

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A biosensor is an analytical device, used for the detection of an analyte that combines a biological component with a physicochemical detector. Development of a biosensor is an interdisciplinary field and a vast knowledge of biology, biochemistry, chemistry, electrochemistry, physics, kinetics and mass transfer is required. Molecular recognition and signal transduction are integrated in various manners of which the molecular recognition is responsible for the selectivity of a biosensor and is done mostly by bio-molecules such as enzymes, antibodies etc. Biosensors like electrochemical biosensors, optical biosensors, electronic biosensors, etc. in ultra-trace amount can trace the mycotoxins in dietary staples. It has been estimated that 25% of the world food crops (42 crops) are affected by myco-toxins.The fungi responsible are ubiquitous and can cause contamination of stored and inadequately dried products. Warmer temperatures and extreme weather events encourage the growth of mycotoxin producing fungi, namely, Aspergillus, Fusarium and Penicillium and to a lesser extent Alternaria, Claviceps and Stachybotrys. Drought stress also favors the growth, conidiation, and dispersal of A. flavus in maize.At present more than 400 different types of myco-toxins are known to exist in nature of which the important and hazardous mycotoxins produced by different fungal genera includes aflatoxins (AFs), citrinin (CIT), cyclopiazonic acid (CPA), fumonisins (FBs), moniliformin (MON), ochratoxin A (OTA), deoxynivalenol (DON), nivalenol (NIV), T-2 toxin (T-2),patulin (PAT) PR toxin (PR) and zearalenone (ZEA). These mycotoxins are known to cause serious health effects on human and animal lives which may be cytotoxic,carcinogenic, immunosuppressive, nephrotoxic, neurotoxic, mutagenic,oestrogenic effects and birth defects.The RNA silencing mechanism has been exploited as a novel and efficient genetic tool for crucial myco-toxin biosynthesis or to regulate genes to control the disease and myco-toxins contamination .siRNAs could reduce the expression of their target genes in Aspergillus flavus, Aspergillusparasiticus, F. graminearum, and Fusariumoxysporum in many literatures.

FPB - 35
Advancement in the Food Preservation

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Food deteriorates in quality due to a wide range of reactions including physical, chemical, and enzymatic and at times, some microbiological reactions. These various forms of spoilage and

deterioration in quality of food are caused by micro-organisms, which are preventable to a large degree by different preservation techniques. These preservation techniques specifically include freezing, chilling, drying, curing, conserving, vacuum packing, modified atmosphere packing, acidifying, fermenting, and adding preservatives. Most of these techniques concentrate on reducing the activity of microorganisms. However nowadays,New and Emerging preservation techniques include more than the inactivation of microorganisms.These techniques include the use of Bacteriocins, the natural inhibitory compounds produce by bacteria to inhibit the growth of potential spoilage or pathogenic microorganisms. Bacteriocins that are most commonly used include lantibiotics and nisin. Other advancement in the field is the application of Hurdle technology for preservation of food. Hurdles in a stable product, controls the microbial spoilage, food poising and also fermentation process. Some other techniques in the series include the application of ionizing radiation, high hydrostatic, high voltage electric discharge, high intensity light and ultrasonication in combination with heat. Today, major focus keeping in view the consumers perspective is towards the use of procedures that deliver food products that are less heavily preserved, higher quality, more convenient, more natural, free from additives, nutritionally healthier, and still with high assurance of microbiological safety.

FPB - 36
Effect of Processing on the Functional Properties of Pulse Based Cabbage Soup

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Nowadays, a substantial part of the cultivated fruits and vegetables are processed in to fluid-like plant-tissue-based food suspensions like soups, sauces, and purees. A Newtonian fluid is a completely viscous fluid having a viscosity that is independent of shear rate at a specified temperature. However, it has been reported that the flow behavior of most vegetable- and fruit-derived suspensions deviates from simple Newtonian behavior, which is a result of the structural modifications occurring while shearing. In the present study, focus has been given on rheology as a functional property because of its importance during the entire production chain up to the moment of consumption and digestion. The effect of heat treatment for different time intervals on rheological properties of cabbage is the prime objective of this study. This finding has been utilized for the preparation of pulse based, cabbage soup which provide proper consistency and organoleptic appeal of the product developed. Cabbage paste was prepared after heat treatment for 5, 8, 10, 12 and 15 minutes under boiling condition. It has been found that after 12 minutes heat treatment under boiling condition cabbage paste mixed with pulse extract (1:1 w/w) provides best rheological property compare to others (5, 8, 10 & 15 minutes of heat treatment). This finding was utilized for preparation of pulse based cabbage soup with good organoleptic appeal.

FPB - 37
Exploiting actinomycetes from unexplored habitats producing carotenoid pigments

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Natural colours are generally extracted from fruits, vegetables, roots and microorganisms and are often called bio-colours because of their biological origin. There is an increasing demand for natural colors in the food, pharmaceutical, cosmetics, textile, printing and dye industry. In recent year's utilization of natural pigments in food stuff, dye stuff, cosmetics and pharmaceutical manufacturing process has been increased; in this context the present study was undertaken. Objective: Isolation, screening and partial characterization of carotenoid pigments produced by actinomycetes from solitary wasp and swallow bird mud nest. Materials and Methods: Actinobacterial species isolated from unexplored habitats were screened for their pigment producing capability in ISP-5 and ISP-6 media. The most promising isolate was characterized using polyphasic taxonomy. The pigment was checked for its antimicrobial and free radical scavenging activity. The stability of the pigment was also checked at different pH and temperature. Results: A total of 109 actinomycetes were isolated from solitary wasp mud nest and swallow bird nest. 65% of the isolates produced diffusible pigment on ISP-6 media, however only 25% produced carotenoid pigment. The pigment produced by Isolate 8(1)* showed highest free radical scavenging activity as compared to others isolates in addition with antimicrobial activity against both Gram-positive and Gram-negative bacteria. This pigment was found highly stable at a pH range of 3.6-8.00 and at a temperature of 5-121°C. The most promising isolate was found to belong the genus Streptomyces based on Polyphasic approach. It seems that the promising isolates from the present study may prove to be an important step in development of food grade natural color.

FPB - 38
Refractance Window Drying of Mango Leather in Layers

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Refractance Window (RW) drying is a novel drying technique, developed by the owners of MCD Technologies, Inc. in Tacoma, Washington. From the previous studies it is established that RW drying technique is superior in terms of nutrient retention capabilities than other conventional drying methods. In this, the material tobe dried is placed on a thin plastic (myler) sheet and, the plastic sheet is heated from below viacirculating hot water. As a heat source water bath has been used for the experimental studies whose temperature was fixed at 95°C. The recommended moisture content

for intermediate moisture food like mango leather is 18-40% (d.b.) which was achieved within 60 minutes using myler sheetand drying about 4mm layer. After 1 hour of drying the water activity of mango leather was around 0.512. When another layer is spread over the first layer it has been observed that the product temperature of 2nd layer was lower as compare to 1st layer and therefore the final moisture content and water activity value will also be more.

FPB - 39
Biodegradability of Nanocomposite film affected by Types of Nanoparticles

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The researchers are interested to develop novel packaging materials produced from biopolymers labelled as "environment-friendly". Several biopolymers have been tried until now for development of bionanocomposite materials. However, the biggest shortcoming of such materials was their weak barrier and mechanical properties and cost of manufacture. So to overcome these problems nanoparticles are added as a reinforcing agent. There are several nanoparticles available such as nanocellulose, nanoclay, SiO_2, ZnO, TiO_2 and carbon nanotubes. Novel biodegradable nanocomposite films obtain by homogeneously dispersing nanoparticles in biopolymer materials through solution casting techniques. The final properties of nanocomposite usually depend on the proper dispersion of nanoparticles in polymer matrix and surface properties of nanoparticles. Bionanocomposite offer a possible alternative to the traditional non-biodegradable polymers, especially in short life-time application and when their recycling is difficult and/or not economical. Nanocomposites exhibit increase barrier properties, increase mechanical strength, improved modulus, dimensional stability and heat resistance. Many author concluded that the biodegradation of films depended on both type and content of nanoparticles. Nanoparticles viz., SiO_2, ZnO, TiO_2 and nanoclay hinders the rate of biodegradation of nanocomposite, where as nanocellulose, increase the rate of biodegradation.

FPB - 40
Microbial production, optimization, characterization of Sorbitol

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In the present study, efforts has been made to optimize media components and different physical process variables viz. pH, temperature and agitation speed for enhanced sorbitol production in batch cultivation by Lactobacillus plantarum NCIM 2912. Glucose and organic nitrogen mix were used as carbon and nitrogen sources for sorbitol production. Shake flask cultivation performed under

optimum physical conditions viz. 37°C temperature, 7.0 pH and agitation speed of 150 rpm, resulted in enhanced sorbitol production. Comparative study of sorbitol production in SSF and SMF was also evaluated. Batch cultivation further performed in 7.5 L lab scale bioreactor (working volume 3.0 L) under optimized conditions resulted in maximum cell biomass of 8.95±0.03 and a sorbitol content of 9.78±0.04 after 42.0 h of fermentation. Scale up study on bioreactor resulted in maximum sorbitol yield ($Y_{p/x}$) and productivity of 1.11(g/g) and 0.50g L^{-1}h. Characterization of Sorbitol was done by HPLC.

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MAP 30 (Momordica Anti-HIV Protein) isolated from bitter gourd (Momordica charantiaL.) seeds a potential source of anti HIV and anti cancer

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Bitter gourd (Momordica charantia L.) commonly called as karela in India, consist of number of constituents which contributes to the nutritional value of the plant. It is a wonderful plant not only providing nutrition but also offering several components which show medicinal activities against number of diseases. Many of its chemical constituents have been explored for its benefits in treating condition like diabetes, viral and bacterial infections, pains, stomach disorders etc. Newer applications include treatment of life threatening cancer and HIV infections too. Constituents of bitter gourd can be utilized for preparing many herbal formulations which can cure with no adverse effects. MAP 30 is protein isolated from bitter gourd which has shown anti HIV and anti cancer activities. This protein acts irreversibly on ribosome by removing adenine residue from eukaryotic ribosomal RNA. Structurally, MAP30 is a single chain protein containing 263 amino acids residues with 30 basic amino acid residues that account for approximately 11% of the total amino acids and its basic pH. The molecular weight of MAP30 is 30 kDa. Biological activity of this protein includes inhibition of in-vitro protein synthesis (ribosome inactivation), anti-tumor, anti-microbial, anti-viral and anti-HIV replication. MAP30, alpha and beta momorcharins (MMCs) are isolated from seeds of M. charantia inhibit HIV replication in acutely and chronically infected cells and thus are considered potential therapeutic agent in HIV infection and AIDS. Further, MAP30 improved the efficacy of anti-HIV therapy when used in combination with other anti-viral drugs. MAP30 holds therapeutic promise over other Ribosome Inactivating Proteins (RIPs) because not only it is active against infection and replication of both HSV and HIV but is non toxic to normal cells. This bitter plant gives many sweet gifts to life some of which we have unwrapped but it may still be holding many more surprises which need to be explored. Bitted gourd is truly a bitter body with sweet soul for human lives.

FPB - 42
Non-Thermal Food Processing and Preservation Technologies

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New trends in food processing, product development and quality assurance are promoting intense research on alternative methods of food preservation. Most food are thermally preserved by subjecting the products to boiling or even higher temperature for few minutes, which usually diminish cooking flavour and cause loss of vitamins and essential nutrients of the product. To overcome and minimize such losses, the concept of non-thermal treatments was born. Non-thermal food processes and preservation methods created interest among food scientists to establish processed product with minimal impact on the nutritional and sensory properties of foods, and extending the shelf life by inhibiting or killing the microorganisms. For example pulsed electric field treatment has lethal effects on various vegetative bacteria, mold, and yeast so its treatment with skim milk, resulting in an extended shelf-life. These processes are considered to be more energy efficient and preserve better quality attributes than conventional thermally based processes. Several rice-based foods are available with novel textures induced by high-pressure treatment. A review on non-thermal process technologies currently developed for the inactivation of microorganisms and thus extend the microbiological shelf life in foods, and to identify their interactions with food while packaging. Processes include ultra-high pressure, ionizing radiation, pulsed X-ray, ultrasound, pulsed light and pulsed electric fields, high-voltage arc discharge, magnetic fields, dense phase carbon dioxide and hurdle technologies.

FPB - 43
Antimicrobial Biocomposite Films using Distillers Grain Solubles by- product of Bioethanol Industry

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High demand of fresh food products has led to significant expansion of the edible film across the Globe. Enhancement of film properties by incorporation of novel materials as excipients of edible film materials is the novel approach. DDGS is a major by- product of the expanding distillery units. Recent research has shown that DDGS has a potential to be used in food industrial sector. Exploitation of DDGS, in film preparation has not been delved into so far. In the present study DDGS from rice grain based alcohol industry has been used. Edible films from the thoroughly characterized DDGS were prepared by changing the various process parameters. Silver, the

available metal nanoparticles have been utilized for their antimicrobial property. Reduced particle size leads to an increased surface area aids in enhancing the antimicrobial performance of the resultant. Development of silver nanoparticle impregnated microcrystalline as the multifunctional filler and its incorporation represents a novel approach for the development antimicrobial composite films. Thus the present research has been aimed to impregnate silver nanoparticles (AgNPs) into microcrystalline cellulose using Murraya koenigii extract as the reducing agent at ambient conditions. It was subsequently applied for the fabrication of the DDGS based antimicrobial Biocomposite films. The developed film was evaluated for antimicrobial applications and positive results were obtained. Extension of the study holds promise for preparation of large scale active packaging material that is of great utility to the food industry.

FPB - 44
Effect of processing techniques on Leaching of magnesium from Trigonella foenum Leaf using LIBS

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In the present paper we have studied the leaching of magnesium (Mg) from Trigonella foenum (common name: methi) leaves during different food processing techniques like blanching (hot water and complete blanching), microwave processing using Laser Induced Breakdown Spectroscopic (LIBS) technique. These processing techniques are frequently used at home as well as in food processing industries. The LIBS spectra of raw methi leaves as well as processed methi leaves are recorded in spectral range 200 nm to 900 nm. We have also recorded the LIBS spectra of the water used for blanching and microwave processing after filtering by muslin cloth. The filtered water has been freezed by deep-freezer (sonar) to record its LIBS spectra. Our results clearly demonstrate that the process of hot water blanching (incomplete blanching) results in higher leaching of magnesium in the water while less leaching is observed in case of cold water. Therefore LIBS can be used as an important monitoring tool for mineral loss in vegetables/food, during different food processing techniques.

FPB - 45
Application of Non Destructive Techniques in Quality Analysis of Food

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Non- Destructive techniques in quality analysis of food products, with the expansion of technological advancements has seen a widespread use in the industries, as the food systems

consisting of production, distribution and consumers, it is essential for producers, processors and consumers to assess and control food quality. The common application has been the raw material grading, on-line sorting, and detection of shelf life in case of nectarines, decontamination checks and to analyze internal defects. The recent techniques used for the same includes optical imaging such as Near Infrared Reflectance Spectroscopy(NIRS), Time Resolved Reflectance (TRS), imaging processing, magnetic resonance imaging , etc; gas sensors such as electronic nose and tongue; mechanical non-destructive methods such as low mass impact test detected by accelerometers or resonance frequency detected by microphone. Unlike, the destructive technology, the non-destructive techniques gives a compact view of the representative sample of the different batches by eliminating the possible variance without destroying the sample.

FPB - 46
Advances in Fruit Juice Concentration

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Concentration of fruit juices, a major unit operation in fruit processing industry, done to reduce the bulk of the material and increase its season of availability, is of critical importance as it determines the quality of the final product. It provides a reduction of transport, packaging and storage cost and present a higher resistance to microbial activity than the original juice in similar conditions. Few commercially feasible methods include vacuum evaporation, freeze - concentration and membrane processes. Conventional evaporative concentration techniques present major drawbacks with respect to high energy consumption, and inferior quality (color, taste, aroma, nutritional value) of the finished product. Centritherm Evaporator is an excellent solution for handling this type of problem as the residence time is extremely short. In last few years, membrane processes such as membrane distillation (MD), reverse osmosis (RO), and pressure-driven membrane processes; microfiltration (MF), ultra filtration (UF), nanofiltration (NF) and reverse osmosis (RO) have been recognized as alternative membrane based separation and concentration processes in fruit juice and other beverages.Concentration of orange juice(29.3mg ascorbic acid/100g) by reverse osmosis, using plate and frame polyamide membranes results in an increase in vitamin C content to 53.9, 82.7 and 101.1 mg/100 g, at 20, 40 and 60 bar, respectively and has a better-preserved characteristic aroma when compared to the juice concentrated by thermal evaporation.The key disadvantage of membrane filtration is the fouling of the membrane causing a reduction in flux and thus a loss in process productivity over time. Vacuum membrane distillation affects the preserving quality of the fruit juices and helps in maintaining superior and natural quality of the fruit juices.Concentration of enzymatically clarified orange and lemon juices with 0.2% pectinase at 50$\pm$2 °C after treatment with cation exchange resin Dowex 50W during storage in different conditions results in about 4 folds reduction in non-enzymatic browning. Further, there are some suggested areas that hold

promise for future research on this subject viz., use of microwave assisted concentration, vacuum systems, cryogenic technology etc.

FPB - 47
Diplokenema Butyracae: A New Source of Fat for Baking Industry

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There is great opportunity to enhance average productivity of all oilseed crops in the country, which needs concerted efforts in the coming years to reduce our dependence on huge imports of vegetable oils. Diplokenema butyracae, also known as Indian butter tree and locally known as Cheura is a multipurpose tree. Very little information exists on the nutritional composition of the seeds and edible uses of the fat obtained from the Diplokenema butyracae (Cheura). The present study was undertaken with the objectives to evaluate the nutritional quality of Diplokenema butyracae seeds and physicochemical properties of the fat obtained from the seeds. According to the results obtained Diplokenema butyracae seeds contain 40.48% crude fat, 7.75% crude protein and 22.92% moisture. The value of fat obtained is an indication that it is a good oilseed. Physicochemical evaluation showed that fat is having very low smoke point (50.33° C) and melting point (42.33° C). The other quality indicators are peroxide value (39.525 mill equivalence of peroxide/ kg sample), saponification value (176.25 mg/100g), iodine value (99.45 g/100g) and acid value (6.16mgKOH/100g). It can be concluded from the results of sensory evaluation that this fat is not suitable for deep and shallow frying as there is a strong aftertaste of the oil itself in the product but it may be incorporated with other fats in baking because the strong flavour of Cheura fat is masked during making cake. Although, there is a wide scope of research in Cheura tree and it's fat quality.

FPB - 48
Uniquebisfunctional recombinant cellulase-xylanase (rBhcell-xyl) from the polyextremophilic bacterium Bacillus haloduransTSLV1 and its utility in saccharification of renewable agro-residues

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Plant biomass is the most abundant source of carbohydrates on the Earth Plant biomass is the most abundant source of carbohydrates on the Earth. Cellulosic and hemicellulosic components constitute up to 40–50 and 20–40 % of the agro-residues which can serve as abundant and

inexpensive renewable source of fermentable sugars for generating various bio-chemicals and bio-fuels. The requirement of multiple enzymes for complete depolymerization of lignocellulosics is one of the major bottlenecks.There are very few reports on the native bifunctional cellulase-xylanases.

In view of the foregoing discussion, this investigation was planned and carried out with the following objectives:

1. Cloning and expression of thermostable bifunctional CMCase and xylanase encoding gene (Bhcell-xyl) from Bacillus halodurans TSLV1 in E.coli
2. Optimization of recombinant BhCell-Xyl (rBhCell-Xyl) production in E.coli
3. Purification and characterization of purified rBhCell-Xyl
4. Testing the applicability of rBhCell-Xyl in saccharification of renewable agro-residues

Cloning and gene expression using recombinant DNA technology, Optimization, purification, characterization and application of recombinant enzyme.

The recombinant E. coli produces a high titre of bifunctional recombinant protein, rBhcell-xyl (2272 CMCase and 910 U L-1 xylanase).The rBhcell-xyl is a ~62 kDa monomeric protein with temperature and pH optima of 60 °C and 6.0 and $T_{1/2}$ of 7.0 h and 3.5 h at 80 °C for CMCase and xylanase, respectively.End product analysis confirmed that rBhcell-xyl is an endo-acting enzyme. Both cellulase and xylanase activity of the recombinant protein makes it a potent enzyme for saccharification and fermentation of agro-residues. The action ofbifunctional recombinant cellulase-xylanase (rBhcell-xyl) on corn cobs and wheat bran liberated reducing sugars, which can be fermented to bioethanol and fine biochemicals.

FPB - 49
An Overview of High Pressure Processing Technique in Food Processing

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High pressure processing (HPP) is one of the emerging non-thermal technique that has gained commercial importance in recent years.High pressure processing is a method of food processing where foods are subjected to elevated pressures, between 100 MPa to 900 MPa, to achieve microbial inactivation or alterations of food attributes such as shelf life extension while retaining the desired qualities of fresh food. HPP technology is known for its potential to manufacture novel value added food products with retained heat labile nutrients, flavours and aroma packed in individual or institutional size packages, and as an alternative to traditional thermal pasteurization and sterilization. HPP in combination with packaging of good barrier properties can prevent browning in minimally processed food products during storage in the sealed pack. In addition to the added value of the product, however, when novel techniques are introduced to replace or enhance conventional processes, their economic efficiency has to be proven in terms of production costs, sustainability, energy efficiency, and new waste products or by products. HPP products marketed

worldwide include fruit puree,apple juice, jam, jellies, ready to eat meals, oysters, etc. This paper gives an overview on preserving of foods by high-pressure processing which includes the technology, process equipment, effect of HPP on micro-organisms, enzymes and food components, commercial applications of HP processing and the convenience for further research which needs to be explored.

FPB - 50
Food Processing by High pressure processing (HPP)

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The use of high pressure processing (HPP) also known as high hydrostatic pressures (HHP) for food processing is finding increased application within the food industry. One of the advantages of this technology is that sensory and nutritional attributes of the product remain virtually unaffected because it does not use heat, thus yielding products with better quality than those processed traditional methods. High pressure processing (HPP) have the ability to inactivate microorganisms as well as enzymes responsible for shortening the life of a product. High pressure processing utilizes intense pressure (about 400-600 MPa or 58,000-87,000psi) at chilled or mild process temperatures (<45° C), allowing most foods to be preserved with minimal effects on taste, texture, appearance, or nutritional value. In addition to lengthening the shelf-life of food products, high pressure processing (HPP) can modify functional properties of components such as proteins, which in turn can lead to the development of new products. Equipment for large-scale production of high pressure processing processed products are commercially available nowadays. Guacamole, sliced ham, oysters, and fruit juices are some of the products currently available in the market. Food Safety & Inspection Service (USDA-FSIS) recognizes high pressure processing as an acceptable food safety intervention for eliminating Listeria monocytogenes in processed meat products. It is also effective in inactivating other hazardous micro-organisms such as E. coli, Salmonella & Vibrio , as well as many yeasts, molds and bacteria responsible for food spoilage. High pressure processing technology is one of the most promising non-thermal processes.

FPB - 51
Impact of Steam -IR Hybrid Processing Technology on Ginger Powder Characteristics

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Industrial processing of Ginger and ginger like spices is substantiated to accelerate the revenue from Global trading. Traditional drying methods yield non uniform product quality caused by long

/inadequate non uniform exposure. Low drying performance and high operating costs are making it expedient for adoption of improved drying methods. In the present investigation a Novel approach of Steam IR Hybrid Drying Technology has been adopted for preparation of ginger powder. Ginger slabs were water blanched at 80^0 C for three minutes and subsequently IR dried. Experiments are carried out at three different drying temperatures (60°, 90° and 105°C). Drying characteristics and water diffusivity were studied for the sliced ginger slabs (unblanched and blanched) by infra red moisture analyzer at different temperatures. Diffusivity, activation energy for both unblanched and blanched ginger powder were found to be comparable. Obtained powder samples were studied for physicochemical, sensory, structural and flow characteristics for comparison. Color and lightness remained unchanged for blanched sliced ginger. Flow properties as Angle of repose, Hausner ratio etc indicated more flowability for the blanched ginger powder. There was retention of gingerol and increased effective diffusivity in the treated samples resulting in better retention of flavor.
It may thus be concluded that the proposed Steam IR hybrid drying technology holds promise for production of ginger powder with improved characteristics for diverse applications.

FPB - 52
Fermentation process for alcoholic beverage production from mahua (Madhuca indica J. F. Mel.) Flowers

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The present study was conducted as a part of preliminary experiments at Post Harvest Process and Food Engineering Department,GovindBallabh Pant University of Agriculture and Technology. The present investigation was for the development of a non-distilled alcoholic beverage from Mahua flowers.Mahua flowers are rich in total sugars out of which maximum proportion is of reducing sugars. Sugars identified are sucrose, maltose, glucose, fructose, arabinose and rhamnose. When flowers are mature and ready to fall, there is maximum total sugar content in the flowers. Fructose is present in a greater proportion than glucose and in the ripe stage the quantities are almost equal. Sucrose increases in amount up to shedding of corollas and is latter converted into invert sugars.Mahua flowers are rich in sugar (68-72%), in addition to a number of minerals and one of the most important raw materials for alcohol fermentation. Eighteen (18) treatment combinations consisting of two temperatures (25 and 30°C), three pH (4.0, 4.5 and 5.0) and three period of fermentation (7, 14 and 21 days) were used in the fermentation conditions. The maximum yield of ethanol (9.51 %) occurred at 25°C with pH 4.5 after 14 days of fermentation of Mahua flower juice. The fermented non-distilled alcoholic beverage contained total sugar (8.83 mg/ml), reducing sugar (0.82 mg/ml), total soluble solids (6.37°Brix) titrable acidity (0.65 %), and volatile acidity (0.086%). Methanol was not detected at any stage of fermentation. The developed fermented alcoholic beverage had characteristic flavor and aroma of Mahua flowers with about 7 to 9% alcohol.

FPB - 53
Impact of Irradiation on Spices Quality - An Overview

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Irradiation has been used to be a valuable method for food decontamination. Spices irradiation is a process of exposing spices to ionizing radiation such as gamma rays emitted from the radioisotopes ^{60}Co and ^{137}Cs, or high energy electrons and X-rays produced by machine sources. To destroy the detrimental biological organisms, utilization of ionizing radiation in food is considered a safe, well proven process that has found many applications. Depending on the absorbed dose of radiation, innumerable outcomes can be accomplished resulting in extended shelf life, reduced storage losses and enhanced parasitological and microbiological safety of foods. The well known irradiated commercial products are spices and spice irradiation is increasingly acknowledged as a method that guarantees hygienic quality of spices, diminishes post-harvest losses and facilitates easy trade in international market. This article reviews activities focusing on the irradiation of spices from the food safety aspect.

FPB - 54
Role of Biotechnology in Agriculture: Food production, quality and processing

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The role of biotechnology in agriculture can enhance efforts to increase food production and improve food quality. A general definition of biotechnology is the use of a living organism or its products for commercial purposes. These activities include making bread, cheese, beer, and wine in addition to selective breeding of food crops and domestic animals. Today, biotechnology involves the use of recombinant DNA techniques to obtain desired qualities or products. Recombinant DNA methods take genetic material from one organism and put it into another Foods produced using biotechnology must meet safety standards. The food processing industry is the oldest and largest industry using biotechnological processes. Further development of food products and processes based on biotechnology depends upon the improvement of existing processes, such as fermentation, immobilized biocatalyst technology, and production of additives and processing aids,

as well as the development of new opportunities for food biotechnology. And, they must be properly labelled according to FDA regulations.

FPB - 55
Optimization of process and shelf life evaluation of retort processed shelf-stable ready-to-eat rice pulav

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A ready-to-eat (RTE) thermally processed rice pulav were developed using retort processing technology. The rice pulav processing parameters like temperature and time 115 to 125 C for 15 to 25 min respectively on the basis of sensory evaluation. The processing temperature and time of 117.67 C for 22.4 min was considered to be the most appropriate for retorting the rice pulav with overall acceptability of 7.46 and desirability 0.79. The developed product was subjected to various chemical, microbial and sensory analyses during storage for 180 days at ambient temperature (17 - 37C). Free fatty acid (FFA), thiobarbituric acid (TBA) value and Peroxide value (PV) increased significantly ($p<0.01$) after 180 days of storage. And the product has good sensory and microbiological profile up to 180 day of storage.

FPB - 56
Use of Biotechnology in Food Industry

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Biological processes have been employed for food production since time immemorial. Many products like bread, cheese, yogurt, beer and wine etc. are produced through fermentation. Food Biotechnology enhances color, flavor, vitamin, enzyme and mineral compositionand provides more options for assessing food safety.Different cell cultures are utilized for the same. Cell cultures are groups of cells grown under controlled environmental condition, usually outside their normal ambience. Cell cultures can be isolated from different plants, viruses, insects, microorganisms, algae, or mammals including stem cells, tissue cells etc. These scientific tools are also a means for quickly augmenting the cell colonies used for manufacturing products such as fermented foods and medicines. This allows more efficientand cost-effective production of the food products along with more ways to improve their functioning ability.Food ingredients are substances used to increase nutritional value to alter consistency and to enhance the flavor. These compounds are those substances which are provided by the nature and are usually of plant or microbial origin.

Biotechnology is using the biology of taste to create healthy foods. Today's food industry depends effectively upon the research alliances between large food processors and the biotechnology. This is the main reason that food companies are quickly attaining critical mass in specialized areas of research and has served to accelerate developments in this area. This trend will continue. However this is the beginning of a new phase. As food companies become more acquainted with this technology this will lead to internalization of research skills and the full integration of biotechnology into the well-established food research disciplines.

FPB - 57
Importance of CAS/MAS in Food Processing Sector

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In current scenario consumer demand for natural minimally processed and fresh foods is increasing. CAS/MAS are proven technology for preserving natural quality of food products in terms of aesthetic appeal. It also reduces the wastage of food. In this technology, the atmosphere is modified in order to decrease the respiration rate, the production of ethylene gas, microbial activity and enzymatic action. This technology involves control of physiological disorder, retardation of senescence and maintains the quality of food product. In order to increase the efficiency in terms of quality and safety, CAS can be integrated with active or interactive packaging. This technology is used for the perishable products (like apple, meat, pears etc.). A time temperature indicator (TTI) is a smart device that indicates accumulated time-temperature history of a product. Time temperature indicators are commonly used to improve food safety and inventory control.

FPB - 58
Importance of food processing and increase shelf-life of food: A review

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Shelf-life is the longevity a food that can be kept under prescribed storage conditions while maintaining its optimum safety and quality to keep intact its natural benefits. Shelf life of a food begins from the time the food is manufactured and it is dependent on many factors like manufacturing process, type of packaging, storage conditions and ingredients. Food processing can provide many benefits to consumersand businesses; however certain aspects of the industry raise concerns over nutrition, food safety, worker justice, local economies and the environment. The processing of all foods types is varied. In this curriculum, processed foods are classified as: minimally

processed food, processed food ingredients and highly processed food. Fortification and enrichment are used to restore or raise nutrient level in food. Enrichment:the process of restoration of the nutrients that are lost during processing in different stages. Fortification goes a step further; it means adding certain nutrients above the levels that naturally occur in a food. The term fortification is also used more generally to refer to any addition of nutrients to a food. This group includes flours, oils, fats, sugars, sweeteners, starches and other ingredients. Common examples are high fructose corn syrup, margarine and vegetable oil. Generally processed food ingredients are not eaten alone; they are typically used in cooking or in the manufacturing of highly processed foods.

FPB - 59
Processing of Food Preserving by High Pressure

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Processing contributes to food security by minimizing waste and losses in the food chain and by increasing food availability and marketability. Food is also processed in order to improve its quality and safety. Food safety is a scientific discipline that provides assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. Consumers have a growing preference for convenient, fresh-like, healthy, minimal-processed food products with natural flavor and taste and extended shelf-live. High pressure processing (HPP) is a promising "non-thermal" technique for food preservation that efficiently inactivates the vegetative microorganisms, most commonly related to food-borne diseases allowing most foods to be preserved with minimal effect on taste, texture or nutritional characteristics. The main advantage of high pressure processing compared to thermal sterilization and pasteurization is maintenance of sensory and nutritional characteristic of treated food products. HPP provides a means for retaining food quality while avoiding the need for excessive thermal treatments or chemical preservation. High-pressure processing provides a unique opportunity for food processors to develop a new generation of value-added food products having superior quality and shelf-life to those produced conventionally.

FPB - 60
Ultraviolet Treatment of Fruit Juices- Enzyme Inactivation and Biochemical Characterization

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The present study was a part of preliminary experiments conducted at Agricultural and Food Engineering Department, Indian Institute of Technology, Kharagpur. The experiment was aimed to

inactivate the enzymes present in coconut water, apple, orange and lemon juices using of UV-C light treatment and to study the effect of UV-C light treatment on physiochemical properties. The juice sample was treated at different treatment conditions using lab scale collimated continuous UV light apparatus developed at IIT, Kharagpur with proper modifications. Experimental conditions were thickness of sample (1, 2, 3cm), Time of operation (0, 15, 30, 45, 60 min) and distance of sample from lamp source (8.6, 13.7, 18.6, 24 cm). The amount of UV fluence will depends on absorption coefficient of sample and sample distance from lamp source. Absorption coefficient was calculated by measuring the slope of the absorbance curve drawn against different sample concentrations. TSS, pH, Color, Titrable acidity, Ascorbic acid, poly phenyl oxidase, peroxidase, Total antioxidant capacity, Total phenolic content of each samples were evaluated and compared with control (Zero treatment time). Higher inactivation of PPO (76%) and POD (87%) was obtained in coconut water treated for 60 min operating time at 1cm sample thickness and 8.6 cm distance of sample from lamp source. The UV light treatment significantly effect on color (E^*=1.5-2.2), Ascorbic acid (8-15%) and Total Phenolic (12-18%) and Antioxidant activity (5-15%). The probable mechanisms to change in physiochemical properties and enzyme activity also reported in this study.

FPB - 61

Fourier transform infrared spectroscopy as an innovative tool for detection of infestation level in rice and wheat grains

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Fourier transform infrared spectroscopy (FTIR) is a techniue to obtain an infrared spectrum of either absorption of a solid, liquid or gas or the emission. It simultaneously collects high spectral resolution data over a wide spectral range. This confers a significant advantage over a dispersive spectrometer which measures intensity over a narrow range of wavelengths at a time. The FTNIR library has been developed for rice and wheat to detect early infestation so that proper measures may be adopted to extend the shelf lige of grains.Insect rearing of Rhyzopertha dominica (F.) and Sitophilus oryzae was done at 65-70% realtive humidity at atemperaturerange of 26±1° C.Theinfestation level of 0, 5, 10 and 15 insects per 100g samplewere taken at 12,14,16,18% moisture content for rice and 10, 12 and 14 % moisture contentfor wheat.The spectra was generated over a range of wave numbers from 12,000 to 4,000 cm^{-1} which were interpreted based on the overtones of different functional groups in the product. The scanner speed was 10 KHz and each spectrum was the average spectrum of 64 scans. A background spectrum was recorded with empty petri dish and background was active for 24 h. The spectra were measured by keeping 100 gm of sample in petri dish measured with integrated sphere.Infested and control samples were analyzed after 0, 45 and 90 days of storage.The major peaks at absorbance bands (wavenumbers) of 12395, 11447, 9055, 7692$cm^{-1}$for wheat;while 5999, 5403, 4967 and 4496$cm^{-1}$for rice.The spectral data were

analyzed using Partial Least Squares Regression (PLS).The performance of the final PLS based calibration models was evaluated by performing cross-validation on the calibration samples. The library developed would be used to detect level of infestation in rice and wheat grains as well as also the physico-chemical parameters within fraction of secs which otherwise would take 6-7 days.the validity of the result was tested by the R^2 and RMSEP values of 97.89 and 0.11 for rice ;and 96.77and 0.14 for wheat grains respectively.

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Optimization of spray drying condition for antimicrobial substances produced from Lactococcus lactis subsp. lactis NCDC 89 and Propinobacterium shermanii NCDC 139 by response surface methodology

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Response surface methodology (RSM) was used to study the effects of spray drying conditions such as inlet temperature, skim milk concentration and feed rate on antimicrobial substances produced by Lactococcus lactis subsp. lactis NCDC 89 and Propinobacterium Shermanii NCDC 139. These strains are used in the dairy products and pharmaceutical industries because of their beneficial effects on the human gastrointestinal tract and in immune modulation. The production of antimicrobial substances was optimized by the Design-Expert version 10 experimental design. An empirical model was developed through RSM to describe the relationship between variables (inlet temperature, skim milk concentration, and feed rate). The maximum antimicrobial activity of L. lactis subsp. lactis NCDC 89 was 15.35 AU/mL with 13.63 % skim milk and 15.56 mL/min feed rate at a inlet temperature of 172.27 °C, whereas in MRS (de Man, Rogosa, and Sharpe) broth, the activity was 15.50 AU/mL. Similarly, the maximum antimicrobial activity of P. shermanii NCDC 139 was 13.40 AU/mL with 14.30 % skim milk and 14.73 mL/min feed rate at a inlet temperature of 159.27 °C, whereas in MRS, the activity was 14.50 AU/mL. The results derived from RSM regression were close to those obtained with the experimental design treatments. These results revealed that an alternative medium could be used for large-scale commercial production of the antimicrobial substances, with potential prospects for application.

FPB - 63
Modeling of the freeze drying behaviour of button white mushroom using Artificial Neural Network

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Freeze drying or Lyophilization is a drying method of choice for biological materials due to its capability to deliver superior end products. The quality in terms of colour and aroma are well preserved with minimum deterioration in the nutritional attributes of the material to be dried. However, the determination for freeze drying behaviours such as moisture content (MC) and drying rate (DR) is complex due to non-linear nature of the data obtained and high number of process parameters such as primary drying temperature (T_p), secondary drying temperature (T_s), pressure (P), sample temperature (S_t), sample thickness (Th_s) and its initial moisture content (I_{mc}). In this article, an artificial neural network has been developed to predict the drying behaviour of Agaricus bisporus (white button mushroom) to set the basis for process optimization. A multilayer perceptron neural network (NN) model with static backpropagation has been chosen to build the network taking 70% of the experimental data as training set and the rest as testing set. The statistical validity of the model was evaluated using the coefficient of determination (R^2). The model predictions were found to be in good agreement with the experimental data set.

FPB - 64
Advent and Advances in CHIEF Technology

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Non-thermal methods of pasteurization are the current need in dairy industries because of their ability to achieve a lot more with reduced energy requirements and increased economy of operations. A research team from the University of Minnesota came up with a new non-thermal pasteurization technique called CHIEF, which stands for Concentrated High Intensity Electric Field, which is now been accepted as an alternative technique of conventional pasteurization. CHIEF uses a unique treatment chamber (orifice) and electrode configuration where a high intensity electric field is concentrated within the orifice through which liquid flows and is pasteurized. The structure of a CHIEF system bears characteristics similar to those of dielectric barrier non-thermal plasma (NTP) reactors. The high pressure of 1000KPa employed in this system ensures a high flow rate through the small orifice of the reactor, enough to bring the heat generated during the treatment quickly to the cooling stage.This high pressure can prevent electric discharge in the liquid, which would otherwise cause damage to milk and the reactor structure. It reduces the electrical conductivity of the liquid being treated and, thus, minimizes temperature rise. CHIEF technology has

been tested and proved to reduce the loss of nutrients in comparison to other thermal processes and has a more lethal effect on microorganisms present in foods.

FPB - 65
Microbial Processing of Jackfruit waste Supplemented with Organic and Inorganic Sources of Nitrogen

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The study on solid state fermentation of jackfruit waste supplemented with different nitrogen sources for enriched animal feed was carried out. Yeast fermentation of jackfruit waste supplemented with ammonium sulphate showed more decrease in pH compared to LAB inoculation alone and in combined inoculation. Combined fermentation of jackfruit waste supplemented with 2 per cent ammonium sulphate (T9) (JF waste + 2% ammonium sulphate + Yeast + LAB) showed highest crude fiber (23.37%). Among three different sources of nitrogen supplementing to jackfruit waste, the inorganic source of ammonium sulphate (T9) has greatly influenced on enhancement of crude protein by combined inoculation of yeast and lactic acid bacteria. The organic source of azolla and gliricidia has more influence on carbohydrate enhancement either by single or combined inoculation of Yeast and lactic acid bacteria.

FPB - 66
Introduction and Application of Food Irradiation in food processing Sector

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Food irradiation is a physical method of processing foods (e.g. freezing, canning).Food irradiation is recommended as an effective and widely applicable food processing method. It has been judged to be safe on extensive available evidence, which can reduce the risk of food poisoning, control food spoilage and extend the shelf-life of foods without detriment to health and with minimal effect on nutritional or sensory quality. Food irradiation processing of food products is achieved by ionising radiation in order to control foodborne pathogens, reduce microbial load and insect infestation, inhibit the germination of root crops, and extends the durable life of perishable produce. One of the most important advantages of food irradiation processing is that it is a cold process which does not significantly alter physico-chemical characters of the treated product. It can be applied to food after its final packaging. Irradiation has received approval for use in several food categories from the

United States Food and Drug Administration (FDA) and has been proven as an effective food safety measure through more than 50 years of research. Food irradiation has been approved in 40 countries including Australia, the United States, Japan, China, France and Holland. Irradiated foods are clearly labeled so that consumers can make an informed choice. This paper provides an introduction and application of irradiation in food processing sector and also the future prospectus of this technology from the commercial viewpoint.

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Production and Optimization of Amylase by Bacillus Polymyxa Ncim No. 2539 Utilizing Agro-industrial Byprodut (Orange Peel)

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In the present study, Bacillus polymyxa NCIM No. 2539 was selected to utilize agro-industrial byproduct (orange peel) for amylase production under submerged fermentation conditions. Screening for amylase production by Bacillus polymyxa was done on starch-agar plate. Different agro-industrial byproducts like cane molasses, wheat bran, rice bran and orange peel were screened for maximum amylase production and orange peel showed maximum enzyme production (activity: 492.31 IU/g sample) among all the four substrates studied. Effect of supplementation of substrate with different sulphur containing amino acids (cysteine, methionine and cystine) and vitamin thiamine was studied individually. Supplementation of the production media with cysteine showed maximum amylase production (515.38 IU/g sample) among all three amino acids and control. Supplementation with thiamine also showed more amylase production (469.23 IU/g sample) as compared to control (415.38 IU/g). Further optimization of the parameters viz. amount of substrate, concentration of amino acid and vitamin for maximum amylase production was done by RSM using Central composite rotatable design (CCRD).

FPB - 68

Relevanceof tissue culture techniques in Sugarcane

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Sugarcane (Saccharumofficinarum L.) has wide range of economic importance due to its major and by-products.Conventional propagation of sugarcane suffered from low propagation rates, expensive labour, time consuming and potential transmission of pathogens from the seed cane to the subsequent crop limits the efficiency of this method (Lakshmanan, 2006). Seed multiplication of

newly released varieties of sugarcane is one of the major constraints. Once a desired clone is identified, it usually takes 6-7 years to produce sufficient quality of improved seed material. This long duration causes a major bottleneck in breeding programmes. For this reason,plant tissue culture offers the best methodology through micro propagation of sugarcane for quality and phytosanitary planting material at a faster rate in a shorter period of time. Sugarcane is a suitable candidate for plant biotechnology and genetic engineering tool due to its complex genomic structure, poly-aneuploidy, rare flowering, and poor fertility. Successful protocols for shoot tip culture, callus culture, embryo culture, virus free plant production, somatic embryogenesis and genetic transformation have been already established. Thus following technique can be used to enhance mass production of sugarcane crop economically with the present trend of demand of sugarcane in the region.The present research work was under taken by keeping in view the importance of tissue culture technology in sugarcane improvement and establishment of efficient protocols for mass scale propagation of healthy, disease free and premium quality planting material through micro propagation to enhance the yield and recovery per hectares of sugarcane.

FPB - 69

Optimization of nutritional supplements for enhanced bio-plastic (PHB) production utilizing sugar refinery waste with potential application in tissue engineering

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Polyhydroxyalkanoates (PHAs) are intracellular carbon energy storage reserve material stored by gram-negative bacteria under the low nutrient concentration. PHAs are best alternative biodegradable plastics (bio-plastics) due to their resemblance with conventional synthetic plastic. The present study investigated the synergistic effect of nutritional supplements (amino acid and vitamin) on PHA production by Alcaligenes sp. NCIM 5085 utilizing a sugar refinery waste (cane molasses) under submerged fermentation process. Initially, the effect of individual factor on PHA yield was studied by supplementing amino acids (cysteine, cystine and methionine), vitamin (thiamine) and cane molasses at varying concentration in production medium. Further, the cultivation media was optimized by varying the levels of cane molasses, methionine and thiamine using response surface methodology to enhance the PHA yield. The maximum PHA yield of 70.89 % was obtained under optimized condition which was then scale up on 7.5 l bioreactor. Batch cultivation in 7.5 l bioreactor under optimized condition gave maximum PHA yield and productivity of 79.26 % and 0.312 g/l/h. The produced PHA was subsequently characterized as PHB by FTIR and NMR. PHB extracted from chosen strain were of relatively high molecular weight and crystallinity index. DSC analysis of extracted PHB gave T_g , T_m and X_c of 4.2 , 179 °C and 66 %, respectively. TGA analysis of PHB produced by Alcaligenes sp. showed thermal stability with maximized degradation

occurring at 302 °C which is above the melting temperature (179 °C) of the purified polymer. The extracted polymer possessed desirable material properties to be used in tissue engineering.

FPB - 70
The Role of Biosensors in Food Analysis

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A biosensor is an analytical device for the detection of an analyte that combines a biological component with a physicochemical detector component. There are two types of biosensors. (1) Calorimetric Biosensor (2) Potentiometric Biosensors It mainly consists of three parts.(a)the sensitivebiological element(b) the transducer(c)or the detector element. The development of biosensor technology represent a crucial task for environmental pollution management ,there is a considerable need to project and realize biosensor with the best feature for commercialization, such as sensitivity, selectivity,stability,reproducibility and low cost. The same multiple approach might be used for development of biosensor platforms suitable for use in fields as diverse as environmental and agrifood to industry, research security and defence, medicaland clinical. The market for biosensor technologies is comprised of five segments: medical, environmental, food and beverages, bio-defence, pharmaceutical research, with the medical applications overshadowing the other segments. The applications of biosensors to real sample must be a necessary steps before their commercialization which is, in general, the aim of the device development. Prospective biosensors market for food, pharmaceutical, agriculture, military, veterinary and environment are still to be explored. Biosensors can be used for estimation of caffeine, estimation of phenolic compounds and antioxidant present in food like alcohol cinnamic acid hydrouscinnamic acid derivatives in spices and also used for detection of urea and mycotoxin present in milk.

FPB - 71
Isolation of heavy metal resistant bacteria from industrial Waste Water : A Review

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A heavy metal is any metal or metalloid of environmental concern. The term originated with reference to the harmful effects of cadmium, mercury and lead, all of which are denser than iron. It has since been applied to any other similarly toxic metal, or metalloid such as arsenic, regardless of density. The primary objective of present study to develop a methodology to isolate heavy metal resistant bacteria from industrial waste water. And the secondary objective is to determination of

physiological parameters, MIC (Minimum inhibitory concentration) , co-tolerance of other heavy metal. By using the different heavy metals like cadmium, lead, mercury at different concentrations 0.25,0.50,0.75,1.0 mM growing stage of microorganism. The main achievements of present study is all the bacterial isolates isolated from the waste water sample were maintained on Cd, Pb, Hg, supplemented media plates. A total of 5 different colonies were observed that were showing tolerance to Hg. Out of 5 colonies only one colony showed tolerance up to 1 mM Hg conc. While one showed tolerance up to 0.75mM and rest of the colonies showed 0.5 and 0.25 mM resistance.

Poster Presentations

Recent Advances in Milk Technology

Section - B

Abstracts
MT - 01 to MT - 20

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MT - 01
Glycation of milk protein-maltodextrin to enhance their functional properties

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In the present investigation, conjugation of whey protein concentrate (WPC-70)-maltodextrin (MD) was carried out to enhance their functional propertieslike solubility, emulsifying properties. Whey protein concentrate -maltodextrin conjugates were prepared via Maillard type reaction by dry heat treatment at 90C and 79% relative humidity for 2 hour.Conjugation by means of covalent bond between the amine group of WPC-70 and carbonyl group of MD was confirmed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), degree of glycation and attenuated total reflectance-Fourier transform infrared (ATR-FTIR) spectroscopy.When assessed in the pH range 3.0-7.0 Conjugates had improved solubility compared to WPC, particularly around the isoelectric point of the protein. Conjugates shows improved emulsifying properties compared to WPC, when their emulsifying properties were assessedin oil in water emulsions. .As indicated by Hunter chromaticity coordinates (L* a* b* values), the conjugation of WPC:MD resulted in increase in a*, b* values and decrease in L* value which indicates yellow colour from the Maillard reaction. In a conclusion,above results indicate that the WPC:MD have better functional properties and can be further used as a food grade wall materials in the preparation of micro/nano-emulsions in food systems.

MT - 02
Preparation and optimization of value added fruits and vegetable cheese

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Fruits and vegetables are an important supplement of the human diet as they posses almost all nutritive components required for growth and development of the human body leading to a healthy physique and mind. Objective of the study was to prepare value added cheese by using combination of fruits & vegetables and to evaluate sensory acceptability & nutritional composition of the prepared product.The basic recipe was standardized and served as control (To) and the 4 treatments i.e. incorporation of Guava, Mandarin orange, Carrot, Bottle gourd at different levels was referred to as T1, T2, T3 & T4. The sensory evaluation of fruits & vegetable cheese was done by a panel of

judges using a 9-point Hedonic Scale. Nutritional analysis was carried out as per AOAC protocol. The data obtained was statistically analysed by using Analysis of Variance (ANOVA) method.The overall acceptability in context with sensory attributes of developed product was found highest in T2 (60% guava, 15% carrot, 10% bottle gourd and 15% mandarin orange) with a mean score of 8.52±0.23 & its chemical analysis reveal the presence of high content of protein (0.99 g), calcium (65.39mg), iron (1.59mg) & beta carotene (1602 µg). Conclusion: cheese can be successfully prepared by using different kinds of fruits and vegetables. The nutritive value increases with the value addition by Fruits and vegetables. These types of value added cheese are good for therapeutic purposes and can be included in the diets of people.

MT - 03
Utilization of sweet corn milk for preparation of dahi

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Dahi was prepared by blending of sweet corn milk with buffalo milk at different proportion. The product obtained was subjected for chemical analysis, organoleptic evaluation by panel of judges and microbial analysis. On an average the fat content of dahi prepared from sweet corn milk blended with buffalo milk was found to be 7.2, 5.6, 4.2 and 3.8 per cent, protein 3.5, 3.3, 3.1 and 3.0 per cent, total sugar 4.8, 4.9, 5.0 and 6.0 per cent, moisture 86.90, 87.94, 88.60 and 89.69 per cent, ash 0.72, 0.71, 0,70 and 0.70 per cent, total solids 13.10 12.06, 11.40 and 10.31 per cent, whey drainage 5.20, 5.40, 6.12 and 7.17 ml/100 ml of dahi, acidity 0.66, 0.70, 0.72 and 0.73 per cent, pH 4.33, 4.31, 4.20 ,4.13 and curd tension 16.92, 24.92, 22.50 and 20.02 gms for treatment T0, T1, T2 and T3 respectively It was observed that as the blending of sweet corn milk increased, there was decrease in fat, protein, ash, total solids and curd tension while moisture, total sugar and whey drainage increased. It was also observed that the overall acceptability score for treatment T0, T1, T2 and T3 was 8.09, 7.49, 7.29 and 6.02 respectively. The average Lactobacilli count of fresh sample was found to be 7.41 ± 0.01, 7.38 ± 0.00, 7.38 ± 0.01 and 7.35 ± 0.02 cfu per g for treatments T0, T1, T2 and T3, respectively and the average Lactococcus count of fresh sample was found to be 7.45 ± 0.01, 7.37 ± 0.01, 7.36 ± 0.01 and 7.28 ± 0.02 cfu per g for treatments T0, T1, T2 and T3, respectively. The coliform count 2-13 cfu per g and yeast and mould count of dahi ranged between 0 to 1 cfu per gm. The cost of control dahi was found to be highest for T0 as Rs. 5200 per 100 kg. The lowest cost was recorded for treatment T3 as Rs. 3360 per 100 kg. The cost for treatment T1 and T2 were Rs. 4280 and Rs. 3820 per 100 kg, respectively. It can be concluded that the sweet corn milk can be very well utilized for preparation of nutritious, palatable and low cost dahi by blending 30 per cent sweet corn milk with 70 per cent buffalo milk.

MT - 04
Efficacy of Partially Purified Pediocin Against Total Microbial Load in Raw Buffalo Milk

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Despite remarkable advances in food science & technology, food borne illness is the rising cause of morbidity in all countries. The wide spread resistance of bacterial pathogens to conventional antibiotics and consumers demand for naturally preservative and minimally processed foods created a need for development of new kind of antimicrobial agents. The present study was carried out to evaluate the feasibility of partially purified pediocin from fermented cheese whey as milk bio-preservative. To achieve this aim identification of different microbes present in raw buffalo milk and their sensitivity to partially purified pediocin for reducing total microbial load in raw buffalo milk was carried out. Liquid cheese whey was prepared after dissolving the dried cheese whey powder. This was supplemented with yeast extract (10 g l^{-1}), Tween80 (1 ml l^{-1}), magnesium sulphate (0.2 g/l) and manganese sulphate (0.05 g/l) at pH 7.0. Supplemented cheese whey, with Pediococcus Pentosaceous NCDC273 as inoclum, was used for partial purification of pediocin using ammonium sulphate method followed by cation exchange chromatography and ultrafiltration. Efficacy of pediocin after ultrafiltration was determine by spot on lown assay and SDS-PAGE was use to conformed purity. All the pediocin preparations were found effective in reducing total count on TGYE, MRS, PDA, VRBA and Baird Parker agar media. These results show that pediocin obtained after fermentation of Pediococcus Pentosaceous NCDC273 in cheese whey reduces total microbial load in raw Buffalo milk. Our results showed the efficient production of partially purified pediocin at reduced cost with potential to inhibit the milk spoilage and pathogenic microorganisms.

MT - 05
Microencapsulation of Dairy Products

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Microencapsulation is of great interest in food industry. Specially, in dairy sector, it is an important step in manufacturing probiotic, fermented and functional products. Incorporation of bioactive compounds and fortification of valuable compounds are among some of the applications of microencapsulation besides stability and controlled release of microbial culture in probiotic and fermentation based products. Certain innovative challenges such as fat-replacement, texture control are also possible because of microencapsulation. Replacing fat by specialised proteins in form of encapsulated globules results in similar texture as in case of fat-rich alternative. Thus microencapsulation can play a role in not only providing with essential compounds in desired way but is also a great tool to bring about desired textural and dietary solutions. Various methods are

being used for microencapsulation, most popular among them being spray drying, spray coating, freeze drying, extrusion, emulsion and gel-particle technology based methods. In spray drying and coating; liquid suspension of the bioactive product is sprayed at the top of a large vessel, creating a mist of fine droplets with the difference being that of temperature and coating material. The freeze-drying technique is one of the most useful processes for specially temperature sensitive substances whereas gel particle based technology involves entrapment in gel matrix, polymer based system (example: pectin-alginate). There is an increasing demand to find suitable methods that provide high productivity and, at the same time, satisfy an adequate quality of the final products.

MT - 06
Effect of Flavour on Sensory Characteristic of ICE Cream Made from Lab and Factory in Varanasi City

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Ice Cream may be defined as a frozen dairy product made by suitable blending and processing of cream and other milk product together with sugar and flavour, with or without stabilizer or colour and with the incorporation of air during the freezing process The objective of the present study is to evaluate the chemical quality and effect of flavours on sensory characteristics of Lab and Factory Ice Cream in Varanasi city has been the main part of the present investigation. In order to collect the samples, five manufacturers were selected who are the main Ice Cream producer in Varanasi city. In order to compare with the quality of market samples, the control samples were prepared in the Laboratory of Udai Pratap College, Department of A.H. & Dairying from cow and buffalo milk and all necessary ingredients were purchased from market. Samples of Ice Cream collected from different factories showed a wide variation in their general appearance and were found to differ from factories to factories and sometime within the samples to the same Factory which may be because of the difference in the composition and manufacturing process in different batches. Body and texture of the Ice Cream were found to be hard; smooth and granular; flavour was found to be pleasant and Mango, most of the samples were suitable for sweet making. The flavours added to the samples where Orange, Vanilla, Strawberry and Mango. Ten untrained panellists were chosen to judge on the quality of Ice Cream in term of colour, flavour, texture, taste and overall acceptability. The physical quality of the dairy products are very important from the consumer point of view. The colour shows a non significant ($p>0.05$) results with the highest score in Ice Cream made by Lab (8.63±0.163) compared with Factory Ice Cream (7.88±0.148). The highest mean of texture, flavour, taste and overall acceptability ($p<0.01$) were obtained in Lab Ice Cream (8.58±0.123, 8.80±0.172, 8.85±0.188 and 8.72±0.161respectively), while the lowest means were obtained in Factory Ice Cream (7.88±0.148, 7.63±0.167, 7.95±0.186, 8.00±0.168 and 7.87±0.167 respectively). The colour and overall acceptability of Ice Cream ($p>0.05$), showed the best result in Ice Cream made from Mango flavour (8.70±0.231 and 8.80±0.232 respectively) and poorest colour scores were in Ice Cream made from Orange (7.75±0.204 and acceptability 7.81±0.277 respectively), in Vanilla the

highest mean sensory score for the taste (8.5±0.223) and lowest mean score (7.90±0.240). in Strawberry Ice Cream , made from Factory, the highest mean score for the sensory character i.e. Taste (8.40±0.275) and lowest mean score for texture (8.20±0.225). The best colour, texture, flavour, taste and overall acceptability scores of Ice Cream made by Lab where in Ice Cream made from Mango (9.30±0.260 for colour), Mango (8.90±0.233 for texture), Mango (9.60±0.163 for flavour) and Mango (9.70±0.153 for taste) and Mango (9.38±0.202 for overall acceptability) respectively. The poorest colour, texture, flavour, taste and overall acceptability scores of Ice Cream made by Lab were found in Orange (8.10±0.233 for colour), Vanila (8.20±0.249 for texture), Orange (8.20±0.327 for flavour), Orange (7.70±0.423 for taste) and overall acceptability also in Orange (8.08±0.311). The best colour, texture, flavour, taste and overall acceptability scores of Ice Cream made by Factory where in Ice Cream made from Mango for colour (8.10±0.277); for the texture Mango (7.70±0.396); for the flavour Mango(8.60±0.340) for the taste also Mango (8.50±0.307) and overall acceptability made from Factory is best in Mango (8.32±0.330). The poorest colour, texture, flavour, taste and overall acceptability scores of Ice Cream made by Factory were found in Orange (7.40±0.306 for colour), Strawberry (7.50±0.269 for texture), Orange (7.50±0.307 for flavour), Orange (7.60±0.340 for taste) and overall acceptability also in Orange (7.55±0.313). However the highest score was found in Mango flavour Lab made Ice Cream for colour, texture flavour, taste and overall acceptability, while lowest score found in Orange flavour for colour, flavour, taste and overall acceptability and for texture in Strawberry flavour made from Factory. The highest significant texture ($p<0.01$) and flavour scores ($p<0.001$) where in Factory Ice Cream made with Mango Ice Cream. However Ice Cream made with Vanilla and Orange flavours, revealed where lower significant ($p<0.01$) and ($p<0.001$) results in Ice Cream produced by Lab. Chemical quality of Ice Cream varied slightly from manufacturer to manufacturer. Fat content of market sample varied between 10.30±0.16 and 10.40±0.06 with an overall average value of 10.045±0.198 percent while the fat content of control samples varied between 13.00 t0 14.00 with the mean value of 13.42± and 0.17 percent, respectively. Acidity content of market Ice Cream samples varied between 0.144±0.005 and 0.13±0.01with an overall value of 0.129±0.00825 percent, while the acidity content of control sample varied between 0.10 and 0.15 with the mean value of 0.118±0.009 percent, respectively.

MT - 07

Physicochemical, sensory evaluation and microbial analysis of rasogolla (Cheese Balls) Fortified with carrot paste

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Rasogolla is delicious sweet product prepared from channa (analogues to cottage cheese) which

appears like soft snow white spherical balls dipped in the sugar syrup and is inseparable part of social culture in the Indian subcontinent. An attempt has been made in this experiment to prepare rasogolla from cow milk standardized at 4% fat and 8.5% SNF blending with carrot to provide better and nutritious rasogolla with acceptance to consumer. Rasogolla samples prepared from different proportion of carrot paste i.e. 0, 10, 15, 20 and 25% with an object to study physicochemical, sensory and microbial quality of the carrot rasogolla. The samples were analyzed for fat, total solids, sucrose, protein and microbial quality in context to total viable count, coliform count and yeast and mould count was analyzed at 0, 3rd, 6th and 9th day at temperature 26±2°C. As the level of carrot increased in rasogolla samples, fat, total solids, sucrose and protein content decreased. Total viable count and yeast and mould count increased as the days proceeded while coliform count was observed to be zero. From the findings of sensory score it was seen that most acceptable carrot rasogolla was obtained by blending rasogolla with 15% carrot paste.

MT - 08
Hormones in Dairy : A Consequence of Blind Race

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India is the largest milk producing country in the world. In India, it has traditionally been the practice to replace the mother's milk with cow's milk. In the present scenario, India has developed a lot, as far as milk sufficiency is concerned, but still we can't get the required nourishment due to inferior quality of milk. Industrialisation and increased demand for milk has led to cross-breeding, creating genetic variants. In modern dairy farms, cows are milked about 300 days a year. For much of that time, the cows are pregnant and it has been found in some researches that pregnant cow's milk contain enhanced level of estrogen hormone in comparison to non-pregnant cow. Recent researches in India has found that the milk of the hybrid cow is not only harmful for health but also reduces immunity. Lots of researches has been done in "Dairy sector" but we are still lacking on documented data about the disorders caused by hormonal incorporation in milk. Hence, it becomes necessary to draw attention of the researchers towards the need of exploration in the concerned area. The literature search included an electronic database, published materials, and standard text books.

MT - 09
Advancement for the better preparation of Mozzarella Cheese

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Mozzarella belongs to the "pasta filta" variety of cheese, which invalve knowledge full stretching, pulling and kneading the curd under hot water to arrive at smooth texture and grain in cheese. An

ideal mozzarella has a smooth, moist surface with a perfect sheen an elastic, stirngy body free from mechanical opening, being an un ripened variety, It may be consumed shortly after manufacture. Its melting and stretching characteristics are highly appreciated in the manufacture of pizza, where it is key ingredient. The best Italian mozzarella comes from capua, cardito, averso, and the selevalley. Many Indian companies are also now producing excellent mozzarella. In the most traditional manner the curd is set, cut, drained and then iced until the pH of the curd is 5.20-5.30. The option usually takes three days, in the modern cheese plants, the curd is held at 30-32^{0}c for 1-3 hrs until the pH reaches 5.20-5.30, when the pH is at the optimum level. Mozzarella cheese packed in polyethylene bags without vacuum. Polyethylene bags with vacuum and cryopac have been stored successfully at refrigerating temp for 18 days. 21 to 42 days and average 42 days respectively.

MT - 10
Socio-economic factor affecting quality of raw milk in dairy value chain

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In India fastest deterioration in milk quality has been observed in dairy value chain, which needs to be taken into accepted by introducing the concept of clean milk production the present study was conducted in the area of Uttar Pradesh co-operative dairy federation (UPCDF) to marking the socio-economic factor of dairy farmers, which affects the quality from pail to dock level. A total of 150 farmers were selected on the basis of random sampling from six district milk unions of (UPCDF) .The milk samples collected from five different level viz. pail (producer) dairy co-operative society (DCS) And dock (processing plant) were analyzed using methylene blue reduction test (MBRT) to estimate milk quality. The raw milk quality in UPCD dairy value chain was excellent pail, very good at DCS good at dock and accepted at five levels. Data on different of socio economic factor of the respondents were analyzed using different statically methods. The overall result revealed family education status experience in dairying Socio participation land holding capacity and herd size of annual income and milk production and milk sale had positive and significant correlation with the milk quality however, land holding capacity had negative significantly correlation. Social participation and annual income were able to explain 46.22% Variability in the milk quality at pail level at the DCS level social participation land holding and milk sale were able to explain 59.08% variability in milk quality .family size average milk consumption and sale were able to explain 32.18% variability in milk quality at dock level.

MT - 11

Process optimization for manufacture of value added indigenous dairy product paneer-mix-kheer Objective: Chemical analysis of value paneer-mix-kheer

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Paneer-mix-kheer is a new value added dairy dessert. Process for manufacturing of this product was based on paneer, basmati rice, sugar and cardamom. This product was prepared by using 3 levels of paneer i.e. 6 % (P_1), 8 % (P_2) and 10% (P_3) and 3 levels of sugar i.e. 6 % (S_1), 7 % (S_2) and 8% (S_3) of buffalo milk. Each treatment combination was replicated thrice and the observations were studied for statistical analysis using Factorial Randomised Block Design (RBD) to test the significance of various levels of paneer & sugar on the quality of this value added product. In chemical analysis of paneer mix kheer; average moisture, fat, protein, ash and total solids contents were found to be 52.07, 10.64, 7.72, 2.01 and 47.93 percent respectively irrespective of different levels of paneer and sugar.

MT - 12

Effect of Fortification of Raisin and Dates in Milk

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Raisin and dates are rich in phenolic compounds: flavonoids and phenolic acids. Flavonoids are not only potent antioxidants but also have a multitude of functional capabilities, which may have an effect on health. The objective of the present study is to increase the amount of soluble polyphenols using milk as an extracting medium. The amount of soluble polyphenols present was measured in gallic acid equivalents using the Folin-Ciocalteau assay. For extraction of polyphenols with milk, four different temperatures were maintained which are room temperature (30° C), 50° C, 70° C and 100° C. It has been found that maximum extraction of polyphenols (76.3 mg of GAE/100 gm date palm) from date palm is obtained with milk at 70° C and that from raisin (68.9 mg of GAE/100 gm raisin) is obtained with milk at 50° C which were even greater than methanol as extracting medium. It can be concluded that maximum amount of soluble polyphenols were achieved with raisin and dates when consumed with hot milk at 50° C and 70° C respectively.

MT - 13
Effect of fat and sugar level on yield of shrikhand

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Shrikhand as a semi-soft, sweetish sour, whole milk product prepared from lactic fermented curd, the curd is partially strained through a muslin cloth to remove the whey and thus produce a solid mass called chakka.This chakka is mixed with the required amount of sugar to yield Shrikhand. The dish is very popular in Gujarat, Maharashtra and Karnataka. The buffalo milk was standardized to three fat levels i.e. 4% (F_1), 5% (F_2) & 6% (F_3). During the preparation of Shrikhand three levels of sugar i.e. 30%(S_1),40% (S_2), 50%(S_3) was added & then the Shrikhand was put in plastic ups. The experiment was laid in CRD with three replication. The impact of all treatment individually and their interaction was studied on yield of Shrikhand. The results of present investigation yield useful information of productive utility for higher fat in Shrikhand the treatments F_3xS_2 showed better result. The highest amount of fat was evaluated in F_3S_2.A higher protein content in Shrikhand was noted for F_3xS_2 treated samples. Fat at 4%, sugar 40% and Shrikhand prepared in plastic cup exhibited higher value of sucrose was recorded in (F_1xS_3) sample. Individually higher total solid content in Shrikhand was observed for the treatment 6% fat and 40% sugar level. The treatment F_3xS_2 result in maximum TS content of Shrikhand. On the basis of sensory and chemical examination of buffalo milk shrikhand the maximum yield of shrikhand was noted in $F_{3\times}S_3$ sample followed by $F_2\times S_2$ and minimum yield of shrikhand was noted in $F_{1\times}S_1$ sample.

MT - 14
Automatic Inspection System for Dairy and Food Industry

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Inspection is an inevitable part of dairy and food product manufacturing. The industry has to ensure high product quality to sustain in the today's highly competitive market. The conventional methods of ensuring the product quality are time consuming, inconsistent and inefficient. One of the ways to achieve 100% good quality is by 100% inspection. Computer vision technology, which is one of the detection means for food evaluation, has proved to be effective to achieve this goal. Machine vision is analysis of images to extract data for controlling a process. A novel technique is in urgent need, which should be rapid, accurate, non-destructive, and may make processing more efficient and economical. The objective was to explore the applicability of computer vision technology for food

product quality monitoring and its enhancement. The applicability of using image illumination, image acquisition, image segmentation, image analyser and decision making system based on PLC and several sensor and processors was explored. For analyses of image of dairy and food products, PC system with installed software's such as MATLAB, VISIONPro, STEMMER imaging may be used quality monitoring and its enhancement. Automatic Inspection System may be used for continuous inspection and inspect each part produced instead of sampling. It may useful for procurement / harvesting, processing and packaging. It maintains permanent record which allowing further analysis. This method has good repeatability and reliability, used as low cost alternative, with great customer satisfaction. Adoption of this system leads to keen, robust inspection system which ensures safety and quality.

MT - 15
Milk-Microbiological profile & Impact of household practices

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Milk is susceptible to contamination by many microorganisms including microbial pathogens responsible for causing diseases.Various processes including pasteurization,boiling or storage under refrigerated conditions are undertaken to minimize the microbial contamination of milk. This study was undertaken with an objective to evaluate the effect of household practices on the microbiological profile of milk. Milk samples of pasteurized,ultra heat treated (UHT) as well as unpasteurized milk (Vendor's milk)were collected.The effect of different storage practices & treatments on the microbiological profile (Standard plate count (SPC), E.Coli, Salmonella, Shigella, Staphylococcus aureus,yeasts & moulds,anaerobic spore count of milk was studied under using National/Internatinal Standard test methods. Average SPC in vendor's milk was found very high as compared to pasteurized milk.Yeasts & moulds,E.Coli & Staphylococcus aureus were detected in the samples of vendor's as well as pasteurized milk. Boiling the milk reduces SPC & kills the other microorganisms.Storage of boiled milk under room temperature or refrigerated condition resulted in a similar increase in SPC at the end of 24h,but storage of un-boiled milk even under refrigerated conditions increased SPC manifold after 24h. The pasteurization process & hygienic conditions at the milk processing units aling with cold chain of milk from suppliers to end users needs improvement .Currently,even pasteurized milk doesn't match the microbiological standards.It's recommended that milkshould be boiled before consumption & refrigerated for storage to improve its shelf life/keeping quality.

MT - 16
Development of peda using artificial sweetener

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Milk is considered as a complete and essential food item for all age groups. Traditional milk products are a part of Indian heritage. Khoa is a base for preparation of many indigenous sweets. It is prepared by mixing khoa and appropriate amount of sugar followed by dessication in kettle or karahi, which dries out the moisture, giving it a long shelf life and making it an ideal Prasad. Peda is recognized as a pure food making it suitable for breaking the fast on religious occasions. With technological improvement and new research findings in the dairy sector, it is possible to adopt value addition in processed milk and milk products. There is growth of large numbers of Indian consumers exhibiting definite preference for value added milk products. The transition from a traditional to modern lifestyle, consumption of diets rich in fat and calories combined with a high level of mental stress has compounded the problem of diseases such as Diabetes, Obesity, Heart problems in the society. Therefore, people have become more attentive towards the calorie intake in their diet. Diabetes has emerged as a major health problem in India. Aspartame is currently the most popular artificial sweetener used in the food industry; however, sucralose may soon replace it.

MT - 17
"Studies on Preparation of Paneer Spread from Buffalo Milk Using Butter"

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The present investigation entitled "Studies on Preparation of Paneer Spread from Buffalo Milk Using Butter" was conducted in the laboratory of Department of A.H. & Dairying (Dairy technology), C.S.A. University of Agriculture & Technology Kanpur. In the experiment paneer spread has been prepared by using four different ratios of paneer and butter (100:0, 80:20, 60:40,and 40:60) and stored at four different periods (0,7,14, and 21days) at 5 ^{0}C refrigeration temperature. Five physical attributes like – Flavour, body & texture, Colour & appearance spreadibility and Overall acceptability and chemical quality viz. Moisture, Fat, protein , Lactose and Ash were determined. This process replicated three times. On the basis of sensory and chemical examination of Paneer spread by using different levels of butter, it was concluded that paneer spread which was prepared by using 60:40

ratio of paneer and butter liked very much at fresh day. This combination was also having optimum percentage of chemical attributes viz. Moisture, Fat, Protein, Lactose, and Ash. It was also concluded from the present investigation that these paneer spread samples can be stored successfully for 21 days without any significant deterioration at 5^0C for stored. After the investigation it could be recommended that the excellent quality and better nutrients can be obtained through using 60:40 ratios of paneer and butter in paneer spread.

MT - 18
Studies on Rheological behavior of Rabri at Different Total Solids

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Rabri is especially prepared concentrated and sweetened whole milk product, containing several layers of clotted cream. Engineering properties such as density and rheological properties are important for design of product manufacturing, filling and conveying systems. Rheological behavior of rabri at different total solids was investigated in present communication. Rabri of different total solids was prepared by using standard method. Rabri serum was obtained by heating sample to 40°C and mixing it thoroughly. Mixed rabri sample was filtered through a sieve (BSS No. 12). The serum portion of rabri was used to obtain flow curve by setting variable shear rate. Anton Paar Rheometer (model: MCR 52, Anton Paar, Germany) with cone and plate geometry probe CP-75 was employed by applying rates of shear from 0 to 1000 s^{-1} with interval of 10 s^{-1}. The rheological data were analyzed using the Rheoplus 132 v3.6 software, provided in the Rheometer. Different models (Phillips-Deutsch, Vinogradov-Malkin, Carreau-gahleitner) were applied to investigate the rheological behavior of the product. In order to select a suitable rheological curve, the models were fitted to the experimental rheological data. Among the different models investigated, Carreau-gahleitner model best described the rheological behaviour of rabri serum with highest coefficient of determination (r^2) values and least chi-square, Mean Bias Error (MBE) and Root Mean Square Error (RMSE) values.

MT - 19
Study of Probiotics (Saccharomyces Cerevisiae) (SC) Yeast culture Supplementation Feeding in Dairy Animals

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"Nutraceuticals can be defined as "a food that provides medical or health benefits." The term comes from combining the words "nutrition" and "pharmaceutical." The nutraceuticals used for animals are

the same basic ones as used for humans: vitamins, minerals, amino acids, essential fatty acids, antioxidants, probiotics, enzymes and herbs. The present study was conducted at Akya Umaheda village of Mandsaur (M.P.) under On Farm Trial (OFT) during 2014-15. In this study (Farmer's practice) animals fed mainly on straw of wheat and/or soybean constituted the basal dry roughage with less quantity of concentrate ration. Where in (Improved technology) animals were additional supplementation with probiotic saccharomyces cerevisiae @ 25 gm / day / animal. Results show that there was 13.15 percent increment in milk production through improved practice. Further it may be concluded that gross return, net return and B: C ratio in improved practices were Rs 22500, Rs 14700 and 2.88 respectively. Also Feed intake/day was increased with improved technology, because of increase percentage of palatability and digestibility. Hence, livestock keepers need to be advised for scientific feeding of their livestock for getting optimum productivity and benefits.

MT - 20

Process optimization of ice cream from different blends of soy milk and standardized milk

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Soybean (Glycine max merrill) belongs to the family Leguminosae. It is a legume of an exceptionally high protein content ranging between 38% and 42 % with lysine constituting a substantial proportion. The present study was carried out to prepare nutritionally enhanced ice-creams by the incorporation of soymilk into the cow's milk and evaluation of their acceptability and nourishing potential. Total five different types of ice creams were prepared from soymilk (SM), cow's milk (CM) as whole and their blends i.e., (T_0 =100% (CM), T_1= 80% (CM) +20% (SM), T_2= 60% (CM) + 40% (SM), T_3= 40% (CM) + 60 %(SM), T_4 =100% (SM). Sensory analysis of the products was carried out on 9 point hedonic scale. The T_2 blended ice-cream (60% cow's milk and 40% soy milk) was most acceptable. The chemical composition of soymilk blended ice cream (T_2) was found to be 8.8% moisture, 91.2% total solids, 0.5% ash, 44.61 % protein and 2.6% fat. The soy milk blended ice creams had high protein content and low fat content as compared to standard cow's milk ice-cream. Thus, soymilk can be fortified as a substitute for ice cream for enhancing its nutritional value.

Advances in Fruits & Vegetables Processing

Section - C

International Conference on Recent Advances in Food Processing and Biotechnology - Centre of Food Science and Technology, I. Ag. Sc., BHU, Varanasi - April 5-6, 2016

IAS - BHU

Abstracts
FVP - 01 to FVP - 60

FVP - 01

Utilization and Value Addition of Sal (Shorea Robusta) Seeds for Sustainable Livelihood Development of Tribal Mass

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Sal (Shorea robusta) is one of the important non timber forest products (NTFP). About 20-30 million forest dwellers of Orissa, Chattisgarh and Madhya Pradesh depend solely on Sal seeds, leaves and resins for their livelihood. Sal seed contain 34.6% fat, 8.45% moisture and 6% ash. Sal butter is used as cooking oil after refining and a primary ingredient in the food and cosmetic sector, such as oil, soap, cocoa-butter equivalent in chocolate making. At present, Sal fruits were collected, spread on hard ground and set fire for de-winging process. The burning of seeds reduces the moisture content, but increases the free fatty acid (FFA) level, making it unfit for use in the food sector. The tribal receive negligible price per kg of seeds due to the lack of technology for sal seed decortication and processing. A small capacity solar dryer along with a decorticator machine at farm level may help the tribal to generate more income.

FVP - 02

Scientific Utilization of By-products in Fruit Processing Industry- A field investigation

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Agro-climatic conditions in India aregreatassets of prevailing biodiversity in the country. During 2012-13 production of fruits and vegetables reached 81 million MT and 162 million MT respectively (National Horticulture Database, 2012), thus standing at second place in the world. Among these fruits apple production assume significant place. In the peak season due to surplus production often farmers have to sell their produce at cheaper rate or sometimes throw it, simply because they cannot make the plucking cost itself. Hence food-processing industries are being encouraged. In fact in recent years, demand for fruit juices has increased due to health awareness. However, solid and liquid waste being generated in food processing industries is a big challenge. In view of the above, a field investigation of apple processing plant (HPMC) located at Parwanoo (HP) has been done. A few problems requiringin-depth research work have been identified. Apple pomace was collected and vacuum dried at 50 °C for the analysis.Preliminary analysis of apple pomace collected from HPMC indicates that being rich in antioxidant activity and other nutrients it can be effectively utilized for nutraceuticals production.Present paper explores the feasibility of using different extracts

(solvent, high pressure, super critical extraction) for the production of nutraceuticals. It would help HPMC in disposal of huge quantity of apple pomace (with seed) generated in this fruit processing industry.

FVP - 03
Nature's Wonderful Nutritious Gift – Tomato

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Abstract: Tomato is a pulpy, low caloric, nutritious fruit generally eaten as a vegetable. It has been referred to as a "functional food". Tomatoes contain relatively high water content which makes them a filling food and they are refreshing in salads on hot days. It provides 18 calories per 100 g. It is also very low in fat contents and has no cholesterol. However it is excellent sources of antioxidants, dietary fiber, minerals and vitamins. It contains lycopene, an antioxidant that gives them their red colour and may also have a role to play in lowering the risk of cancer such as prostate, lung, colon, oesophagus, breast and skin. Cooked or heat processed tomatoes contain more lycopene, because cooking helps to release lycopene from the tomato cells. Tomato has also ability to regulate blood sugar, a reduction in the effects of stress, a headache cure, build strong bones, skin protection from UV light and even protection against gall and kidney stones. 100 g fresh tomato contains 237 mg of potassium and only 5 mg of sodium. Potassium is an important component of cell and body fluids that help controlling heart rate and blood pressure caused by sodium. Tomato extracts have been shown to help lower total cholesterol, LDL cholesterol, and triglycerides. So, it is also listed as "heart healthy foods".

FVP - 04
Biological control of postharvest diseases of fruits and vegetables by microbial antagonists

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Post-harvest diseases cause considerable losses to fruits and vegetables at any time during post-harvest handling, from harvest to consumption. Aside from direct economic losses, diseased produce also causes a potential health risk. Synthetic fungicides are primary means to control post-harvest diseases of fruits and vegetables. However, the recent trend is shifting towards biological control, which emerged as one of the most promising, ecofriendly and safer alternative to chemicals. Today various biological approaches are available, of which antagonistic microorganism are most

popular throughout the world. Microbial antagonistic can be applied either before or after harvest, but its application after harvest are more effective than pre-harvest application. With the aim of extending post-harvest life and control of post-harvest diseases of produce, mixed culture of microbial antagonists found to produce better control than individual culture or strain. Its effect can also be enhanced if it is used with low doses of fungicides, salt additives and some physical treatments like hot water dips, irradiation treatment etc. Today different microbial agent like Cryptococcus laurentii, Pichiaguilliermondii, Debaryomyceshansenii, Bacillus subtilis, Candida spp., Trichodermaharzianum etc. are being used in different countries. Many biological products like Aspire, Biosave etc. are also developed by various firm and are being used. Although the results of this technology is increasing, we have need to continuous exploration and potential uses of this technology in different part of world.

FVP - 05
Biological Approach for Management of Crown Rot Disease Complex of Banana

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Banana (Musa paradisiaca L.), one of the most popular and nutritious fresh fruit in the world is cultivated in more than 150 countries and India alone contributing to 29.2 % of the total global production. In spite of the fair amount of production, the post harvest losses caused due to both physical (handling and storage) and biological agents (pathogens) negatively impact the market value of bananas and are responsible for up to 20-25 % post harvest losses in India. Crown rot, caused by the activity of a fungal complex affects bananas in all banana-producing countries and is considered to be one of the main post harvest disease of banana. The first studies on crown rot focused on the etiology of the disease, especially on the identification of the most pathogenic fungal species involved, and on postharvest control methods, mainly chemical. There are now some evidences which suggests that fruit physiology at harvest influences crown rot development and that all interactions among the microorganisms implicated should be considered. There is considerable growing interest in alternative methods to reduce or even completely eliminate fungicide treatments. To be efficient, these alternative control methods should not be too specific considering the broad spectrum of pathogens involved in the complex. Postharvest biological control is very promising alternative because the crown rot infection site on the fruit is limited, the environmental conditions during storage are clearly defined and stable. The results of many studies have suggested that the use of microorganisms such as fungi, bacteria, and yeasts could provide partial crown rot control. It has also been shown that biological control efficacy increases with the antagonistic agent concentration and with the incubation time between the application of the antagonist and crown contamination by the fungal complex. Antagonists can be used to significantly reduce lesions induced by the fungal complex that causes crown rot, but the control efficacy is

limited and variable. This type of control, when used alone, cannot provide total crown rot management, so should be combined with other control tactics such as calcium additives and MA packaging. Crown rot research should enhance the overall understanding of this disease and thus lead to the development of an effective integrated control strategy.

FVP - 06

Objective: Enhancement of shelf-life of minimally processed Bitter Gourd (Momordica charantia L.) using Modified Atmospheric Packaging (MAP)

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The effects of sodium hypochlorite, hydrogen peroxide and soaking time were taken as variables for optimizing minimal processing of bitter gourd slices by CCRD design of RSM taking the contents of vitamin C, □-carotene, antioxidant activity and total phenolics as responses. The optimized minimally processed bitter gourd slices were packaged in low density polythene (LDPE) bags one having gas composition of 70% N_2, 25% CO_2 & 5% O_2 and the other with 70% N_2, 20% CO_2 & 10% O_2 by using modified atmospheric packaging machine (PBI, Densensor, Denmark). Packaged bitter gourd slices were stored at 5°C, 20°C and 35°C in triplicate for each gas composition and microbial analysis was done to study the shelf-life. The effect of gas composition and storage temperature on the shelf-life of MAP packaged minimally processed bitter gourd slices were analyzed along with proximate analysis before and after the optimization of minimally processed bitter gourd.It has been possible for the first time that by the use of chemical treatment in combination with MAP, the shelf-life of bitter gourd has been extended to a considerable period. The result is of significant interest due to low cost and easily availability and even link between agricultural sector and more prosperous and sustainable industrial application.

FVP - 07

Recent Advances in Osmotic Dehydration of Fruits and Vegetables

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Fruits and vegetables are protective foods and highly perishable in nature having limited shelf life. Osmotic dehydration is an important preservation technique in the processing of dehydrated foods. It is used for the partial removal of water from plant tissues by immersion in a hypertonic solution

(sugar and/or salt) to reduce the moisture content of foods before actual drying process. It is less energy intensive than air or vacuum drying method and provides minimum thermal degradation of nutrients due to low temperature water removal process. Osmotic dehydration is mass exchange between the osmotic solution and foodstuff and the traditional systems have a number of limitations including slow rate of mass exchange, shrinkage, spoilage during the process, colour changes, nutritional losses etc. For the last many years a large number of developments have been made to overcome these limitations. Among the various osmotic agents used in osmotic dehydration of different fruits sucrose is considered superior for apple, watermelon, apricot, pomegranate arils, banana, papaya at 60Brix and for mango 45Brix at temperature of 50C-60C. Among vegetables, 10% salt for carrot or 50Brix sucrose solution; 26.5% salt solution for green beans; 20% sugar or 10% salt solution for potato and 5-10% salt solution for radish have been reported to be superior. Further, solution to sample ratio also affects the osmotic drying rate and studies have shown that a ratio of 4:1 is effective for most of the commodities. These techniques have potential advantages for the food processing industry to maintain the food quality and to preserve the wholesomeness of the food. The resultant osmotic solution can also be used in juice or beverage industries as a byproduct, improving process economy, or it may be re-concentrated for further drying.The increasing health consciousness of people and demand for minimally processed foods offer great opportunities for its exploration in future.

FVP - 08
Statistical Approach for Optimization of Processing Parameters for Osmodried Amla

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Amla fruits are richest source of vitamin C. However these fruits are highly perishable in nature. It is better to process amla fruit to improve taste and shelf life. Osmotic dehydration, being a simple and less energy intensive than air or vacuum drying process, is thus an effective method for preservation of fruits and vegetables.To develop osmodried amla of high nutritional quality, the amla slices of 2mm thickness were osmotically treated at different temperatures and sugar concentrations. Different experimental combinations of osmotic process parameters were tried using Box and Behnken design of experiments. Response surface methodology (RSM) was used to investigate the effect of sugar concentration (45-65°B), solution temperature (30-50°C), fruit to solution ratio (1:5-1:15) and immersion time (2-6 hour) on the vitamin C, rehydration,total phenol and naringin content of osmodried amla slice.Results showed ($p < 0.05$) satisfactory correlation between actual and fitted values. Data obtained from RSM on osmodried amla production were subjected to the analysis of variance (ANOVA) and analyzed using a second order multiple regression polynomial equation. Optimization of the osmotic dehydration process was performed to get maximum vitamin C, water absorption capacity, total phenol and naringin content.The

optimum process parameters obtained by computer generated response surface 3D-plots and contour plot gave an optimum value of 45^{0}B of sugar concentration, 50^{0}C of solution temperature, 1:10 of fruit to solution ratio and 2 hour of immersion time.

FVP - 09

Physicochemical properties of Pectins from Kinnow peels (Citrus reticulata Blanco) obtained using different extraction conditions

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Kinnow peel is the waste of the citrus fruit processing industry and its disposal is becoming a major problem as it causes environmental pollution which can be used to make pectin. Pectins were extracted from fresh kinnow peels using two methods (i) acid slurry method (ii) pretreatment of peels by adsorption followed by acid slurry method. Analysis of chemical composition showed that the pectin with adsorption treatment contained higher methoxyl content and anhydrounic acid, and higher degree of esterification than the untreated pectin. The adsorption treatment gives lesser yields when compared to untreated pectins.

FVP - 10

Response of Integrated Nutrient Management Involving Inorganic and Biofertilizer Organic Source Of Nutrient On Growth,Yield of Cauliflower (Brassica Oleracea L. var. botrytis)

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Cauliflower (Brassica oleracea L. Var. botrytis), occupies an important place among cole crop in India. Cauliflower is a nutrient loving crop and respond to heavy application of chemical fertilizer. In recent past increasing awareness of ecofriendly and sustainable agriculture necessitates to improve the integrated nutrient management in order to reduce the application of harmful and costly inputs of chemical fertilizer. In this regard bio-fertilizer and organic manures may be effective and long lasting option as a component of integrated nutrient management. Keeping this in view the present project in hand response of cauliflower (Brassia oleracea L. Var. botytis) to various fertility levels, bio-fertilizers and plant population was conducted at main experiment station (Vegetable Research Farm), During rabi season of 2014-15 on curd production of cauliflower. The observation of vegetative character and curding behavior offer information of paramount importance to research worker as well as commercial growers of vegetables. The nature of response obtained due to the diverse treatment show beneficial effect on growth and yield parameters of cauliflower.

FVP - 11
Utilization of Underutilized Boerhaavia Deffusa Leaves for Enrichment of Traditional Food Products

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Boerhaavia deffusa (Pattharchatta) commonly known as Raktapunarnava, Shothaghni, is a herbaceous plant species growing prostrate or ascending upward in habitats like grasslands, agricultural fields, fallow lands, wastelands and residential compounds. In the traditional system of medicine, b.deffusa have been widely used for the treatment of dyspepsia, jaundice, enlargement of spleen, and abdominal pain, and as an antistress agent. The worldwide use of b.deffusa leaves to treat liver disorders was validated when researchers demonstrated, in 1980 and 1991, that its leaves extract had antihepatotoxic properties The objectives to determine the nutritional composition of fresh b.deffusa leaves, to assess the organoleptic evaluation of products Chilla, and Mathri. . The investigation was carried out "Utilization of underutilized Boerhaavia Deffusa leaves for enrichment of traditional food products" by incorporation of b.deffusa leaves incorporated in different proportion as treatments T_1, T_2, T_3 and respectively T_0. The replicated four times for all products and data obtained investigation were statistically analyzed by using analysis of variance (ANOVA), (t) test and critical difference (CD) techniques. Chemical analysis was analyzed by the procedure of AOAC (2005). The result obtained that the b.deffusa leaves incorporated in Chilla and Mathri were acceptable on the basis of sensory evaluation. In both products Treatment T_1 found to be the best treatment followed by T_2 and T_3. The result of nutritional composition of prepared chilla was found rich in energy, vit C and calcium (308kcal/100kcal, 19.17mg/100g, 164.06mg/100g) and Mathri was rich in energy, vit C and calcium (227.46kcal/100kcal, 11.2mg/100g, 57.34mg/100g).

FVP - 12
Metabolic Changes in Vegetables After Harvest - Physical and Biochemical

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Most of the vegetables contain more than 80 % water and some vegetables such as tomato, cabbage, spinach, asparagus, snap bean, lettuce and cucumber contain as high as 90 --95 % water. As little 5 % loss in water causes many vegetables to appear wilted or shriveled which make the vegetable tissue tough or mushy, losing crispness and palatability and eventually unmarketable. Water loss is also associated with degradative effects on vegetable component such as pigments

and vitamins. Vegetables exhibit water loss mainly by transpiration through stomata. Leafy greens lose water through stomata, whereas in tomato the stem scars and in potato the lenticels provide the for water loss. Structure of vegetable and the physiological age at harvest largely influence the rate of water loss which in turn depends upon the relative humidity, temperature, air movement and atmospheric pressure of the environment. The water loss in vegetables is assessed by working out physiological loss in weight of the produce over a period of time. Physiological Loss in weight (%) = initial weight -final weight/initial weight x 100.Even after harvest vegetables continue to respire and it primarily involves enzymatic oxidation of sugars to carbon dioxide and water with release of energy. Respiration results in the reduction of reducing sugars, non -reducing sugars and total sugars. Loss of compounds such as proteins, lipids and organic acids is also channelized through respiration.

FVP - 13
Making fruits and vegetables profitable through processing and storage

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Fruits and vegetables are an important dietary component as they provide the essential minerals, vitamins and fibre required for maintaining health. But being they are highly perishable commodities and the wide temperature range makes it more susceptible for decaying and rotting. India is incurring post harvest losses of fruits and vegetable with worth Rs. 2 lakh crore per year, due to lack of storage and processing facilities, according to a study. At the same time there is big gap between recommended and actually consumption of fruits and vegetables per day per capita. Annual consumption (kg/person/annum) of fruits was 9.6 (rural), 15.6 (urban) and 11.8 (India) while it was 74.3 (rural), 79.1 (urban), 76.1 (India) for vegetables (Mittal et al, 2007), is less. These two contrasting facts could be brought together by fruit and vegetables safe storage and need based processing. Under diversified climatic conditions and highly populated country, it makes essential. Establishing processing plants at major fruit growing areas could be boon for arid and semi arid region farmers with solution on market glutting problem. Also due to value addition either by time, place or form could improve the economic condition. Developing wholesale markets together with enhancing the cold storage capacities in local and regional markets is important for reducing post-harvest fruits and vegetable losses and enhancing their market arrival. The demand for fruits and vegetables in India would grow exponentially being Indian economy and agriculture sector is likely to grow at over eight per cent and about four per cent, respectively as estimated by the 12th Five Year Plan. Banana, mango, citrus, papaya and guava account for major share in total fruit production across India. Potato, tomato, onion, brinjal and tapioca account for maximum share in vegetable production in the country. At such critical condition warehouses, cold storages and fruit processing plays important role.

FVP - 14
Antioxidant activity of curcumin and related compounds

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The medical use of turmeric dates back to ancient times. It has been used specifically to treat contusions, bruises, sprains and as a carminative and astringent. Turmeric has antiseptic and vermicidal properties. Its active component curcumin as a medicament has received much attention in recent times in India. Dietary factors are widely believed to play an important role in determining the risk of several cancers. Research on the effects of turmeric and curcumin on cytotoxity in cultured cells have yielded encouraging results. There are several mechanisms by which one can counteract the effects of carcinogens on the body. Lipid peroxidations are among the proposed mechanisms for cancer .Reactivated oxygen species have been implicated in mutagenesis, carcinogenesis, teratogenesis, ageing as well as chronic diseases. Several micronutrients and non-nutrient components of diet have anti-oxidant properties. Highly reactive oxygen molecules or oxygen radicals generated by carcinogens or their metabolites in the body are trapped by several anti-oxidants. The anti-oxidant properties of curcumin have been demonstrated as early as 1976.In an elegant experiment, under in vitro situaions, liposomal lipid peroxidations and peroxide induced DNA damage investigated, revealed that curcumin and the water soluble extracts of turmeric counteracted the damage. Turmerin, in indirect experiments has been shown to decrease arachidonic acid release, which is recognized as an important event in membrane-mediated chromosomal damage. The protective effects of curcumin have been demonstrated in paracetamal-included hepatocyto-toxity in vitro and in vivo.

FVP - 15
"Utilization of Cape gooseberry, Red Cabbage and Onion Stalk for the Development of Preserved Food Product"

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Fruits and vegetables have significant nutritional contribution to human well being due to their high nutritive value and their consumption in the form of preserved food products ensure the addition of their nutritional benefits into daily human diet. To determine the Organoleptic acceptability, nutritive value and cost of the preserved food product developed by utilization of Cape gooseberry, red cabbage and onion stalk. A preserved food product named "Jam" was made by utilization of Cape gooseberry, red cabbage and onion stalk at 75:20:5 percent, 65:25:10 percent and 55:30:15

percent level referred to as T_1, T_2, T_3 respectively and the control T_0 was made with Cape gooseberry. The product was organoleptically evaluated at Nine point Hedonic scale. Nutritional composition was calculated by using the food composition tables. The data obtained during study were analyzed statistically by using analysis of variance (ANOVA) t-(test) and critical difference C.D technique. On the basis of findings, it was observed that treatment T_2 scored highest with regard to colour and appearance (8.3±0.13), body and texture (8.4±0.17), taste and flavour (8.46±0.17) and over all acceptability (8.37±0.10). Treatment T_3 contains higher amount of Protein (1.8 g), calcium (26.5 mg), Iron (20 mg), Vitamin C (49 mg) and beta-carotene (2078.85µg) as compared to control and other treatments. Cost of the product per 100g of raw ingredients ranged from Rs.7.13- 8.0. it is concluded that Cape gooseberry, red cabbage and onion stalk can be utilized for the development of preserved food product like jam to improve their nutrient content.

FVP - 16

Impact of Nutrition Education Awareness Programme on consumption of underutilized Moringa oleifera and Borhavia diffusa to combat micronutrient deficiency in vulnerable groups in Khausambi District of Allahabad

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Nutrition education programmes should have at least three components i.e. increasing the nutrition knowledge and awareness of the rural people, promoting desirable food behaviour and nutritional practices and increasing the diversity and quantity of family food supplies (Deshpandey et al. , 2003). Vegetables are the most important source of vitamin A, which is deficient in most part of the world; where rice based diets predominate, blinding thousands of children, annually (Pandey et al., 2014). Therefore, underutilized plants are highly recommended due to their relatively high nutritional value, vital for income generation and important role in food security during the times of drought and poor harvest. The present study was conducted in Khausambi district of Uttar Pradesh. The total 60 rural women were selected from Khausambi district between the age group of 25-45 years. Purposive sampling techniques were used for the selection of the respondents. The data was collected through a developed questionnaire containing general profile and nutrition Knowedge test as pre exposure data and post exposure data. Before imparting nutrition education 57.25 percent people were able to identify underutilized green leafy vegetables and 52.75 percent people were consume it. While imparting nutrition education 97.87 percent respondents were able to identify underutilized green leafy vegetables and 82.25 percent respondents were started to consume underutilized green leafy vegetables in their daily life.

FVP - 17
Pineapple wine: Innovative Way for Pineapple Processing

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Wine is an alcoholic beverage prepared traditionally from grapes. It has alcoholic content around 14 %. The annual per-capita consumption in India is estimated to be very low as compared to other countries. Due to changing lifestyle the wine consumption is found to be increasing and novel processing methods along with different fruit varieties are chosen for wine production with different characteristics for attracting consumer segments. Pineapple (Ananas comosus) is a tropical fruit containing reducing sugar around 10 to 11%. Golden / yellow wine can be prepared from pineapple juice individually or along with fruits such as passion fruit (Passiflorae dulis), mango (Mangifera indica) etc. The wine produced is having excellent organoleptic properties. The processing is done at temperatures from 20-22 °C. The pH drops during fermentation while alcohol is produced in the range of 12-14%. The yeast to be added at the rate of 3 log CFU/ml. Researchers have found that the wine produced is delicious and acceptable to consumers by sensory evaluation. The value addition is possible with the help of addition of local fruit varieties. The wine production from pineapple will help in reduction of wine import, creation of jobs at rural level, and development by income generation.

FVP - 18
Impact of various cooking and processing methods on oxalate content of Amaranthus and Spinach leaves"

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Leafy Vegetables like Spinach and Amaranthus form an essential component of the meal by providing vitamins, minerals such as iron, calcium, magnesium, zinc and other important nutrients for human health. Oxalates are known to interfere with calcium absorption by forming insoluble salts with calcium. Oxalic acid ingestion results in corrosion of the mouth and gastrointestinal tract, gastric haemorrhage, renal failure and haematuria. Other associated problems include low plasma calcium, which may cause convulsion, and high plasma oxalate.The oxalate content of Spinach and Amaranthus subjected to various common cooking methods such as, blanching, drying, open pan cooking and pressure cooking was estimated and replicated three times.The oxalic acid content of fresh samples were 84.2 mg in Spinach and 170mg in Amaranthus. Green leafy vegetables were blanched for 10 minute shows the highest reduction for oxalate among the various selected

cooking and processing methods where as after drying treatment, the oxalic acid content was increased in comparision to the other cooking and processing methods. Different cooking methods (blanching, pressure cooking, open pan cooking, drying and boiling) have varied effects in reducing the levels of oxalate . However, blanching was found to be the best methods in order to reduce the contents of oxalate.The reduction of anti nutritional factors on cooking is expected to enhance the nutritional value of these green leafy vegetables.

FVP - 19
Use of flowers in food stuff

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Flowers used in food dates back to thousands of years and was first recorded in 140 B.C. Many cultures use edible flowers in dishes. There are many food items and beverages that use edible flowers in their recipes, including the popular green liquor started in 17th century France: Chartreuse; Carnation petals is one of the secret ingredients. Flowers are added to foods to provide taste, aroma, and colour. They can be part of a main dish, salad, or dessert. They can be added as garnish. Flowers can be incorporated into beverages as flavourings, or used to make teas or wines. They are added to spreads such as butter or fruit preserves, and to vinegar, marinades, and dressings. Some are dried and used as medicinal or culinary herbs. Edible flowers include many varieties of roses, lavender, violets, borage and nasturtiums. Fresh edible flowers are also outstanding in salad. Nothing decorates a plate quite like flowers. A number of foods are types of flowers or are derived from parts of flowers. The costly spice saffron is pollen collected from the inside of a type of crocus flower. Broccoli, artichokes, and capers are all technically flower buds, albeit immature forms. Flowers reported as edible include Moringa oleifera flowers, which are popular food item in the Indian subcontinent.The Vietnamesdish with Sesbaniabispinosa flowers,Chamomile (Chamaemelum nobile), Chrysanthemum(Chrysanthemum spp.), Dianthus (Dianthus spp.), Lavender (Lavandula spp.), Nasturtium (Tropaeolum majus), Rose (Rosa spp.), (Salvia officinalis), Thyme (Thymus vulgaris) has gained popularity in recent years.

FVP -20
Processing of Dragon Fruit

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Dragon fruit also called as pitaya in many regions is botanically known as Hylocereus undantus. Until 1994, only scarce research existed on these plants; however, the worldwide interest in this novel fruit crop is evident, as numbers of pitaya-related publications have grown rapidly, especially during

the past decade. Here, we attempt to review existing knowledge on the taxonomy, cultivation, harvesting, processing, nutritional & health benefits of this unique crop. It could easily be called a "crazy" fruit, as its appearance is so improbable. Dragon fruit is low in calories yet offers numerous nutrients, including vitamin C, vitamins B, phosphorus, protein, calcium, fibre content and antioxidants. It is proven to lower blood sugar levels as well as blood pressure, strengthen bones and teeth, promote healthy blood and tissue formation, strengthen the immune system, heal bruises and wounds faster and prevent respiratory problems. Like other red fruits, dragon fruit contains lycopene, which helps protect against cancer and heart disease. It is best eaten chilled, chopped into cubes and added to fruit salad or blended into a refreshing drink or smoothed. Processed products of this unique fruit include Jam, jelly, wine, concentrate, chocolate, juice, antioxidant infusion etc. It also shows high national and international market. This may become your new favourite fruit.

FVP - 21

Effect of Cation Exchange Resin Treatment on Reduction of Non-Enzymatic Browning of Orange Juice and Semi-concentrates

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Biochemically, browning predominantly results due to the reaction of sugars and amino acids leading to the formation of melanoidins (brown polymers). Browning reactions are supposed to slow down in the absence of any of these two substrates Maintaining the product at low temperature is the common mean to avoid colour and flavour deterioration of processed citrus fruit juices, concentrates and dehydrated products in long term storage. But when subjected to non-refrigerated storage, citrus juice rapidly develop objectionable colour and flavour making the product unacceptable. Effect of removal of reaction substrate (amino acids) from sweet orange juice by using cation exchange resin was studied for reduction of browning of single strength juice and semi-concentrates of 15 and 30 °Brix. Cation exchange resin (CER), Dowex-50W was used for removal of amino acids. The treated and untreated juices were concentrated to 15 and 30°Brix in a rotary vacuum evaporator. Single strength juice alongwith semi-concentrates of 15 and 30 oBrix were stored for a period of one month at refrigerated, ambient and accelerated temperature (37$\pm$2°C, 65% RH). During 30 days storage, loss of amino acids was mere 3.07% in the concentrates prepared from cation exchange resin treated juice as compared to about 6.68% loss in the products prepared from untreated juice. Ascorbic acid content showed a net loss of 14.59% (dwb) after 30 days storage in products prepared from untreated juice as compared to far lesser losses of just 4.85% (dwb) in the products prepared from cation exchange resin treated juice under similar conditions of storage. Total sugar registered a net loss of 3.52% on dry weight basis. Treated juice showed higher amount of total sugars with mean value of 75.48% as compared to untreated juices with

corresponding value of 71.01%. Cation exchange resin treatment of malta juice resulted into about three folds in non-enzymatic browning during storage.

FVP - 22

Effect of temperatures on drying kinetics of tomato (Solanum lycopersicum L) and winter melon (Benincasa hispida) and analysis of color and antioxidant property

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Drying is particularly important for handling and distribution of agricultural products with high moisture content and limited shelf life such as fruits and vegetables. The objective of the research is to study different physicochemical properties of tomato and winter melon with a view to fortify of these two components in other food material in future. Effect of different temperatures (40°C, 50°C and 60°C) on tomato and wintermelon were studied by two thin-layer drying models: Page model and Lewis model. Equilibrium moisture content had a significant role on the normalized drying curve and was determined for tomato and winter melon at each temperature (40°C, 50°C and 60°C). The models were compared based on their coefficients of determination (R^2) and model fit was analyzed by root mean square error (RMSE) value. Color profile analysis was studied for different drying temperatures and it was observed that increase in drying temperature, a* value was decreased and b* was increased for tomato powder, in wintermelon powder there were no significant differences on b* value. Phenol, flavonoid content of tomato powder and winter melon powder was 9.34 mg/g and 0.945 mg/g; 6.75 mg/g and 0.852 mg/g. Antioxidant activity for tomato was 62.670% and winter melon was 60.56%.

FVP - 23

Variations of antioxidant activity during ripening of Guava cultivars

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Oxidative stress resulted from free radicals and reactive oxygen species are associated with many diseases. Several studies are going on worldwide directed towards finding natural antioxidants of plant origin. Plants containing phenolic compounds have been reported to possess strong antioxidant activity. To evaluate the antioxidant activity during ripening stages through DPPH (2,2-diphenyl-1-pic-rylhydrazyl) radical scavenging activity and ferric reducing antioxidant power (FRAP) assay in Guava cultivars.Changes in antioxidant activities of five Guava cultivars (Lalit, Allahabad Surkha, Red fleshed, Chittidar and Safeda) were studied at three different ripening stages (unripe,

semi-ripe and ripe), and the effect of solvents (acetone,ethanol, methanol and distilled water) at different concentration (50%, 70%, 100% v/v) was evaluated on the extraction of antioxidant activity of Guava fruits.The stages of ripening significantly influenced the antioxidant activity. Antioxidant activity of red fleshed cultivars (Lalit, Red fleshed, Sukha) were found more than white fleshed cultivars (Chittidar, Safeda).Among all the solvents employed, 50% ethanol extract showed highest amount of antioxidant activity. The percent radical scavenging activity (DPPH) was found maximum at unripe stage followed by semiripe and ripe stages of maturity. The FRAP assay increases during ripening. Maximum result was shown in ripe stage than in semiripe and unripe stages of ripening. The results obtained suggest the red fleshed cultivars of Guava possess potential source of natural antioxidants for food and neutraceutical applications.

FVP - 24
Primary Clarification of Kinnow Fruit Juice: A Comparison Between Centrifugation and Microfiltration

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Kinnow fruit is a much appreciated tropical fruit juice due to its unique aroma, flavor and also for its nutritional and energetic components. Two clarification processes, namely centrifugation and microfiltration was used for primary clarification of kinnow fruit juice. The resultant clarified juice is obtained by varying the centrifugation speed (RPM and TIME) and microfiltration by varying (TMP and CFR). The juice were characterized in terms of TSS, acidity, vitamin C content, Total sugar, Viscosity, Polyphenol content, protin, Naringin and Limonin. Centrifuged juice contains high concentration of total polyphenol and protein relative to microfiltration. Juice recovered after microfiltration had lower viscosity. The energy consumption of the centrifugation is much higher than microfilteration.

FVP - 25
Development of Different Products from Wood Apple

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Wood apple (Limonia acidissima) is the cheaper, highly nutritious, seasonally available and very good source of dietary fiber (1.29%) and used for human consumption throughout the year for its

medicinal properties. This study was planned to utilize the preserved wood apple by preserving them as jam and powder. Wood apple pulp is excellent for making jam. The fruits were graded and washed then cut into pieces. It was soaked in water and seeds and gum were removed. The pulp is separated and is homogenized in a mixer. The pulp was then weighed. Water and sugar is taken in a saucepan & is heated with stirring until it creates consistent syrup.Then the pulp was cooked in the syrup with constant stirring and acid was added to it. The mixture was cooked till the end point (TSS:68.5% using refractometer).200 ppm Sodium benzoate was added to the jam as a preservative. Finally, the jam was poured into clean, dry, sterilized bottle and sealed. It was cooled and stored in refrigerator. The moisture content of the pulp was found to be 78.2% and that of jam is 35.4%. The ash content of the pulp is 3.8% and that of jam is 0.6%. Wood apple pulp was extracted using the same procedure. Then the pulp was boiled in minimum quantity of water, and was blended uniformly in mixer grinder. The pulp was then dried in a tray drier at 60^{0}C.The dried mixture was again ground in mixer grinder for product uniformity.

FVP - 26
Studies on Blending Nectar Beverage in Different Ratio of Litchi Juice and Pineapple Juice

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Juice blending is one of the best methods to improve the nutritional quality of the juice. Studies on different combination of litchi and pineapple blended nectar were evaluated for physico-chemical, sensory characteristics and shelf life in refrigerator temperature. Some of the important findings of present nectar investigation are summarized as total soluble solids, reducing sugar and total sugar showed gradual increase in the duration of 8 months and decreased in all treatment of blended nectar at low temperature till end of storage. Highest content of TSS and total sugar were found in treatment 100% litchi juice, reducing sugar content in 100% pineapple juice after 8 months of storage. Titratable acid, pH and ascorbic acid content were gradual decreased of blended nectar during refrigerated temperature up to 9 months storage period. The maximum titritable acidity content was showed in treatment 75% litchi +25% pineapple 0.50 per cent 9 months after storage as compared to other treatments. The pH value decreased from 3.01 to 2.43 and ascorbic acid from 15.63 mg/100g to 10.25 mg/100g during storage. The organoleptic test 100% litchi and 100% pineapple juice ranked as maximum acceptable with highest score in colour, taste and overall acceptability after 9 months of storage. The production of blended fruit nectars is of great importance in fruit juice industry.

FVP - 27
"Effect of Enrichment on Quality of Aonla (Emblica officinalis G.) Fruit Bars"

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The present investigation on enrichment of aonla pulp to form fruit bars were carried out under laboratory condition in the Department of Processing Technology, Kerala Agricultural University in the year 2013-14. The main objective of the study was to standardize enrichment of aonla pulp to develop fruit bars. The experiment was laid out in CRD with 10 treatments viz. Aonla pulp (100%), Aonla (75%)+ Mango(25%), Aonla (50%)+ Mango(50%), Aonla (25%)+ Mango(75%), Aonla (75%)+ Papaya (25%), Aonla (50%)+ Papaya (50%), Aonla (25%)+ Papaya (75%), Aonla (75%)+ Jackfruit (25%), Aonla (50%)+ Jackfruit (50%), Aonla (25%)+ Jackfruit (75%). Aonla enriched with fruit pulp of mango and papaya in 1:3 proportion and with jackfruit in 3:1 proportion, was found superior in organoleptic evaluation. Enriched fruit bars from these three combinations along with fruit bar from pure aonla were selected for storage studies. A declining trend in moisture, acidity, non reducing sugars and ascorbic acid and total carotenoids was observed whereas Total Soluble Solids, total sugars, reducing sugars and non-enzymatic browning showed an upward trend. Slight increase in microbial load was observed at the end of the storage period. Organoleptic scores showed a gradual decline during storage but the scores were within the range of acceptability throughout the storage period. Enrichment of aonla pulp with fruit pulp of provitamin A rich fruits like mango, papaya and jackfruit reduced astringency and acidity, thereby resulting in fruit bars with altered palatability and enhanced nutrition. Enriched fruit bars contained three vital antioxidants viz. Vitamin C, carotenoids and polyphenols.

FVP - 28
Development of a Value-added Fermented Nutra-beverage From Madhuca latifolia Flower

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Abstract: For the past centuries, mahua flowers have been known for the production of distilled liquor by the tribal and rural people of India, which is hazardous to health. The main aim was to improve the traditional brewing process to produce a fermented product with low alcohol content

enriched with nutraceuticals. The mahua must was blended with guava and fermentation was set at 18ºC, 25ºC and 30ºC respectively. The most favourable ratio of °Brix :titratable acidity (°6:0.56 %) was found in mahua-guava product fermented at (25±1)°C. The alcohol content of the product was in between 8.0 - 9.0 % with higher alcohol content of 0.03, <0.01 and <0.01 % w/w for C3, C4 and C5 respectively. The potential of mahua as a nutrabeverage was evaluated on the basis of total phenolic content (TPC) and antioxidant value. The TPC of the blended product was 171.83 ± 5.21 mg GAE/L and showed the highest antioxidant activity of 96.5 % and 89.6 % with ABTS and DPPH assays respectively. In the study, the mahua-guava product showed higher degree of protection against lipid peroxidation. Thus, these blending approaches could be adopted for the improvement of the antioxidant potential of mahua-based fortified products which could solve the problem of low quality traditional beverages by enhancing the nutritional value of the final product.

FVP - 29
Psidium guajava (Guava): A Plant of Multipurpose Medicinal Applications

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Guava (Psidium guajava Linn.) commonly known for its food and nutritional values throughout the world. The medicinal properties of guava fruit, leaf and other parts of the plant are also well known in traditional system of medicine. Since, each part of guava tree possesses economic value; it is grown on commercial scale. Guava plant is considerable process has been achieved regarding the biological activity and medicinal application of guava and the fruit considered as poor man apple of tropics. The aim of this review is to present some chemical compounds in Psidium guajava and their pharmacological effects. The main constituents of guava leaves are phenolic compounds, isoflavonoids, gallic acid, catechin, epicathechin, rutin, naringenin, kaempferol. The pulp is rich in ascorbic acid, carotenoids (lycopene, □-carotene and □-cryptoxanthin). The seeds, skin and barks possess glycosids, carotenoids and phenolic compounds. Therefore, all parts of the plant have been used for different purposes: because of its versatile properties viz: hepatoprotection, antioxidant, anti-inflammatory, anti-spasmodic, anti-cancer, antimicrobial, anti-hyperglycemic, analgesic, endothelial progenitor cells, anti-stomachache and anti-diarrhea. Psidium guajava has many positive effects on health and thus it should be researched more extensively through clinical trials. Furthermore leaves, seeds and peel are treated as wastes by the food processing industry and are discarded, so their use by value addition would reduce the disposal of these parts of guava as pollutants.

FVP - 30
Optimization of physical process variables for development of aloe vera-mango RTS beverages

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The aloe vera-mango ready to serve beverage in major ingredient mango (75%), aloe vera (25%) and optimized sugar. During the investigation, the effect different level of time, temperature and TSS was studied by employing a 3 factor. The best formulation with time 23 minute, temperature 76.62°C and 16.5 °Brix TSS. The product on the basis aloe vera based the formulation was found to be best appropriate for manufacture aloe vera-mango RTS beverage. The content of aloe-emodin in beverage show no significant difference before and after manufacturing. The predicted sensory score of 8.10, 7.83, 8.33 and 7.67 for colour& appearance, taste, flavor and consistency respectively, the physic-chemical value 15.53 (g/ml), 2.40 (g/ml), 13.13 (g/ml), 0.26, 3.95, 6.23(mg/ml), 0.21 (mg/ml) and 40.96 (%) for total sugar, reducing sugar, non-reducing sugar, acidity, pH, ascorbic acid, polyphenol and DPPH respectively.

FVP - 31
Aloe Vera: A Functional Ingredient of Food

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Aloevera is a succulent plant species of family Xanthorrhoeaceae. Vitamin, mineral, amino acid and fatty acid content of Aloe vera is high. It helps in digestion, detoxification, reduces inflammation, boosts up immune system. It acts as disinfectant, antibiotic, antibacterial, antifungal, antiviral, antiseptic. The antioxidant value of Aloe vera gel isestimated by Folin-Ciocalteu method and is found to be65.25mg/100g.Two herbal products; Aloe vera juice and jam (functional beverage and food) have been prepared. Aloe vera leaves were washed and peeled. Clear gel was extracted and blended with equal volume of citrus juice. The smooth mixture was mixed with sugar and salt and heated for short time.Sodium benzoate was added as a preservative. Finally, the juice was poured into clean, dry bottle and sealed. The acidity, total solid and vitamin C content of Aloe vera juice were found to be 0.28% in terms of C.A., 35.62% and 0.24 IU / 100ml respectively. Clear Aloe gel was produced as above. Sugar solution was prepared and mixed with clear gel and was heated until it created consistent syrup.After that, pectin & lemon were poured & the mixture was stirred & heated up to

end point. Sodium benzoate was added as a preservative.Finally, the jam was poured into clean, dry bottle and sealed. The acidity and ash content (using AOAC method) of Aloe vera jamwere found to be0.45% in terms of C.A., and 0.6% (dry basis) respectively.

FVP - 32
Development of Flavored Bitter Gourdchips

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Development of flavored bitter gourd chips by reducing its bitterness, along with maintaining its nutritional properties. Bitter gourds were cut into slices followed by blanching, soaking in lime water and then, dipping in four different solutions, such as salt solution, vinegar, tartaric acid solution and citric acid solution for development of flavor. These slices were dried by using tray dryer. Then the chips were fried in soya-refined oil and results were compared from one another to find out a suitable flavor of bitter gourd chips. Optimization of flavor for bitter gourd chips was developed by using Statistical Package for Social Sciences (SPSS). The effect of all the four flavors of the chips on sensory scores indicated that all the attributes under study varied significantly ($P<0.05$) in the samples. Highest overall acceptability was found in salt flavored chips' sample. The scores were decided as for color and appearance-20, body and texture-40, flavor and taste-40 and overall acceptability-100. The salt flavored chips obtained score for color & appearance 16.2, body and texture scored 38.7, flavor and taste scored 37.5 and overall acceptability scored 83.

FVP - 33
Utilization of Papaya Pulp for Lassi Preparation

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The present investigation entitled "Utilization of papaya pulp for lassi preparation". was undertaken during the year 2010-2011. Milk was standardized to 4 per cent fat, and the lassi was prepared with different levels of papaya pulp Viz. 0 (T_1), 4 (T_2), 8 (T_3), and 12 (T_4) per cent by weight of dahi. The results of four treatments with four replications were statistically analysed by using completely randomized design (CRD). The data obtained after chemical analysis of fat, total solids, titratable acidity, protein and evaluation of sensory characteristics like colour, appearance, flavour, body and texture were subjected to statistical analysis. The overall acceptability also analysed by the same method. The different levels of papaya pulp had a definite effect on improving the quality regarding colour, appearance, flavour, body and texture and overall acceptability of lassi. The sensory

evaluation for (overall acceptability) carried out by the judges, showed that lassi prepared by blending with 8 per cent papaya pulp (T_3) as most acceptable treatment. The cost of production of lassi was increase with the increase in the level of papaya pulp. The cost of production was higher of treatment T_4 with 12 per cent papaya pulp level (Rs. 29.73 per kg) while, the lassi prepared by blending with 8 per cent papaya pulp level (T_3 treatment) costing (Rs. 29.61 per kg) which was superiorly accepted by the panel of judges. Hence, it is concluded that best quality papaya lassi can be prepared by using 8 per cent papaya pulp. This lassi contained 3.18 per cent fat, 20.43 per cent T.S., 0.92 per cent acidity and 2.61 per cent protein. The cost of production of papaya pulp lassi was Rs.29.61/kg.

FVP - 34
Rising Trend of Fruit and Vegetable Processing Industry

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Fresh and processed fruit and vegetable products are traded in domestic, regional and extra-regional markets. However, for numerous reasons, the collective performance of the non-traditional fruit industry in export markets has not yielded significant foreign exchange earnings, which can match the existing performance of traditional commodities. The major objective is to manufacture wide range of fruits and vegetables products. The consumption of fruits and vegetables has increased significantly as consumers have become more health-conscious. Owing to the perishable nature of the fresh produce, international trade in fruits and vegetables is mostly confined to the processed forms. Processing (canning, drying, freezing, and preparation of juices, jams, and jellies) increases the shelf life of fruits and vegetables. A wide range of products is presently manufactured; jams and jellies, wines, fruit drinks, candied fruits, sauces (fruit based including hot pepper), snacks (dried fruit and fried snacks), ice creams and yogurt. The strength and success of a country's or region's agriculture depends on its ability to satisfy domestic, regional and international market demand for selected fresh, semi-processed or finished agricultural commodities on a consistent and timely basis and at competitive prices. The global fruits and vegetables processing industry has experienced consistent demand over the five years to 2015, as economies of every size continue to consume processed fruits and vegetable products and consumer spending increases as the world recovers from global the recession.

FVP - 35
Flowers: Delicious and Decorative Touch to Food

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Flowers symbolize beauty, purity, peace and love. From a symbol of love, flowers have transformed into an industry, generating both income as well as employment. In present scenario floral industry is an energetic, global fast growing industry which has achieved eloquent growth rates during the past few decades. Besides this the scope of flowers is getting wider because of their wider adaptability in food and non-food items as flowers and leaves are added to foods to provide taste, aroma and colour. New information concerning the composition and nutritional value of edible flowers is also important and represents a sufficient reason for their consumption. The only need is to explore it with knowledge and its different uses. Flowers add a decorative and delicious touch to everyday cooking and elegance to special-occasion dishes. Growing edible flowers and using green leaves and culinary herb blossoms expands the pleasure of cooking from the garden. Use of different flowers and leaves in food products enrich their value and flavour along with adding beauty. Their flavours range from spicy to sweet a milder form of their leaves, fruit or fragrance. They can be part of a main dish, a salad, or a dessert, can be added as a garnish. Flowers can be incorporated into beverages as flavourings or used to make teas or wines. They are added to spreads such as butter or fruit preserves and to vinegar, marinades and dressings. Oriental dishes make use of daylily buds and the Romans used mallow, rose and violets. Italian and Hispanic cultures gave stuffed squash blossoms and Asian Indians use rose petals in many recipes. Flowers like calendula, chrysanthemum, sunflower, hibiscus, scented geranium, rose, nasturtium, violet, cornflower, dianthus, honeysuckle are common flowers that are used in food industries for preparing various food items from them. Findings showed that common edible flowers have the potential to be used as an additive in food to prevent chronic disease, help health promotion and prevent food oxidization. However, the antioxidant mechanisms, the anti-tumor, anti-inflammation and anti-aging activity of the edible flower extracts should be further studied to develop more applications as natural antioxidants.

FVP - 36
Development and Quality Evaluation of Beetroot Candy

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Beetroot is a cool season crop having high nutritive value and great potential in processed forms. Still beetroot consumption is very low as compared to other root crops. Some products have been

formulated viz. juices, pickles, jam, etc. using beetroot but no systemic information is available regarding the development of beetroot candy. Objective: The study was aimed to standardize the procedure for development of beetroot candy, to study its chemical composition, storage stability, sensory attributes and to analyze the significant differences between them. Materials and Methods: Two types of preliminary treatments viz. steam-blanching (B1) and boiling (B2) were used to prepare beetroot candies. B1 and B2 candies were analyzed for differences in chemical composition, storage stability and for their sensory attributes (using 9-point Hedonic scale and Score card method). Results: Chemical analysis of B1 candy revealed the values of moisture, protein, folic acid, pH, TSS, titrable acidity, total sugars, reducing sugars and non-reducing sugars as 10.83%, 2.04%, 4.76%, 4.96, 75°Brix, 0.56%, 48.11%, 28% and 19.36% respectively, while chemical analysis of B2 candy revealed moisture, protein, folic acid, pH, TSS, titrable acidity, total sugars, reducing sugars and non-reducing sugars as 11.5%, 1.90%, 4.65%, 4.97, 75°Brix, 0.68%, 45.96%, 28.35% and 17.60% respectively. On statistical analysis, no significant difference was found between B1 and B2 candies on the basis of chemical analysis except in titrable acidity values. However significant difference was found between B1 and B2 candies with regards to their color, flavor and taste. Microbial analysis revealed that B1 and B2 candies can be stored safely in HDPE bags for 3 months at room temperature. Steam-blanching treatment was found to be better than boiling treatment for making beetroot candies. Beetroot candy can contribute to food and nutrition security because of its low bulk and volume, higher nutritional value, convenience and relatively longer shelf life.

FVP - 37
Advances in Food Industry through Flower Fragrance

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Floral scent is a highly variable, complex mixture of lowmolecular-weight, volatile organic compounds that attracts insect and animal pollinators. Hundreds, perhaps thousands, of different volatile compounds are emitted from flowers in varying levels and mixtures.Since ancient times, floral fragrance had a prominent influence on societal customs, and much value has been placed on fragrant flowers and fragrances derived from them.Although flowers can be identical in their colour or shape, there are no two floral scents that are exactly the same because of the large diversity of volatile compounds and their relative abundances and interactions.In many species, including antirrhinum, petunia and rose, petals are the primary site of floral scent emission with fragrance compounds emitted from the petal's epidermal layers.One traditional practice is to use flowers in food and drink, for example, adding scented flowers in sweets and beverages. Scented flowers provide good aroma, resulting in good emotions and commonly known as aromatherapy.Food and cosmetics manufacturers enhance their products with pleasant flavours and fragrances to make them more attractive to consumers.Man's admiration of flower fragrance rapidly turned volatile substances into a high-impact commercial commodity. Mainly synthetically produced, but also

natural, volatiles are heavily used in the foodand drink industries.Oils extracted from many flower crops like Rose, Tuberose, Jasmine, Marigold, etc. is mainly used in the perfumery and cosmetics industry as a base component of many of the modern perfumes but it also finds application in the food industry as a flavour additive. Dried flowers of jasmine are used for the preparation of jasmine tea. Blend of jasmine and green tea is very popular and often consumed type of tea in Asia. Syrup made of jasmine flowers is used as flavouring agent in the food industry. Utilization of fragrance of flower crops in food industry hold an immense potential with the advancement of technology, but a systematic scientific study is needed in this area.

FVP - 38
Edible Flowers as a New Promising Source of Human Nutrition

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For centuries edible flowers have been an integral part of human nutrition. Many kinds of edible flowers were already used in ancient Greece and Rome as relishes and flavour enhancers of many sweet and savoury dishes. In ancient Rome, flowers of various species of roses were used when cooking various kinds of puree. In medieval France, the flowers of calendula were used when preparing various salads. Due to demand of more attractive and tasty food by the people, sales of fresh, top-quality flowers for human consumption are increasing worldwide. These products, suitably packed in bunches, boxes, etc. are sold either directly in farm shops or through various specialized outlets. Both the quality of foodstuffs and aesthetic aspects contribute to the appearance of consumed meals. The attraction and appeal of individual dishes could be enhanced by edible flowers. In China and Japan, edible flowers have been consumed for thousands of years. Due to nutritive value, flowers like Antirrhinum majus, Calendula officinalis, Centaurea cyanus, Chrysanthemum frutescens, Chrysanthemum partheniu, Dianthus caryophyllus, Rosa odorata, Tagetes patula, etc. have the potential to be utilized as edible flowers. Globalization has contributed not only to a better awareness of consumers but also to the comeback of earlier lifestyles, in which edible flowers played an important role. Moreover, new food-processing technologies as well as new logistic methods and quick distribution of cooled and well preserved foodstuffs have enabled us to return to earlier common and widespread food resources. Nowadays, edible flowers are used as garnishes and mostly consumed fresh. Nevertheless, they can also be consumed dried, in cocktails, canned in sugar, preserved in distillates, etc. A high nutritional value, antioxidant capacity and attractive appearance predetermine edible flowers to be a new and promising foodstuff species for a wider use in human nutrition. Education of the public and the promotion of edible flowers are also very important for popularization as a new and prospective source for the food industry, gastronomy as well as a promising object of human nutrition.

FVP - 39
Preparation of Ready to rehydrate Freeze-Dried Jackfruit Pudding

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Jackfruit was utilized in the formulation of freeze dried pudding. The pudding was optimized using response surface methodology and sensory evaluation was done on a nine point hedonic scale.The objective of the study is utilize the underutilized nutritious fruit to a more acceptable product and evaluate its physical, chemical and microbiological analysis of the product. For the purpose jackfruit of soft, orange variety was procured from the local market along withGhee, Coconut milk powder,Jaggery, Green Gram and Cashew nut. The raw material was optimized using Response Surface Methodology and the optimized ingredients was used to prepare Jackfruit Pudding and the pudding was freeze dried to maintain all the quality attributes The Optimized conditions were obtained as 46.98 % jackfruit, 16.92% jaggery and 2.37% coconut milk powder. Rehydration ratio for freeze-dried pudding was estimated.Initial analysis of freeze-dried pudding(moisture, ash, fat, protein)was carried out. Chemical and Physical analysis such as Carbohydrate,Total Carotenoid,Dietary Fiber(soluble and insoluble), Thermo-Gravimetric Analysis, Calorimetric Analysis, Gas Chromatographic analysis,Acidity, PH, Wateractivity, Texture, Density, was also estimated. Storage studies of the product was carried out for 6 months.

FVP - 40
Optimization Process Variables For Preparation of Palmarya Candy

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Talmmishri (Palm candy) is prepared from Neera, the nector of toddy palm or Asian palmyara palm (Borassusflabellifer) and sugar. Palm nector is a very common product and can be obtained from easily available today palm trees in many parts of India as well as many other Asian and African countries. Palmyra palm Jaggery (gur) is much more nutritious than crude cane sugar, containing 1.04% protein, 0.19% fat, 76.86% sucrose, 1.66% glucose, 3.15% total minerals, 0.861 % calcium, 0.052% phosphorus; also 11.01 mg iron per 100 g and 0.767 mg of copper per 100 g . The ingredients used for processing of candy were sugar, Palmyra jaggery, water and nucleation aid showing a specific role. The temperature of standardized sample was varying from 100 to 107°C and corresponding TSS was from 65 to 85° B, amount of nucleation aid 0.1g to 0.3g is incorporated for storage temperature is 3 to 7 days to increase the crystal yield. Thermo-physical properties of

prepared Palmyra Jaggery sample are measured during the heat concentration. The industries indulged in production of palm candy face a lot of technical problems leading to lesser market price and greater costs of production while the consumers do not get the quality and uniformity in the product .Hence there is an urgent need to develop process technology for the production of palm candy to extend technical support to the existing industries in the field and to provide customers with better product.

FVP - 41

Improvement of Growth, Yield and Quality in Kinnow Mandarin through Foliar Application of Zinc and Boron

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A field experiment was conducted at KVK, Chittorgarh and Department of Horticulture, Rajasthan College of Agriculture, Udaipur during 2014-15. The soil of experimental field was low in nitrogen, zinc and boron, medium in phosphorus and high in potassium. The experiment consisted of 9 treatments comprising T_1 (control), T_2 (0.1% boric acid), T_3 (0.2% boric acid), T_4 (0.4% zinc sulphate), T_5 (0.5% zinc sulphate), T_6 (0.1% boric acid + 0.4% zinc sulphate), T_7 (0.1% boric acid + 0.5% zinc sulphate), T_8 (0.2% boric acid + 0.4% zinc sulphate), T_9 (0.2% boric acid + 0.5% zinc sulphate) applied at fruit set and peach size stage of fruit through foliar spray, separately on uniform kinnow mandarin plants. These treatments were evaluated under one way analysis of variance replicated thrice with adopting uniform cultural schedules during the experimentation. The results revealed that all treatments significantly increased the vegetative attributes (plant height, tree spread (N-S & E-W), shoot length), yield characteristics (fruit retention, number of fruit plant^{-1}, fruit weight, fruit volume, fruit diameter (equatorial & polar), yield plant^{-1}, estimated yield ha^{-1}, qualitative attributes (TSS, acidity, TSS/acid ratio, reducing sugars, total sugar, ascorbic acid, rind thickness, juice content, number of seeds fruit^{-1}) and leaf nutrient status (zinc & boron). Among the treatments combined, application of 0.2 per cent boric acid + 0.5 per cent zinc sulphate (T_9) at fruit set and peach size stage of fruit through foliar spray gave higher vegetative growth, yield, quality and leaf nutrient status attributes in kinnow mandarin. As far as economics is concerned maximum gross return ` 3,76,440 ha.$^{-1}$, maximum net returns ` 3,10,032 ha.$^{-1}$ and B:C ratio (1:4.76) were obtained in (0.2% B+0.5% Zn) T_9 treatments through foliar application.

FVP - 42

Varieties of physical and bio-chemical characteristics among some cultivars of Elephant foot yam (Amorphophallus paeoniifolius) at harvest fresh stage

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Elephant foot yam (Amorphophallus paeoniifolius) is a tuber having extensive curative and digestive properties which belongs to the family Araceae. The experiment was conducted during 2012-2014 at AICRP Tuber Crops laboratory, BCKV, West Bengal to study the variability existing among the corms of twelve varieties after harvest with respect to morphological and biochemical attributes. It has been found that the different cultivars had dry matter (27.08-38.51%), TSS value (7.37-8.93°Brix), total Sugar (1.31-1.73%), ascorbic acid (2.02-2.93mg/100g), carbohydrate (57.58-74.65mg/100g), starch (15.34-19.42%), protein (1.16-1.86%), total oxalate (29.38-35.21mg/100g), □-carotene (213.25-342.90µg/100g), acidity (0.138-0.162%) and total phenols (44.52-54.27mg/100g) .These varied significantly among the cultivars. From the results it is evident that elephant foot yam has appreciably high amount of nutrients. Genotypes high in antioxidant value and protein, carotene can be used to develophigh nutraceutical value products and low oxalate levels recommended safety for consumption without acute toxicity to humans, makes it a potent curative food for preventing various diseases. Elephant foot yam breeders can use this information to developgenotypes with superior health-beneficial propertiesas well as to ensure specific taste and flesh color preferred by consumers.

FVP - 43

Process standardization for the development of sugar free/low calorie aonla candy

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The objective of the study was to develop low calorie aonla candy using artificial sweetner. Sugar free aonla candy was developed using sucralose and aspartame as an artificial sweetner with different concentration. The developed candy was analyzed for various quality parameters i.e., vitamin C, titrable acidity, tannin, sensory attributes, calorific value, hunter colour analysis and storage stability using standard procedures. Sugar free aonla candy was optimized with 10% artificial sweetner i.e., sucralose and aspartame. Sugar free candy contain 224 mg Vit C, 1.60% tannin with 0.89% acidity as compared to sugar candy (230mg Vit C, 1.55% tannin with 0.6% acidity). During storage Vit C, tannin and colour of candy decreased whereas moisture, acidity and microbial load increased. Low calorie can be stored for 120 days in LDPE bags at ambient

temperature. It was concluded that highly nutritious and low calorie candy could be prepared and popularised for diabetic, obese and health conscious people.

FVP - 44
Product Formulation and Shelf Life Study of Rasbhari Nectar

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Cape gooseberry (Physalis peruviana L.) also known as rasbhari and golden berry belongs to family solanaceae and is a highly underutilized fruit crop. Cape gooseberry have tremendous health benefits as it is low in calories, being rich in polyphenols, phytochemicals such as carotenoids, potassium, and contains modest levels of vitamin A,B,B_3 and C. Major bioactive compounds of Physalis spp. such as physalins and glycosides (such as myricetin-3-O-neohesperidoside) have been shown to possess anticancer activities. Rasbhari nectar was developed with the view that this particular flavor is completely novel in the world of fruit juices and beverages. The sugar helps in mellowing down the tartness of the rasbhari, whereas the salt was used as flavor enhancer. This product is a perfect heat and stress buster due to the rich minor nutrients profile (vitamins and minerals) and also being rich in phytochemicals and polyphenols. The appealing orange color and refreshing taste makes it a good choice among other fruit drinks. It helps in hypertension control, reducing the risk of cancer, improves vision, increases calcium and phosphorous absorption and boosts immunity. The analysis of nectar was carried out under laboratory conditions and following parameters were studied: Acidity, T.S.S, Ascorbic acid content, pH, Total and reducing sugars. Microbiological studies for total plate count, yeast & mould count and coliforms count were also done.

FVP - 45
Quality Evaluation and Product Formulation of Gaderi (Colocasia Esculenta)

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Gaderi (Colocasia esculenta) is a root vegetable belonging to the Aracea family. Colocasia esculenta corms are one of the highest vegetable sources of energy. It is a good source of dietary fiber and also contains various vitamins such as -carotene, vitamin C and B complex (thiamin, riboflavin and niacin) and minerals like potassium, zinc, folate and phosphorus. However, acridity has resulted in its underutilization. The acridity can be reduced by peeling, grating, soaking, boiling and fermentation. It is highly perishable and losses occur after harvest. So, the dehydrated chips can be an alternative

product, which can be stored and utilized. The present study is undertaken with the objectives to study the chemical composition of Gaderi (Colocasia esculenta), its product formulation and assess their sensory characteristics. The fresh Gaderi were washed, peeled, sliced, boiled in salt water for 30 min, and dried at 60-65 °C for 6-8 hours. The dehydrated chips were stored in an air tight jar and kept in cool and dry place. Moisture, ash, crude fat, crude fiber and crude protein content on wet weight basis were 65.63, 1.75, 0.17, 0.65 and 1.2 percent respectively. Antinutrients content such as oxalate, tannins, phytate and phenol were 37.8, 5.95, 4.69 and 35.67 mg/100g respectively. The chips had desirable organoleptic properties as indicated by the taste panel studies. The potential of this crop can meet food security, helps in income generation and nutritional enhancement.

FVP - 46
Postharvest management of mushroom

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The production and consumption of mushrooms are rising very fast throughout the world, mainly due to greater awareness of their nutritive and medicinal value. Mushrooms are a potent source of good quality protein especially being rich in lysine. Postharvest losses are very high in most of the horticultural commodities and may be one of the highest in mushrooms. Since mushrooms are living entities, even after harvesting, they are affected by a number of factors leading to their postharvest spoilage and losses. These comprise, of infection by micro-organisms, spoilage by enzymes and unfavourable condition during picking, transport,packaging, storing and marketing. As soon as the fruiting body matures and harvested, degradation process starts and it becomes unfit for consumption after sometime if not handled properly. To overcome this barrier, during peak season, suitable postharvest management/practices are to be followed to increase the shelf-life and marketability of mushrooms . Short-term preservation methods like prepackaging, coupled with low temperature storage, irradiation and steeping preservation help extend their storage life from 1 to 3 weeks. Long-term preservation methods like canning, drying and pickling can help make it available throughout the year. Thus it can be concluded that by following appropriate postharvest management practices shelf-life and marketability of mushrooms can be increased.

FVP - 47
Fruit Grading System: A Review

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Grading of agricultural produce especially the fruits is an important unit operation in food

processing. In India mostly fruit growers grade the fruit manually. Manual grading is carried out by trained operators who considered a number of grading factors and fruit are separated according to their physical quality.Manually grading is costly and grading operation isaffected due to shortage of labor in peak seasons. Humanoperations may be inconsistent, less efficient and time consuming. New trends in marketing as specified by various monitoring bodies demand high quality graded products. Farmersare looking forward for having an appropriate agricultural producegrading machine in order to alleviate the labor shortage, save time and improve graded product's quality. The need is thus for the development of fruit graders for better quality assessment of fruits as Fruit commercialization is the main purpose of its grading. Fruitin the same tree differ in quality such as feature, flavor because their growth as effected by many environmental factors. Especially, fruitsfrom different orchards differ significantly in size and quality. Grading may not only standardize fruitproduct but also promote management of the fruit tree in orchard and product quality. In this paper, an overview of how fruits can be graded and sorted is discussed. This paper also providesinformation regarding various types of fruit graders which work on the various principles like weight, sensor, vision and color. In general overall information on the fruit grading system has been reviewed.

FVP - 48
Influence of Temperature on Flowering and Growth in Fruit Crops

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The success and failure of the orchard is entirely dependent upon the temperature. Plant growth and other physiological changes, viz. flowering, fruiting and fruit quality is temperature dependant. Adverse effect of high and low temperature has been noted during both flowering and growth stages in various fruit crops. The various stages starting from flower bud differentiation, anthesis, rate of flowering and even development of various parts of flowers is influenced by the prevailing environmental temperature. Lack of chilling associated with mild winter conditions results in abnormal pattern of bud break and development in temperate fruit trees. The best responses for every plant either for vegetative growth or for its reproductive potentials are obtained in the cardinal temperature ranges, which includes minimum, maximum and optimum. The plant temperature at which tissue dies is around 115°F. In general, plants survive within a temperature range of 0 to 50 C. The adverse effect of temperature on fruit plants occurs when crosses its limits. These effects are either due to direct injuries or due the reduced activity of enzymes and disturbed metabolic processes.Both high and low temperatures can cause injury to the fruit plants. These injuries may be desiccation, chilling, freezing, sun-burning and physiological injuries.

FVP - 49
Blue Green Algae Spirullina as Single Cell Protein

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In recent years,due to rapid growth in population, the human beings facing a deficiency of protein and nutrients. The present study deals with the production of single cell protein as food for humans. Many scientists considered cyanobacteria (blue green algae) as super food. It is rich in protein and also considered as single cell protein. Spirullina is a gram negative,photosynthetic,filamentous,spiral shape, multicellular,microalgae belonging to group cyanophyceae. This is nontoxic, nonpathogenic species of cyanobacteria . Spirullinais easily grown in tropical and subtropical climate. It is rich invitamins, minerals, beta carotene,essential fatty acid and antioxidants. The studied shown that it has anticarcinogenic,lowering blood pressure and reduce cholesterol level.Spirullinaculture were isolated and culture in poly vinyl chloride tanks.During experimental period all the water parameter were kept under control and to measure the growth and survival. All standard methods were followed during growth period. The cyanobacteria were harvested at that time and dried into powdered or compressed into tablets for easy distribution. Due to presence of low purine concentration it is easily digestable. Hence, it can be recommended as protein supplement. This non-conventional protein fulfill the demand of available protein as food.The large scale production will done to minimize the cost. In the recent years commercial production of Spirullina has been increased because of a growing awareness and its nutritional quality, but more studies will help to advance this technology.

FVP - 50
Physico-chemical changes during growth and development of Mallika mango (Mangifera indica L.) fruits

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In Mallika mango fruit moisture, total soluble solids, acidity, ascorbic acid, reducing and non-reducing sugars, total sugars and starch were estimated from developing stage (42 days) to maturity. The average fruit weight and specific gravity were estimated at the harvest maturity (112 days after fruit set). There was an increase in fruit weight with the concomitant increase in fruit size. The

moisture content constantly decreased as the fruits proceeded towards senescence with a reverse trend in case of specific gravity which increased till harvest. The immature fruits were perceived to be acidic, and rich in vitamin-C, but with the advancement in maturity there was a considerable decrease in acidity and vitamin-C. The decline in acidity and vitamin-C remained a continuous phenomenon till the senescence of fruits. Total soluble solids consistently increased with advancement in maturity and rapidly enhanced till the senescence of the fruits. Reducing and non-reducing sugars increased until harvest. After an initial decrease in total sugars, it increased till maturity and ripening. Reducing and total sugars slightly decreased at senescent stage, while non-reducing sugars minutely increased at senescent stage of fruits. The accumulation of starch was found to be low at the earlier stages of development of fruits but during later stages its accumulation drastically increased and this increase continued till maturity. However, there was a decline in starch content of fruit with the advancement in ripening.

FVP - 51
Post Harvest Management of Cucurbitaceous, Root and Tuber Crops

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Vegetables play a significant role in Indian Agriculture constitutes 10-12% of the total food intake/diet. India is the second largest producer of vegetables in the world i.e. 162.18 million tonnes(NHB, 2013-14). A considerable amount of vegetables produced in India is lost due to improper pre-harvest and post-harvest operations as a result; there is a considerable gap between the gross production and net availability. The post-harvest losses in vegetables are as high as 30 to 35% of India's total vegetable production is lost due to improper post-harvest handling, transportation and storage. Improper handling and storage causes physical damage due to tissue breakdown. Mechanical losses include bruising, cracking, cuts, microbial spoilage by fungi and bacteria, whereas physiological losses include changes in respiration, transpiration, pigments, organic acids and flavor. Losses in vegetables start first from the field, after harvestduring grading and packing, in storage, transportation and in the wholesale and retail markets. There are various standards followed for grading various vegetables in the two grades: i.e. (i) good quality or general grade (ii) people quality or commercial grade.The factors, responsible for post- harvest losses in root, tuber and cucurbitaceous crops at various stages, viz; harvesting, curing, sorting, grading storing on farm, transportation, storage under refrigerated/ controlled atmosphere/ modified atmosphere and ultimately marketing should be thoroughly standardized and proper technology should be developed for each stage of chain to improve the entire post- harvest system.In India,export of the horticultural produce has not been very encouraging because only a small fraction is utilized for processing. Thus due to lack of infrastructural facilities like cold chains, low

productivity and high costs of input materials makes our export uncompetitive in the international market, therefore, considerable efforts should be made to develop the food processing industries in the country for better utilization of the product at a proper stage to reduce the losses of the crops.

FVP - 52
Study of Nutritional Composition and Shelf life of Persimmon Incorporated Jam

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India is blessed with a variety of agro- climatic conditions favouring the production of wide range of fruits. Nowadays, various factors including impaired supply chain, personal food choices, market pressure, misbalance the utilization of fruits. Various indigenous fruits are used by local people but because of its use on a very limited scale, they get categorized as underutilized food. Persimmon (Diospyros kaki) is one such, an important underutilized, native fruit having nutritional, health benefits. The present study is pursued with the objective of evaluating nutrient content of Hachiya variety (seedless) of Persimmon fruit followed by the shelf life study of jam incorporated with persimmon. The fruit contains 3.12 percent dietary fiber, 22.38° Brix total soluble solids, 0.81 percent pectin, vitamin content of 17.76 mg/ 100 gm ascorbic acid. Jam prepared by the standard method with proportion of 60:20:20 (Persimmon: Apple: Guava) was selected as the best product on the basis of sensory evaluation having the highest mean overall acceptability score of 8.20. The study on storage stability conducted for 60 days revealed that ascorbic acid content decreased significantly after 15 days of storage whereas acidity and total soluble solids increased significantly from 0 to 60 days. This reflects its better stability for up to 60 days without affecting its quality. The study can pave a path in the direction of employing less popular fruits by designing various products incorporating the specific fruit resulting in the all year round availability, healthy step towards preventing of chronic diseases and efficient horticultural management.

FVP - 53
Processing possibilities of underutilized fruits in India

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India is a prominent country on the pomological map of the globe. The diverse weather conditions provide suitable conditions for variety of fruit production. These fruits are available in bulk and also in different seasons. This results in very limited scope for proper expansion of other minor fruits, though they are nutrient rich and sometimes are the main source of livelihood for the poor peoples.

Most of the minor and underutilized fruits are often available only in the local markets and are practically nowhere in other parts of the country. A large number of these fruits can grow under adverse conditions and are also known for their therapeutic and nutritive value and can satisfy the demands of the health-conscious consumers. However, some of these fruits are not acceptable in the market in fresh form due to their acidic nature and astringent taste. Hence, there is a need to concentrate on research efforts in diversification and popularization of such underutilized fruit crops. To achieve this, there is a need to create demand for such fruit crops in the domestic and international markets in the form of underutilized fruit products like aonla pickle, aonla squash, aonla supari pachanaonla (digestive aonla), ber powder, salted ber and tamarind products like concentrate, panipuri masala and various others. This, to some extent, can be achieved through developing suitable processing and marketing strategies for these underutilized fruits.

FVP - 54
Thrifty Technologies for Preservation of Horticultural Commodities

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The horticulture sector is considered a viable diversification proposition for the traditional food grain crops owing to their higher returns per unit. At present, India is the second largest producer of horticultural produce in world. Horticultural commodities are highly perishable in nature and their availability season is limited. During the period of glut, it causes heavy losses to the grower as they are compelled to sell them at throwaway prices to middlemen and contractors. These distress sales are all the more debilitating for small and marginal farmers who produce a larger proportion of horticultural produce. These losses need to be reduced by proper management and addition of value to produce through thrifty technologies. Technologies like evaporative cool storage, solar drying, fermentation, pickling, canning, etc. are come under thrifty technology for preservation of horticultural produce. The emphasis behind all these technological strategies, at using more eco-friendly green technologies, energy conservation, use of biodegradable packaging and minimal processing techniques, is to conserve and preserve various health promoting phyto-nutrients in various processed fruits and vegetables more efficiently. Cost also limits the consumption of horticultural produce. In many developing countries, the average daily income is equivalent to the price of half kg jam. It is, therefore, not surprising that many consumers can only occasionally afford fruit and vegetable processed product and they are consequently not part of the everyday diet. If the rural generations are trained in thrifty technologies of preservation, it will help in employment generation in that particular area.

FVP - 55

Assessment of Some Trace Metals in Vegetables and Cereals- A Case Study of Indian Market

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The concentration of trace metals such as As, Cu, Cd, Pb, Cr and Hg in unwashed, washed (soaked 2% CH_3COOH solution before washing) and boiled various vegetables (roots, stems, leafy, fruits and legumes) and cereals collected from market, grown in Varanasi district (rural, industrial and urban area) in India was assessed using atomic absorption spectrophotometer. The results obtained revealed that concentrations of major studied trace metals were within the prescribed limit of critical value international standards (WHO, 1994) except Cu in Spinacia oleracea (12.32 µg/g dry weight) at MS3. Leafy vegetables were found to contain the highest metals values especially Spinacia oleracea followed by roots vegetable like Brassica rapa, at all the studied sites. The presence of trace metals concentrations in different parts of the vegetables might be related to their concentration in the polluted air with industrial activities especially at MS3. The comparative study of trace metals in unwashed, washed and boiled vegetables and cereals showed that the boiled sample have less metallic contents in comparison to washed. Non acetic acid treated vegetables and cereals (unwashed) have more metallic contents and might be more hazardous and pose high risk on consumer. The study concludes that contaminated soil, atmospheric depositions and marketing systems of vegetables play a significant role in elevating the levels of heavy metals in vegetables and cereals having potential health hazards to consumers of locally produced foodstuffs

FVP - 56

Enhancement of Post-harvest Shelf-life of Green bell peppers (Capsicum annum L.) using Calcium Lactate Dip Treatment

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The aim of this study the effects of calcium lactate based dip on physico-chemical, sensory and microbial quality of whole green bell peppers were packed in low-density polyethylene (LDPE) pouches. Each package of bell peppers was heat sealed and stored for 28 days at 4, 10 and 25 °C. The physico-chemical properties such as weight loss, total soluble solids (TSS), titratble acidity (TA), pH, ascorbic acid content, firmness, antioxidant activity and flavonoid content, sensory parameters (crunchiness, toughness, juiciness, sweetness, aroma intensity, stickiness of skin, overall

acceptability and colour) and microbial levels (total aerobic bacteria, coliform bacteria, and yeast and molds), were monitored every 7 days during 28 days of storage. Graded, sanitized and air dried whole capsicum samples were dipped in the calcium lactate dip solution (A 3% (w/v) solution of calcium lactate was prepared by dissolving 150 g of extra pure calcium lactate powder in 5 l of cold distilled water in a stainless steel vessel and stirring gently with a glass rod for few min until the powder got completely dissolved) and left for 30 min with gentle stirring occasionally. After 30 min, the samples were taken out of the dip solution in a plastic sieved crate and dried under the air fan at room temperature. The extra drips of dip solution adhering to the samples were rinsed with a tissue paper. The control samples were dipped in distilled water for the same period as the chemical dip treatment. Then dipped bell peppers samples and the untreated control samples were packed in the LDPE (low-density polyethylene) pouches150 gauge thick with package dimension 18 × 30 cm and heat sealed by sealing machine. Then equal number of sealed bell peppers pouches of control and chemical dipped bell peppers were stored at 4, 10 and 25 °C for 28 days in incubators. It indicated that the 3 % calcium lactate solution used for dipping bell peppers was found to preserve freshly harvested whole green bell peppers when packed in LDPE (low-density polyethylene) pouches stored at different low temperature 4, 10 and 25 °C had significant effect in maintaining physico-chemical properties, sensory attributes and microbiological quality during the 28 days of storage. Total aerobic bacterial counts and the yeast and mould counts in the treated samples were found to be elevated significantly more than the control samples during the storage period for a considerable period of time treated samples to retain more acceptable quality at 4 and 10 °C.

FVP - 57
Remediation of dairy and sewage wastewater using microbial fuel cell technology

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To examine the performance of MFC, Using different waste water samples. with different concentration of sodium acetate. MFC set up - made up of two plastic container(1L), Zero resistance copper wire stripped and wrapped around Carbon electrode, aq. air pump to cathode chamber, PVC pipe filled with salt bridge agar, Phosphate buffer placed in aerobic chamber, electrode treated with deionised water and H_2O_2 to increase porosity, multimeter, magnetic stirrer for uniform distribution of substrate in anode chamber. Determination of COD- amount of organic matter in water is estimated by their oxidability by chemical oxidant such as KMn04 or K2Cr207. In permanganate method, organic matter is oxidized with known amount of KMn04 and then excess 02 is allowed to react with KI to liberate Iodine, which is estimated titrimetrically with sodium thiosulphate (starch as indicator) for dairy wastewater COD decreased from 70.19 mg/l to 16.53 mg/l and for sewage

wastewater COD decreased from 120 mg/l to 24 mg/l, which is little less than 90% COD removal. Coulombic efficiency of sewage wastewater (82.22%) is greater than dairy wastewater (76.44%). Maximum power density achieved for sewage waste was 161.35 mW/m^2 at external resistance of 1000fi and maximum voltage of 614 mV fed with 0.4% Sodium Acetate.

FVP - 58
Application of Edible Coatings for Fresh and Minimally Processed Fruits and Vegetables

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Fresh and minimally processed fruits and vegetables are one of the major growth segments in the food retail industry. This new market trend has thus increased the demands to the food industry for seeking new strategies to increase storability and shelf life and to enhance microbial safety of fresh produce. The technology of edible coatings has been considered as one of the potential approaches for meeting this demand. Edible coatings from renewable sources, including lipids, polysaccharides, and proteins, can function as barriers to water vapour, gases, and other solutes and also as carriers of many functional ingredients, such as antimicrobial and antioxidant agents, thus enhancing quality and extending shelf life of fresh and minimally processed fruits and vegetables. Traditionally, edible coatings have been used as a barrier to minimize water loss and delay the natural senescence of coated fruits through selective permeability to gases. However, the new generation of edible coatings is being especially designed to allow the incorporation and/or controlled release of antioxidants, vitamins, nutraceuticals, and natural antimicrobial agents by means of the application of promising technologies such as Nano encapsulation and the layer-by-layer assembly.The success of edible coatings for fresh products totally depends on the control of internal gas composition. Quality criteria for fruits and vegetables coated with edible films must be determined carefully and the quality parameters must be monitored throughout the storage period.Studies have to go further in gaining understanding on how coatings produce a modified atmosphere inside the product during storage, and on how temperature, humidity, product variety, product uniqueness and time, among other attributes affect the performance of coatings.In addition, research has to focus on aspects such as consumer acceptability and final cost of the coated product.

FVP - 59
Postharvest Management of Cassava

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Cassava(Manihot esculenta) is a tropical tuber crop.Local words for tapioca roots in India include:

Odia (sagudana), Malayalam (kappa or maraccīni),and Tamil (maravaḷḷikiḻanku).It is an important subsidiary or staple food of the world's population. Cassava is the third largest source of food carbohydrates in the tropics, after rice andmaize. It play significant role in food security of tropical population. It also find application in food industry. The main objective of cassava postharvest management is to reduces postharvest losses and generate additional income.Methods include curing,pre-cooling, washing and drying, grading, and processing.Cassava tubers are generally harvested 9-12 months after planting. Harvested Cassava tuber should be stored under condition which can extend their self-life. Two types of deterioration occurs during storage physiological and due to micro-organism. The fresh pealed tuber are eaten after boiling or roasting. Cassava dried chips, flour, alcohol are the major cassava products. Refrigeration, deepfreezing, waxing and application of various chemical treatment can also be used for enhancing storage life. A major portion of cassava produce is processed into dried forms. The de hydrated cassava can be stored in suitable containers for months. Fresh cassava tubers are sliced into small pieces or chips. White chips are produced by removing the outer skin of tubers, slicing and sun dry and parboiled chips are obtained by immersing the chips in boiling water for 10 min before drying.

FVP - 60
Nutritional Quality and Antioxidant Activity of Brinjal Fruits

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Plants are affected by many pathogens, which not only caused the disease but also reduced the nutritional quality of the produce. Rhizoctonia solani is a major pathogen of brinjal that causes severe damage to the plants and reduce the nutrient uptake and ultimately reduce the nutritional quality of the produce. Brinjal fruits were collected from the Trichoderma treated and untreated, pathogen (R. solani) inoculated control plants and evaluated for their nutritional quality and antioxidant activity. Results indicated that fruits from consortium of Trichoderma harzianum (BHU-51+BHU-105) treated plants gave higher carbohydrate, protein and total phenolic content than individual Trichoderma, whereas the lowest content was recorded in untreated pathogen inoculated control. DPPH free radical scavenging, hydroxyl radical scavenging, iron chelation and reducing power activity were also recorded higher in the Trichoderma treated plants compared with untreated pathogen inoculated control.

Poster Presentations

Recent Advances in Cereals, Pulses & Oil Seeds Technology

Section - D

International Conference on Recent Advances in Food Processing and Biotechnology - Centre of Food Science and Technology, I. Ag. Sc., BHU, Varanasi - April 5-6, 2016

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Abstracts
CPO - 01 to CPO - 48

CPO - 01

Mycological analysis of lentil (Lens culinarisMedikus.)- Effect of fungal metabolites on seed quality

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Many kinds of seeds harbour a great variety of microflora, especially fungi. This is particularly true tothe kind of seeds which are more or less exposed to contamination by airborne inoculum. Lentil (Lens culinarisMedikus), a major pulse crop of rabiseason in rainfed areas, was selected for the present investigation. A total of seventeen (17) fungal species were isolated from seeds of lentil of which Aspergillus spp. were predominant.Data obtained during the study reveal the fact that secondary metabolites of seed mycoflora do affect the seed quality of lentil in terms of itsgerminability and emergence. Maximum inhibitory effect on the germination percentage of lentil seeds was brought about by the culture filtrates of Aspergillus niger. This was followed by the culture filtrates ofother species of Aspergillus,Cladosporiumcladosporioidesand Fusariumsolani. However, cultur.

CPO - 02

Ecological plant-microbe interactions with special reference to Phytomycology: Fungi from soil and seed and effects of their interactions with crop plants

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Fungi have always been of special importance to the mankind not only in terms of their effects on everyday human life but also that on the cultivated crop plants. The two major habitats of fungi, viz.

soil and seed, have ever been presenting a suitable ecological environment for sustenance of the microorganism.As a habitat, soil is rich in fungal population, as they most often dominate the soil microbiological scenario. Soil fungi are of three types-decomposers or saprophytic fungi, parasites or pathogenic fungi and Mutualistic or mycorrhizal fungi. Fungi perform important activities related to water dynamics, nutrient cycling, and disease suppression. Along with bacteria, fungi are important as decomposers in the soil food web, converting hard to digest organic material into usable forms. In no-till, fungal population dominate the soil food web.Fungal hyphae must be in close contact with living or dead organic soil residues to absorb nutrients, so they usually grow in association with other soil microorganisms. They compete aggressively for scarce nutrients, and competition usually results in a succession or change in microbial composition as nutrients are absorbed or depleted.Also, a number of soil inhabiting (soil residents) and soil invading (soil visitors) fungi have played havoc to the crop cultivation in the history of mankind and are considered a potential threat to crop cultivation even in the contemporary agriculture as they are not only difficult to manage but also take quite a long period to subside. Since plant roots and soil fungi share the common habitat, their interactions, when contrasting, are highly categorical.

CPO - 03
Formulation, Quality Evaluation and Shelf Life of Legume Supplemented Cereal Bar

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Cereal bars are the snack foods of good sensory characteristics due to their nutrient combinations. One of the strategies to produce the cereal bars with good protein quality is cereal-legume complementation. The aim of this work was to develop cereal bar by incorporation of De fatted soya flour (DSF) and to evaluate the organoleptic characteristics, proximate composition and shelf life.The sensory evaluation of formulated cereal bars was carried out as per 9 point Hedonic scale. Proximate composition, minerals (calcium and iron),In-vitro protein digestibility, In-vitro calcium and iron bioavailability, free fatty acid, peroxide value and colour of developed cereal bar was determined by AOAC standard methods. Data was statistically analysed.De fatted soya cereal bar (DSCB) was prepared by substituting different proportion of defatted soya flour viz 100:0(T0), 90:10 (T1), 80:20 (T2) 70:30 (T3), 60:40 (T4), 50:50 (T5), 40:50 (T6) with basic meal. T2 was highly acceptable from all the other treatments. Protein content was significantly higher in DSCB (19.61 ± 0.00g/100g) compared to the control cereal bar (CCB) 9.32 ± 0.30g/100g. In-vitro protein digestibility, Total Ca and Fe, In-vitro Ca and Fe bioavailability of DSCB was found to be significantly higher than the CCB. Storage studies showed that the DSCB and CCB were found stable and highly acceptable at the end of the storage period of three months in HDPE polypouches by vacuum packaging at ambient temperature (23-44°C)

CPO - 04

Studies on the Drying Kinetics of Bathua (Chenopodium Album) Leaves and Its Incorporation in Conventional Foods for Fortification(Mathri)

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Bathua (Chenopodium album Linn; family: Chenopodiaceae) is cultivated in gardens and agricultural land and it is distributed all over South East Asia. The leaves are rich in potassium and vitamin C and iron and carotene . However being a seasonal crop studies were carried out to preserve it for usage throughout the year on industrial scale.The drying of the bathua was done at five different temperatures namely 50, 55, 60, 65, 70°C. All the five dried samples were produced and then were tested for the levels of beta-carotene and iron and the best powder was selected for the preparation of / incorporation in conventional foods like Mathri . It was found out that the powder dried at a temperature of 65°C had high and satisfactory amounts of nutrients in it.The snack food(mathri) was prepared by the incorporation of bathua powder at various levels . The final products were judged on the basis of sensory attributes and overall acceptability. It was found that the mathri with 7% incorporation gave best results with a score of 36.62. The studies indicated that moisture content varied significantly and ranged in control sample and the test sample from 21.45% to 20.077%. The protein content too varied from 9 g to 7.5 g in control and the test samples. Fat varied from 22% to 24.45% and ash 1.34 % to 2.5%.

CPO - 05

Utilisation of Cereals and Legumes for the development of Value added Pasta

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Natural antioxidants have gained considerable interest in recent years for their role in preventing the auto oxidation of fats, oils and fat containing food products. The keeping quality of foods such as crackers, cookies and pasta is of great economic importance since these products are widely used and are often stored for extended periods before consumption. Cereals and legumes like bajra, green gram and soyabean are found to be nutritious and have high levels of antioxidants. Germination of green gram increases the nutritive value, increases the antioxidant activity as well as makes it more digestible. In view of this, products like pasta is an excellent vehicle for addition of functional ingredients like bajra, germinated green gram and soyabean as a source of antioxidant, minerals and protein. In the present research work, for the development of pasta, Bajra flour, germinated green gram paste and soyabean flour were incorporated in semolina for the development of pasta to increase its nutritional and antioxidant activity. Response Surface

Methodology was used to optimize the levels of ingredient i.e. bajra flour, germinated green gram paste and soyabean flour for the product development.Pasta having composition, bajra flour (7.5%), germinated green gram paste (10%) and soyabean flour (20%) was found to be optimum. Incorporation of bajra flour, germinated green gram paste and soyabean flour increases the nutritional and bioactive components of optimised pasta when compared to control.

CPO - 06
SPME/GC–MS study on Volatile Compounds from Aromatic and Non-aromatic Rice (Oryzasativa L.) Cultivars of India

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Rice (Oryzasativa L.) is enjoyed as the staple food for more than half of the world's population and consumed with little processing like dehulled, milled, and cooked because of its flavour and texture. Some cultivars, like aromatic rice, are praised over others due to their unique quality with special aroma and flavour with cooking. Aroma and flavour are considered as one of the most significant factors which may be regarded as the source of foreign exchange earnings with considered in market business, which distinguishes it from ordinary rice. The profile of rice volatile compounds has been studied by many researchers and some of them have also used SPME/GC–MS to investigate a corresponding volatile compound in rice. However, few researches have been done to study different volatile compounds in different aromatic rice cultivars that would make them more desirable than others when cooked. In this study, solid phase micro extraction (SPME) method combine with gas chromatography–mass spectrometry (GC–MS) used to identify the volatile compounds from one aromatic and two non-aromatic cultivars. The identified volatile compounds in aromatic and non-aromatic cultivars belong to the chemical classes of aldehydes, alcohols, ketones,esters, furan, aromatic hydrocarbon, organic acid, and N-containing aromatic etc. This study showed that there is a great diversity of volatiles in both aromatic and non-aromatic rice cultivars and, with further research, this may lead to a better understanding of the combination of compounds that gives a cultivar a special aroma and flavour.

CPO - 07
Effect of different starch modification techniques on pasting, digestibility and structural properties of pearl millet starch

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Starch modification increases the functionality of the starch by altering its structure in control manner. Pearl millet starch might be a good alternative for functional food formulation due to its low

Glycaemic index, provided its native characteristics would be modified. Therefore, the present study was aimed with the modification of pearl starch to improve its various qualities like structural, in vitrodigestibility and pasting properties. Pearl millet starch was subjected under three different chemical modification techniques viz.crosslinking, oxidation, oxidised cross-linking. Native and oxidized–cross linked starch showed reduced pasting temperature compared to cross linked and oxidized modified starch. However, reduced peak viscosity was noticed in case of cross linked modified starch and reduced set back value was found in cross linked and native starch.Alpha-amylase and Amyloglucosidase were used to determine the starch digestibility of native and modified starch at prime and gelatinization temperature (80°C and 100°C). Readily digestible starch and resistant starch contentwas reported to be highest in native (11.8%, 100°C) and oxidized- cross linked (21.1%, prime) and lowest in oxidized- cross linked (5.2%, prime) and in native starch (4.6%, 100°C), respectively. Hydrolysis index based estimated glycaemic index was observed to be lowest (47.5%, 51.2% and 53.8%) in oxidized-cross linked starch in both prime and gelatinized (80, 100°C) form starch. The X-ray pattern of native and modified pearl millet starch conforms to the 'A' diffraction pattern and the prominent peaks of native, oxidized, cross-linked and oxidized-cross-linked pearl millet starches were observed at 2 fi = 15.2°C, 17.2°C, 18.0°C, 20.1°C, 22.9°C, 26.7°C, 30.4°C, 37.9°C and 47.9°C and weaker peaks at around 2fi = 11.267°C.

CPO - 08

Effect of soaking on anti-nutritional factors present in small red and large red kidney beans

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Phaseolus vulgaris is an herbaceous annual plant, grown worldwide for its edible beans, used both as the dry seed and as unripe fruit, both of which are referred to as beans. Kidney beans and other beans such as pinto beans, navy beans and black beans are known scientifically as Phaseolus vulgaris. Kidney beans are good source of important nutrients with good amount of protein, mineral matter, crude fiber, and carbohydrates. The present study was undertaken to determine the anti-nutritional factors viz. total phenols, tannins and phytates of small red kidney beans and large red kidney beans before and after soaking. Anti-nutritional factors were significantly reduced with different processing techniques, tannins proved to be the most labile, while phytic acid was the most resistant to all processes except sprouting. Many foods, particularly of plant origin, contain a wide range of antinutritional factors which interfere with the assimilation of nutrient contained in them. Significant difference existed between anti-nutritional factors of both the kidney beans. Antinutrients viz. phytates (13.27 mg/ 100 g) before soaking and phytates (9.90 mg/100g) after soaking were observed in higher amount in Large red kidney beans whereas, higher values for antinutrients viz. total phenols (2.23 mg/100g) and tannins (6.66 mg/100g) before soaking and

total phenols (2.04mg/100g) and tannins (2.91mg/100g) after soaking were observed in small red kidney beans.

CPO - 09
Effect of Thermal and Non Thermal Processing on Antioxidant Potential of Cowpea Seeds

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The objective of this study is to compare the thermal, nonthermal and bio-processing treatments on the total phenolic content and antioxidant activity of processed cow pea cultivars. Mature cowpea seeds of four varieties were procured and effect of thermal (boiling, autoclaving, roasting, microwave) and non-thermal (soaking and germination) on total phenolic content and antioxidative properties of four cowpea cultivars (EC-4216, BL-2, Kohinoor and Gomati) was examined. TPC content was assessed using FC reagent. Antioxidant activities of extract were examined using DPPH, FRAP and reducing power.Results showed that among thermal processing reduction in TPC was between (61.22-86%) which was highest in autoclaving followed by microwave boiling and roasting, while fermentation showed increase in TPC up to 56.01%. All selected cultivars of cowpea had shown significant increase in DPPH activity for thermal and non thermal processing. Highest DPPH activity was observed in Gomti cultivar after roasting (32.75%) which may be due to the formation of maillard reaction products. Thermal processing and soaking of cowpea seeds reduced FRAP content in all the cultivars where as fermentation significantly increased FRAP values (49-60%). The observed reduction in TPC and antioxidant activity was mainly due to leaching of these compounds from the seed coat into the soaking or cooking water. Therefore it can be concluded that fermentation has promising effect on retention and enhancement of antioxidant activity of cowpea cultivars. It could therefore be recommended that cowpea could contribute significantly in the management of degenerative diseases.

CPO - 10
Studies on Preparation and Optimization of Biscuits for Fasting Purpose

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Fasting is an integral part of many of the major religions in India including Islam, Judaism, Christianity & Hindu religion. Fasting can also mean limiting oneself to one meal during the day and/or abstaining from eating certain food types and/or eating only certain food types. Amongst Hindus during

fasting, starchy items such as Potatoes, Sago and Sweet potatoes are allowed. In this study, buckwheat flour, sago flour and coconut flour were used to prepare fasting biscuits. The cocoa powder was also added to improve its flavour and appearance. Six samples of fasting biscuits were prapared in different ratios of buckwheat flour, sago flour and coconut flour as 40:30:30, 50:20:30, 60:10:30, 30:40:30, 20:50:30, 10:60:30. In optimization, the sample containing buckwheat flour, sago flour and coconut flour (20:50:30) was found best on the basis of sensory and textural characteristics. The baking temperature and time of this biscuit was optimized 160°C for 25 minutes This optimized fasting biscuit was found to have 2.6% moisture, 1.2% ash, 8.7% protein, 60 % carbohydrate, 28.3% fat and 1.8 % fiber & Energy is about 530 Kcal. According to retail market price of raw materials, the cost of the prepared biscuits was Rs. 13 per 100g.

CPO - 11
Evaluation of Sensory Accessibility and Nutritive Values of Multigrain Flour Mixture Products

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Millets and Cereals can provide more Nutrients, Phytochemicals and Antioxidants which should be in demand for maintaining a good health status. By fortifying a food increases the level of Macro and Micro Nutrients, Dietary fibres, and Phenolic compounds which shows to impart an antimutagenic, antiglycemic and antiprotective activites. The preparation of multigrain flour mixture and assess the organoleptic properties of the prepared products with determine the nutritive value of the prepared products. The required materials i.e. Wheat grains, Oats, Finger millet, Buck wheat and Pearl millet were collected from the local market of Allahabad city and the flour and products were prepared in the lab. The nutrient composition as available in Gopalan's (2014) publication was used to calculate the nutritive values. Percentage, mean Score, standard error of mean, critical difference and ANOVA were applied and the sensory attributes in all multigrain products illustrated according to overall acceptability in the method. The result shows the sensory evaluation of the multigrain chapatti & biscuit illustrated that the according to overall acceptability mean score of chapatti & biscuit indicates that the treatment T_2 (8.3) scored maximum followed by other treatments. Hence From the ANOVA table of all three products that , it is evident that the calculated value of F is greater than the table value on 4,8 (d.f.) at 5% probability level so there was significant difference between treatments regarding all sensory Attributes of the product. The nutritive value of all three products was shown more in Treatment 4. From the above results which were obtained from the research it could be concluded that the simple wheat flour chapatti or other products could be replaced by multigrain products without much changes in taste because all the multigrain mixture products have a very good sensory score and also rich in nutritive values than normal wheat flour.

CPO - 12

Optimization of Ripe Mango Peel fortification level in Bread using Response Surface Methodology

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Ripe Mango Peel (RMP) provides a greater source of antioxidants and dietary fibre. Nowadays it is widely used in various food sectors like bakery units, beverage processing, etc as a fortifying agent to enhance the functionality of the food. Fortification after a certain level gives a negative impact to the physical and sensorial attributes of food and often renders them to be unacceptable. In the present study, breads fortified with ripe mango peel powder are optimized using three factors at five levels central composite response surface design (CCRD). Specific volume of loaf is one of the most desirable parameters for bread quality. The interactive effect of the process parameters on the volume makes it suitable to be chosen as the response. Baking temperature (200 – 240 ° C), time (10 – 30 min) and level of fortification (1 – 9 %) are selected as the process variables. The experiments were conducted to evaluate the effects of three independent variables on the maximum specific volume. From the experimental data second order polynomial mathematical model were developed with high coefficient of determination values of R^2 >0.90.Through validation of experiments, it was found that baking temperature of 225° C, baking time of 22.5 min and 4.5% fortification of RMP gave the maximum specific volume for bread. A comparative study has been done on the analyzed quality parameters of optimized bread sample to that of the control sample with results showing similar variation. Thus it can be suggested that the optimized fortification level in bread can be determined successfully for acceptance as a functional food.

CPO - 13

Effect of fortifcant in rice flour by conventional pasta press extrusion

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The prime objective of this research is to iron fortification by conventional pasta press extrusion to reduce the risk of anemia and analyze the effect of fortification on quality.Study was conducted to prepare the iron fortified rice by an extrusion method, the rice flour, stabilizers, emulsifier are premixed and trails were taken by adding iron fortificant like Ferrous bis glycinate, Sunactive ferrous. Also dietary fibers are added. The amount of iron fortificant was used as per the daily consumption of rice by population in India. The dough was prepared from premix and passed

through conventional pasta press extruder. Extruded fortified kernel cut by special cutter, and dried in hot air oven at 90o C for 30 min. The fortified kernels are analyzed to moisture, color, measurement, cooking properties like water absorption capacity, cooking loss, cooking time. Sunactive ferrous fortificant found best results based on above properties. The addition of dietary fibers causes a negative impact on the color of kernels. The ferrous bis glycinate also shows negative impact which is having the high cooking loss and bitter taste.

CPO - 14
Bio-embolden of rice by traditional fermentation process

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Rice is known as the grain of life, and is synonymous with food for every Indian, but, its nutrient composition is poor due to presence of anti-nutrient compounds, deficiency of essential amino acids and energy density. The rice based fermented foods and beverage preparations are commendable in Indian food culture to improve taste and nutrition. Most of the traditional fermented foods in our country are scientifically untouched and considering this the present research is being conducted to explore the quality and composition of a very popular rice based fermented beverage name Haria. The quantity and composition of participatory microbes were made culture dependent and independent studies. The major macro- and micro-nutrients were determined by standard protocols using high throughput analytical instruments.It was detected that mold, yeast, lactic acid bacteria (LAB), and Bifidobacterium sp. were the most predominant microbes in haria. These group of microbes secreted high titer of fi -amylase, fi -amylase (1-4gluco/galactosidase, and 1-3 & 1-7 glucosidase), glucoamylase, protease and little quantities of lipase. The composite and synergistic action of amylases leads to complete and partial digestion of starch into mono and oligosaccharides GC-MS analysis clearly demonstrated the occurrence of many health beneficial sugar derivatives in the mature ferment. Free proteins (6 mg/g) as well as amino acid contents (490 fi g/g) were also increased due to protease action. Phytic acid, a major antinutrient in the rice was dephytinized by the action of phytase (18.93 U/gm), which helps in the mineral fortification of the ferments. Apart from these, different hydro-soluble vitamins, essential fatty acids, alcohols, phenolics and flavonoids were also increased considerably So, the fermentation of this nutritionally poor graded rice grain by a mixed culture of microbes and their enzymatic counterparts can improve the functional characteristics by many folds beyond the basic nutrients and that confer different health-promoting attributes. There is enough scope to explore this as a national drink as well as a functional beverage in the market.

CPO - 15
Development of High Fibre and High Protein Bread and its Quality Evaluation

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Development of high nutritious bread using different combination of whole wheat flour, oat flour, defatted soy flour and ground flaxseed (100:00:00:00, 85:05:05:05, 80:10:05:05, 75:15:05:05, 75:15:05:05, 65:25:05:05 respectively). High fibrous and protein as the cereals and pulses supplement the protein quality of each other. Keeping the recent attention of dietary fibre, oat flour, defatted soy flour, ground flaxseed were incorporated with whole wheat flour in different combination.The bread made from above blends was subjected to extensive studies with respect to their quality characteristics. The high fibre and high protein bread was analysed and compared of their quality attributes such as moisture, protein, fat, carbohydrate, sugars, dietary fibre, ash and minerals. Among the sample prepared using the combination 65:25:05:05 (WW: OAT: SOY: FS) was found to be best on the basis of moisture content, protein content, dietary fibre and ash content (9.40%, 15.75%, 12.375% and 2.10% respectively). The blending of oat flour, defatted soy flour and ground flaxseed with whole wheat flour resulted in an increasing effect on the content of minerals such as calcium, iron and phosphorus.

CPO - 16
Enhancement of Frying Quality and Stability of Vegetable Oil by Incorporating Sesame Oil

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Sesame oilseed,despite a high proportion of polyunsaturated (Omega-6) fatty acids (41%), it is least prone, among cooking oils with high smoke points, to turn rancid when kept in the open or during cooking. This is due to the natural antioxidants and bioactive constituents present in the oil.Therefore, the present work deals with the effect of sesame oilseed (Black and White variety), on the stability of frying oil during thermal treatment and on the sensorial quality of fried potato chips was studied. White sesame oil (WSO) and black sesame oil (BSO) was blended with cottonseed oil (CSO) and linseed oil (LO) respectively in 50:50 ratio (Blends- BSO:CSO, BSO:LO, WSO:CSO, WSO:LO). The assessment of blends along with the pure oils were evaluated for their thermo - oxidation potential at 180° C for 30 minutes continuously for 5 days. The physiological and sensorial evaluation of the potato chips were also done.Standard methods for the determination of

deterioration of frying oil (pure and blend) and changes in potato chips was done.At the end of the frying period, a significant changein pure oils and blended oil was observed. A remarkable reduction in FFA, peroxide value, color, anisidine value, conjugated dienes, fat content and totox value of CSO and LO in comparison to BSO:CSO, BSO:LO, WSO:LO and WSO:CSO were observed. Sensorial characteristics of potato chips prepared with pure oils and blended oil had the best taste and color till the 5th day of frying. Hence, CSO and LO exhibited an improved stability and quality when WSO and BSO were incorporated, compared to the oil without them.

CPO - 17

Utilization of Buckwheat (Fagopyrumesculentum) for Preparation of RTE Extruded Snack Product"

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Buckwheat (Fagopyrumspecies) (Kuttuin Hindi) is an old traditional underutilized crop plant belonging to the family Polygonaceae. As reported, the buckwheat is found to have good nutritional qualities but is still an underutilized crop. The objective of this project is, to utilize buckwheat flour along with some other ingredients, and to study the effects of this substitution on the sensory and textural attributes of prepared RTE snack food, which is palatable as raw and cooked in milk both. For preparing the RTE snack extruded snack product, the flour of buckwheat was mixed with the wheat flour and semolina in varying ratio.. The ingedients were then mixed with water to prepare the dough. Dough was then extruded and dried first at (50^0 C for 30 minutes), and then baked at (150^0 C for 15 minutes). The extrudates were then subjected to sensory analysis. Sample ratio (50: 30: 20) was found best acceptable, in texture, color, and flavor.

CPO - 18

The Impact of Malting on Anti Nutritional Factors of Composite Flour Made from Foxtail Millet, Wheat and Chickpea

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Cereals like wheat, millet and chick pea are widely used as a staple food in our country. Foxtail millet and Chickpea contain high amounts of proteins and minerals. Wheat is also a good source of zinc, copper, iron, and potassium. But the bioavailability of nutrients is very limited in these cereals due to presence of certain anti-nutritional factors especially phytate, tannins, phenols, etc. which

interferes in nutrient absorption through intestinal tract. The objective of the study was to analyze the impact of malting on anti nutritional factors (phytate,tannins,phenols) of composite flour made from foxtail millets, wheat and chickpea. Foxtail millet, wheat and chickpea undergo malting process in which 12 hrs steeping and 48 hrs. germination had been performed. Processed foxtail millet, wheat and chickpea were converted into flour and these flour were mixed in different proportions (40:30:30). The anti nutritional factors were analyzed by using standard principles and procedures. Results showed that after malting, phytic acid content of composite flour was reduced by 46.77% respectively. Tannin content of unprocessed mixed flour was 31.0 g/100g respectively. After malting, tannin content was reduced to 19.0 mg/100g respectively. After malting, phenol content of composite flour was reduced by 20.82% respectively.

CPO - 19
Physico-mechanical and Nutritional Evaluation of Taro Flour Based Gluten Free Cookies

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Development of gluten-free cookies from taro flour for celiac patient.Taro and cassava flours, Rice flour (fine powder from white rice), sorghum (Sorghum bicolor) flour, sugar, fat and baking powder and Edible guar gum. Taro flour based gluten free cookies suitable for celiac patient were developed using taro flour (40-60%), rice flour (20-25%), sorghum flour (15-20%) and cassava flour (5-15%). Cookies were developed using creamery method and evaluated for physical properties, textural analysis, proximate composition and sensory characteristics.Nutritional and physico-mechanical evaluation of gluten-free cookies showed that taro flour could be successfully utilized along with other flours such as rice, sorghum and cassava for the development of cookies which could be safely consumed by coeliac patients. The low calorie density in the cookies coupled with the high content of minerals such as phosphorus, potassium, magnesium and copper could be added advantage for taro flour based gluten-free cookies. Based on the high scores for all the sensory parameters, it could be concluded that taro flour based blend containing 50% taro flour, 25% rice flour, 15% sorghum flour and 10% cassava flour was the best combination for making gluten-free cookies.

CPO - 20
Chia Seeds a new Food Crop

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With increasing public health awareness worldwide, demand for functional food with multiple health

benefits has also increased. The use of medicinal food from folk medicine to prevent diseases such as diabetes, obesity, and cardiovascular problems is now gaining momentum among the public. Seeds from Salvia hispanica L. or more commonly known as chia, are a traditional food in central and southern America. Chia was used by the Aztecs as food, mixed with other foods, mixed in water and drunk as a beverage, ground into flour, included in medicines, and pressed for oil. Now it is also grown in India at Andhra Pradesh and Karnataka and many other organic forms for commercial production. Currently, it is widely consumed for various health benefits especially in maintaining healthy serum lipid level. This efi ect is contributed by the presence of phenolic acid and omega 3/6 oil in the chia seed. Apart from its fatty acid content, due to its other properties like hydration capacity, high mineral (Calcium, magnesium and iron), dietary fiber and antioxidant content, it can be supplemented in manufacturing of various beverages, in various food formulations and other health supplements. Although, the presence of active ingredients in chia seed, warrants its health benefits. However, the safety and efi cacy of this medicinal food or natural product need to be validated by scientific research.

CPO - 21
Baking, functional and physicochemical properties of Wheat- Sweet potato composite flour"

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Due to climatic conditions some countries cannot grow wheat and have to import it in large volumes to fulfill ever rising demand of popular wheat products like bread. Post-harvest losses of surplus fruits and vegetables like sweet potatocan be reduced by processing them into flours which have a longer shelf life. Composite flours which may be defined as blend of wheat and non-wheat flours are a promising solution to curb problem of wheat shortage as well as the post-harvest losses of fruits and vegetables.Effect of sweet potato flour addition on baking and functional properties of Wheat- sweet potato composite flour.Rawsweet potato processed into flour and blended with wheat flour in the ratios90:10(WS1), 85:15(WS2), 80:20(WS3)&75:25(WS4). Bread was prepared from sample composite flours and physical characteristics like specific volume, oven spring and sensory parameters were compared with control bread. Based on results the best composition was subjected to analysis of functional properties like WAC, OAC, foaming capacity, swelling index, pasting properties, and proximate composition along with dough characteristics like gluten content and gassing capacity. Based on physical characteristics and sensory analysis, WS3 was labelled as best suitable for bread production. In terms of color, L* value of WS bread crumb was significantly lower than control but a* and b* values were close to control. In TPA, there was no significant difference between springiness values but hardness increased significantly and chewiness decreased. WAC and OAC of WS flour were found to be significantly higher than the control. Overall, the WS bread till 20% sweet potato flour addition was fairly acceptable.

CPO - 22

Development and Sensory Optimization of Low Cost Micronutrients Rich Products by Using Processed Composite Flour to Combat Malnutrition

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Food based approaches are recognized as an essential part of an urgently needed more comprehensive strategy for improving nutrition by increasing the availability and consumption to combat iron and other micronutrient deficiencies. The combination of Whole wheat flour, Ragi flour, Green gram flour, Soy flour and Roasted groundnut contains high amount of energy, protein with essential amino acids composition along with vitamins and minerals content, will enhance the nutrients value of homemade products which would be consider beneficial for malnourished population. The specific objective of the study was, to develop low cost functional food products with the incorporation of locally available indigenous foods especially designed for children and to assess organoleptic quality of the prepared products. Composite flour was prepared using soaked Whole wheat flour (WF) and other soaked flour namely; Ragi flour (RF). Green gram flour (GGF), Soy flour (SF) and Roasted groundnut (RG) to develop homemade product Mathri. For product, the basic recipes (control T_0) have three variations T_1, T_2, T_3 respectively, where the amounts of the ingredients were varied. The organoleptic qualities of these samples were analyzed by panelists on a 9 point hedonic scale. The results indicate that the processed composite flour based products were significantly accepted. On the basis of findings it was observed Treatment T_2 of Mathri was found to be best with regards to colour, taste and overall acceptability. The present study concludes that, processed composite flour (Whole wheat flour, Ragi flour, Green gram flour, Soy flour) and Roasted groundnut could be used to enhance nutritive quality of home made products with acceptable sensory properties as they deliver for malnourished children.

CPO - 23

Enhance Consumer Acceptability of Quality Protein Maize

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Maize has been a staple food crop of South Rajasthan since ancient times. During last few years due to change in food habits of urban and peri-urban people, consumption of maize has been reduced as food. Maize contains 60-68 per cent starch and 8-13 per cent protein. Opaque varieties have more

nutrients and contain a high percentage of essential amino acids. It has more riboflavin as compared to wheat and rice and is a rich source of phosphorus and potassium. On the other hand, maize seeds are deficient in essential amino acids; lysine and tryptophan. Continuous use of maize in villages of tribal dominated areas has resulted in harmful consequences such as growth retardation, protein energy mal-nutrition, anaemia, pellagra, free radical damage etc. To overcome these problems, Quality Protein Maize (QPM) was introduced in Rajasthan in recent years. Maize based value added products are not available in the market for the consumer, even though products developed from maize has high market potential and most important food alternative to gluten sensitive patients. A performa was developed and standardized to identify various entrepreneurs working for maize based recipes, their quality, quantity and market value. It was found that major maize recipes developed and sold in the market were from small scale entrepreneurs. The recipes included majorly the traditional products like maize papdi, laddu,papad, popcorn, ghat rab, rabodi etc. These are some of the most in demand and consumed by nearly people of all the class. Quality Protein maize (QPM) variety was identified and availability was checked. QPM Pratap 1 was purchased in a single lot from the University KVK-Banswara for the preparation of various recipes.Keeping these facts in to mind QPM based value added nankhatai, coconut cookies, salted biscuit, puffed corn, khaman, appe, pasta, bread, cookies, cake, ladoo, karba etc. by Centre of Excellence on Maize at MPUAT, Udaipur district of Rajasthan. Organoleptic evaluation was carried out to compare the sensory attributes and consumer acceptability of these products. It has been observed that the QPM Based Nankhatai, Biscuits and Cookies were liked extremely by the trained panel of judges whereas other products have been liked very much on nine point hedonic scale.

CPO - 24
"Utilization of Rice Bran in gluten free Buckwheat Muffin"

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Buckwheat is a highly nutritious pseudo-cereal and contains no gluten. It is rich source of dietary fiber and rutin that has potential antioxidant activity. As by- product, rice bran is a good source of proteins, fiber and minerals. Muffin is an acceptable popular staple food. The main objectives include standardization of bread formulation with studies on sensory, nutritional, texture and shelflife analysis.The study was conducted in Dept. of food science, CFST, Sambalpur University, Odisha. The raw rice bran was obtained from Lath Rice Mill, Bargarh, Odisha. Three flour blends were prepared by mixing buckwheat flour with rice bran in the proportions of 95:5(B), 90:10(C) and 85:15(D), while 100% buckwheat flour was used as control(sample A). The standard AOAC methods were implemented for proximate composition estimation and texture (springiness and firmness) by texture analyzer.The moisture, crude protein, crude fat and ash contents increased significantly from 20.07% to 23.67%, 12.04% to 13.10%, 1.57% to 3.77% and 1.46% to 2.41% respectively;

with increased level of bran supplementation. The carbohydrate content was found to be decreased to 52.953 % from 67.112% and so the calorie value was also decreased from 456.698 Kcal to 424.23 Kcal. The springiness in texture was found to be decreased with 6 days of storage. The muffin containing 10% of rice bran is widely accepted among the composition. The product has better utilization of rice bran as well as a new step in gluten-free product for human consumption.

CPO - 25
Development and Quality Evaluation of Protein Enriched Biscuits from Wheat and Soy Flour

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Baked products are considered as excellent vehicle for fortification, value addition and feeding at mass scale. The development of soya based snack foods has increased and is attracting much more attention from researchers, especially in the production of biscuits, bread and pastries. Protein rich biscuits can be prepared from composite flours such as wheat flour fortified with soy, cottonseed, peanut or corn germ flours. The present study was conducted to evaluate the use different levels of soy flour in refined wheat flour for development of biscuits. Soyabean seeds were roasted to making soy flour. Enriched biscuits were produced using refined wheat and soybean flour blends, in the ratios: 100:0, 90:10, 80:20, 70:30, 60:40 and 50:50. Nutrient contents and sensory characteristics of biscuits were analysed. Whereas biscuit 50:50 ratio was found higher sensory scores with regard to colour, flavour, body and texture, crunchiness, mouth feel and overall acceptability(8.1,8.1,7.96,7.8,7.8 and 8.03). In nutrient analysis, protein value of soy biscuits (50:50) increased from 9.24 to 14.30 in comparison to control. Energy and fat values of biscuits also increased, whereas carbohydrate content showed decreased value.

CPO - 26
Small and Minor Millets - Importance, Challenges and Future Perspectives

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Cereal grains are considered to be one of the most important sources of dietary proteins, carbohydrates, vitamins, minerals and fiber for human around the world. Millets are one of the oldest foods known to human and possibly the first cereal grain to be used for domestic purposes.

These are nutritionally rich and occupy an important place in the diet of people in many parts of the world. The rice eater is weightless like a bird while one who eats millet is stronger like a wolf: one who eats Raagi remains 'nirogi' throughout his life - An old Kannada saying. Although, millets are nutritionally superior to cereals their utilization as a food is still mostly confined to the traditional consumers and population of lower economic community. The climate change, water scarcity, population increase, declining yields of major cereals, adequate access to enough food, strengthening local agro-food systems present a challenging task to the scientists and the nutritionists to investigate the possibilities of producing, processing, and utilizing other potential food sources to end hunger and poverty. However, the special features of the millets, their beneficial uses and health consciousness of the consumer have made food scientists and engineers to develop various food products and mechanize the processes. In addition, because of important contribution of millets to national food security and potential health benefits, millet grain is now receiving increasing interest from food scientists, technologists, and nutritionists. The aim of this paper is to discuss the recent advances in research carried out to date for purposes of evaluation of nutritional quality and potential health benefits of millet grains. Processing technologies used for improving the edible and nutritional characteristics of millet as well as challenges and future perspectives to promote millet utilization as food for a large and growing population.

CPO - 27

Studies on the Rheological Characteristics of Millets Dough Under the Action of Thermo-Mechanical Stress

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Designed experiments were conducted to study the rheological characteristics of different millets dough under the action of thermo-mechanical stress. Mixolab device is used for this study by subjected millets dough into it and rheological characteristics were recorded in form of five different torques. The illustrated mixolab profiles of gluten free ingredients give information of their rheological behavior. This acquired an importance to creating of new products as we could predict some properties of them by these mixolab profiles. According to the mixolab profiles of the investigated systems in comparison of millet flours of sorghum, barnyard, oat, and pearl millet, the sorghum flour exhibit highest water absorption values, highest stability, highest protein, low amylase activity, and high shelf life of the end product. Mixolab profiler readings for sorghum were absorption 8, mixing 5, gluten 3, viscosity 2, amylase activity 9, and retrogradation 6. According to these readings we find that sorghum is best in comparison with its companions. All told the millet flours have good characteristics of dough but we cannot use millet flour alone due to poor dough extensibility. Blending of millet with other cereal flours can achieve a good quality product.

CPO - 28
Agronomic Approaches in Biofortification of Cereal Crops with Zinc and Iron

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The implementation of agronomic biofortification of cereal crops with Fe and Zn appears to be a rapid and simple solution to the deficiency of these elements in soils and plants. Zinc (Zn) and iron (Fe) deficiencies are well-documented public health issue affecting nearly half of the world population. Developing countries are among the worst affected from Zn and Fe deficiencies which result in number of serious health complications, such as impairments in brain function and mental development, high susceptibility to deadly infectious disease and high risk for anemia. Very low concentrations and poor bioavailability of Zn and Fe in the commonly consumed foods seem to be the main reason for widespread occurrence of micronutrient deficiencies in human populations. Cereal-based foods are most commonly consumed foods and contribute up to 75 % of the daily calorie intake in the rural parts of the developing countries. Zn and Fe deficiencies are also common micronutrient deficiencies in agricultural soils limiting both crop production and nutritional quality. Breeding new cereal genotypes with high genetic capacity for grain accumulation of micronutrients is widely accepted and most sustainable solution to the problem. There are impressive progresses in breeding new genotypes for high micronutrient density. However, the breeding approach is a long-term process and may be affected from very low chemical solubility of Zn and Fe in soils due to high pH and low organic matter. Agronomy-related approaches offer short-term and complementary solutions to the Zn and Fe deficiency in human health and crop production. Soil amendments contributing to solubility of Zn and Fe in soil solution, cereal-legume intercropping systems, and soil and foliar application of micronutrient-containing fertilizers are well-documented agronomic tools which contribute to root uptake, shoot and grain accumulation of Fe and Zn. Fertilizer strategy is a simple and effective agronomic practice to contribute grain concentrations of micronutrients. Increasing number of evidence is available showing that soil and especially foliar application of Zn fertilizers results in impressive enhancements in grain Zn concentration. In contrast, soil and foliar application of Fe fertilizers is not effective in increasing grain Fe concentration. In wheat, foliar application of ZnSO4 at later growth stages seems to be more effective in enhancing grain Zn concentration than the application at earlier growth stages. Late foliar application of Zn is also effective in higher accumulation of Zn in the endosperm part of grains compared to earlier application. Enrichment of commonly soil-applied fertilizers like urea with Zn seems to be also very helpful strategy in improving grain Zn concentration. Soil and/or foliar application of nitrogen fertilizers improve both root uptake and grain accumulation of Fe and Zn.

CPO - 29
Development of Protein and Fiber rich Ready-to-eat Snacks using Single Screw Extruder

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Extruded RTE Snacks are prepared from flour blends made with pea flour, corn flour and pomegranate pomace in a proportion of 70-90%, 10-30% and 0-15% respectively and moisture is adjusted to 10-15%. The pea flour is developed from the dried green peas. Different formulations are extruded at temperature 70-90°C. The exit diameter of the circular die is 1mm. Sensory acceptability, physical parameters and nutrient analysis along with storage ability of the product is conducted. It contains balanced ratio of protein-carbohydrate and high in dietary fibers. This study demonstrates the utilization of pomegranate pomace, a by-product resulting from juice pressing, which is a good source of polyphenols, natural antioxidants and dietary fiber.

CPO - 30
Oat- A potential ingredient for development of functional food

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Oats are considered a secondary crop in most civilizations mainly used for animal forage, rather than human consumption. The oat is primarily grown for feed and forage but its use is now more focused on mining its benefits as health food. Oats match barley in features that are beneficial for good health, sometimes even better in few aspects. The importance of oat in the biomedical and cosmetic industry is also on the rise. Oats are able to tolerate biotic and abiotic stress to a great extent and are most suited among the basket of crops for many countries to mitigate the current regime of climate change. Oats, the staple food of people for ages in some countries, drew away from favour due to changes in food preferences. The oat is now being preferred as a functional food as it is rich source of fibres and also has antioxidant properties. It is consumed primarily as a breakfast cereal. Oats consists of low density lipoprotein (LDL) cholesterol; its consumption assures beneficial health effects such as safety against heart diseases, helps regulating blood sugar level in diabetics and also manages gastro-intestinal health and obesity. The increasing awareness about health related benefits and varied industrial uses of this crop have also raised hopes for boost in its production. The advances in scientific knowledge and technology have led to enhancement in yield and quality of oat cultivars suited to the requirements of consumers and the industry. Oats are very good source of fibre, especially beta- glucan and are rich in vitamins, minerals and antioxidants. Whole oats are the only source of a unique group of antioxidants called avenanthramides, believed to have protective

effects against heart diseases. Oats have well balanced nutritional composition and one serving 30 grams of oats contains 117 calories. By weight raw oats contain 66% carbohydrates, 17% protein, 7% fat, 11% fiber. Due its high nutritive content and nutraceutical properties, incorporation of oats in various food and dairy products as a additive possess great scope in development of functional foods.

CPO - 31
Chemical Properties of Cookies Prepared by the Different Combination of Soya and Corn Flour

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Bakery products are mainly prepared from soya and maize as its main ingredient. Soy and maize flour was incorporated in different proportion i.e T_1 (50:50), T_2 (60:40), T_3 (70:30), T_4 (80:40), T_5 (90:10). Chemical parameters of control and soy & maize blend cookies were analyzed after baking. Thereby blending soy and maize flour nutritional quality can be improved. Combinations of MF/SF significantly improved ($p<0.05$) the nutrient contents of the blends when compared to MF alone. The cookie containing maximum level of SF have high content of protein, crude fibre, ash and fat while the cookie containing maximum level of MF have high content of carbohydrate. The use of soy flour/maize flour blends for cookie preparation is an advantage in a non traditional wheat producing country and in improving nutritional quality too.

CPO - 32
Fortified Vegetable Pudding: Technology and Quality Control

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The food industry is moving towards developing new products by using innovative technology and ingredients with health benefits. It is clear that the use of globular proteins from legumes and grains can be a very interesting alternative to animal based food. Beside the nutritional properties, proteins from leguminous seeds and grains have gained increasing importance because of their functional properties, including gelling, emulsifying, fat absorbing and water binding properties. In recent years, interest in animal free foods has increased tremendously due to rise of nutritionally dependent illnesses, like diabetes type II, cardiovascular and digestive diseases. Lecithin commercially used as an emulsifier and reduce or eliminate eggs in the food products. Nutritionally,

lecithin, whose commercial source is soybean oil makes it suitable for vegetarians, increases HDL cholesterol while reducing LDL cholesterol by making LDL more soluble. In this study, microwave processed fortified vegetable pudding was developed using corn flour, soy lecithin, butter and milk as major ingredients. Sugar was substituted with addition of dates, honey and liquid date palm jaggery (Nolen gur). Vegetable and egg puddings were also made for comparison. Sensory analysis showed excellent gradation for fortified vegetable pudding. Polyphenol content measurements were carried out to draw a comparison between different types of pudding and resulted in higher value in fortified vegetable pudding than vegetable and egg pudding (4.85, 1.85, and 2.03 gm GAE/100gm respectively). Chemical analysis showed that fortified pudding contains lesser amount of sugar and fat compared to other puddings which may increase its popularity among diet conscious people and diabetic patients. So, fortified vegetable pudding can be served to the consumers as a health beneficial dairy dessert.

CPO - 33

Effect of thermal processing on carbohydrate fractions of selected cultivars of Chickpea (Cicer arietinum L.) and Cowpea (Vigna unguiculata L.)

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Effect of thermal processing on carbohydrate fractions of selected cultivars of Chickpea (Cicer arietinum L.) and Cowpea (Vigna unguiculata L.) The available carbohydrate (monosaccharides and disaccharides) and unavailable carbohydrate (oligosaccharides) contents of two cultivars of pulses viz. Chickpea (Desi types-PUSA-362, PUSA-1103, K-850, kabuli types –PUSA-1088, PUSA-1053) and Cowpea (Gomti, BL-1, BL-2, EC-4216) were estimated and effect of thermal processing (boiling, roasting, autoclaving and microwave cooking) was also investigated. Determination of total available carbohydrates was carried out by anthrone method. Bioscan methods of sugar analysis were also applied to evaluate changes in the soluble sugar fraction. An increase in TAC (Total available carbohydrate) of (21% to 33.4%) and reduction in oligosaccharide (Raffinose) by 52% after thermal processing was observed. Highest quantity was observed in Chickpea K-850(61.6 g/100g) and lowest in PUSA-1053 (41.3 g/100g) in raw flour. Statistical analysis (ANOVA) showed that after heat treatment, reducing sugars (glucose and other monosaccharides) increased but oligosaccharide decreased. Sugar content ranged from 1.6 mg/100g to 1225 mg/100g in kabuli type (PUSA-1053) cultivar of chickpea. Oligosaccharide-raffinose content decreased from 1225mg/100g to 479mg/100g in boiling and 279mg/100g in roasting treatments and was not detected after microwave and autoclaving process both at (15 and 30 min), respectively.

CPO - 34

Potential utilization of Garden cress (Lipidium sativum) for developing nutraceutical buns

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To improve the nutritional quality of buns with special reference to protein, fibre and mineral contents by supplementing Garden cress (Lipidium sativum). Nutraceutical buns were prepared following a standard procedure and various formulations have been prepared incorporating wheat flour, garden cress flour, sugar, salt, yeast, skimmed milk powder and shortening with slight modification. The best quality buns enriched with garden cress was developed by optimizing various ingredients/ parameters and was analyzed for sensory, physical, functional, biochemical parameters and storage stability using standard procedures. The buns prepared by supplementing garden cress flour had higher values of proteins, ash, fibre and mineral contents specially iron, potassium, calcium, copper, zinc than the control sample. Good quality buns were optimized with 4% garden cress flour with excellent sensory qualities. The best combination of the nutraceutical bun along with control sample were packed in LDPE and stored for 7 days at room temperature. These buns were stable more than 7 days without showing any changes in colour and mould growth. Regular intake of these buns can help poor people of developing countries to prevent protein and mineral deficiency diseases.

CPO - 35

Nutri cereals based composite flour : an alternative source for baked products

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The development of food products using composite flour has increased and is attracting much attention from researchers, especially in the production of bakery products. Millets have various nutrition qualities, and have rightly been called "nutri-cereals". Wheat is traditionally used in breads, and consumption of millet can be increased by replacing wheat by millet to a required extent. The aim of this study was to optimize millet-based composite flours for the preparation of breads. The composite flour samples were prepared using six different combinations of wheat, finger millet, black soybean and horse gram flour i.e ($CF_1$100:0:0:0:0, CF_2 85:5:5:5:5, CF_3 80:10:5:5, CF_4 70:10:10:10, CF_5 65:15:10:10, CF_6 55:15:15:15) and then best combination was find out on the basis of dough characteristics) i.e. dough volume, weight, specific volume and height. After getting

optimized ratio of dough sample bread was prepared. Bread samples were formulated using optimized flour blend as per standard procedure given by AACC (1990). Standard levels of ingredients for 100 g flour are following: yeast 3.0 g, salt 1.5 g, sugar 2.5 g, shortening agent 4.0 g and potassium bromated 10 ppm. Standard procedure includes combination of time and temperatures during dough formation are: mixing (by hand) for 3 min followed by fermentation at 24-28^{0}C for 75 minutes then re-mixing for 25 sec, recovery time 20 min moulding 5 min and proofing 55 min. The formulated bread was subjected to nutritional, physical (loaf volume, weight, specific volume and height), and rheological properties (firmness and elasticity). Results shown that Composite flour CF_2 which was formulated by mixing 5% finger millet, 5% black soybean, 5% horse gram and 85% wheat flour had best dough qualities. The CF_2 bread had loaf weight 202.80 g, loaf volume 741.00 cm^3, specific volume 3.72cm^3/g, height 7.5 cm and firmness 3.18 kg, respectively which was found to be better as compared to loaf characteristics of (control) white bread. Also its nutritional analysis concluded that it had 13.41% protein, 1.5% fibre, 3.61 mg/100g iron, 90.35 mg/100g Ca, 192 mg/100g P, 301.5 Kcal. Sensory scores also gave the comparable results. However Total cost of composite flour based bread was calculated as Rs. 7.0 per 200 g loaf weight which was observed to be little bit higher than wheat flour bread Rs. 5.0/200 g loaf weight.

CPO - 36

Formulation and Quality evaluation of composite flour for missi roti fortified with Sorghum (Sorghum bicolor)

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The objective of the study was to formulate composite flour mixes for missi roti using coarse cereal. Composite flour mixes (fortified with sorghum) for missi roti were prepared following standard procedure and various formulations have been prepared replacing wheat flour with sorghum as well as chickpea with full fat soy flour. The other ingredients i.e. dried fenugreek leaves/green chilli/coriander/onion and salt have also been optimized. The developed mixes were analyzed for sensory, physical, nutritional, functional, Hunter color analysis and storage stability using standard procedures. Sorghum based missi roti mix was found most acceptable with the ratio of wheat (45): chickpea (25): sorghum (20): full fat soy flour (5): dried spices 5% with excellent sensory qualities. Sorghum based missi roti mixes had higher values of proteins, carbohydrates, ash, fibre and mineral contents especially iron and potassium than the control sample. Hunter color analysis of instant missi roti mixes and roti showed decreased in L- value in all samples with supplementation of sorghum and full fat soy flour. Polypropylene was found to be the best as compared to other packaging materials for storage of instant mix up to 90 days. Development and consumption of such value added instant missi roti mix will help in increasing the utilization of coarse cereal in daily diet of the population.

CPO - 37

"Optimization of Processfor Preparation of RTE extruded Snack by using Buckwheat flour"

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Buckwheat (Fagopyrumspecies) (Kuttuin Hindi) is an old traditional underutilized crop plant belonging to the family Polygonaceae. As reported, the buckwheat is found to have good nutritional qualities but is still an underutilized crop. The objective of this project is, to utilize buckwheat flour along with some other ingredients, and to study the effects of this substitution on the sensory and textural attributes of prepared RTE snack food, which is palatable as raw and cooked in milk both. For preparing the RTE snack extruded snack product, the flour of buckwheat was mixed with the wheat flour and semolina in varying ratio. The ingedients were then mixed with water to prepare the dough. Dough was then extruded and dried first at (50^0 C for 30 minutes), and then baked at (150^0 C for 15 minutes). The extrudates were then subjected to sensory analysis. Sample ratio (50: 30: 20) was found best acceptable, in texture, color, and flavor.

CPO - 38

Development of Finger Millet Cakes with Variables of Chocolate and Banana

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Finger millet (Eleusine coracana) is an important crop grown in India. It has excellent nutritive value in terms of macro and micro nutrients. It is the richest source of calcium and is known as "poor's milk". It is also a rich source of carbohydrates, dietary fiber and total mineral contents. The study was undertaken to incorporate finger millet flour in cake preparation to diversify the use of finger millet flour. Chocolate and banana cakes were developed by incorporating different levels finger millet flour and were evaluated for physical, nutritional and organoleptic characteristics. The nutritional analysis of finger millet flour revealed that it contained 12.76 per cent moisture, 1.78 per cent ash, 1.0 per cent fat, 5.90 per cent protein, 1.9 per cent fiber, 290.00mg per cent calcium and 3.2 mg per cent iron. In banana cake maximum of 60 per cent finger millet flour could be used while in chocolate cake maximum of 50 per cent finger millet flour could be used. Addition of gluten @ 3g/100g millet flour in both the cakes facilitated use of finger millet flour upto 100 per cent. Both chocolate and banana

cakes with and without gluten were found to be acceptable (sensory score ranged from 6.7 to 8.1 on Hedonic scale). The incorporation of finger millet flour in cakes improved the nutritional quality. Significantly higher content of total ash, crude fat, calcium and iron except protein were observed in both types of cakes on comparison to control cake with 100 per cent refined wheat flour.

CPO - 39
Study on Formulation and Sensory Evaluation of Brown Rice -Soya Idli

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Idli is one of the balanced breakfast food in India .The present study was undertaken to determine the enhancement of functionality of brown rice-soya idli by incorporating soya flour, whole bengal gram flour, fenugreek seeds in brown rice idli batter. Brown rice-soya Idlis were prepared from brown rice and black gram flour incorporating soya flour, whole Bengal gram flour in the ratio of 10gm, 20gm and 30gm before fermentation and 5gm fenugreek seeds were added in all mixture. The developed products were analyzed for organoleptic qualities .The results revealed that 30gm incorporation of soya flour, bengal gram flour was widely accepted in terms of sensory parameters. Selections of ingredients for the development of brown rice -soya idli product were based on availability, nutrient content and their cost. The basic ingredients were brown rice (100 gm), black gram flour was added (80gm) as a base and incorporated soya flour, bengal gram flour at different ratio. Sensory analysis of brown rice-soya idli was carried out by Hedonic rating test. The sensory evaluations were carried out by organoleptic evaluation that is mouth feel, color, flavor, texture and over all acceptability. Sample T1H2 which contained 100:80:30:30:5 was more acceptable. It was suggested that these idlis are helpful in lowering the blood cholesterol level, decreasing the insulin level in diabetics' patients and are also rich in iron to maintain the blood level balance in women during menstruation and pregnancy.

CPO - 40
Process Optimization of Carrot-OAT Cookies Using Response Surface Methodology

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The objective of present study was undertaken to examine the possibilities of improving the functional quality of wheat flour based biscuit by the fortification with carrots and oats to develop ready to eat cookie, a functional bakery product. Oats have health benefits associated with dietary fiber such as beta glucan, functional protein, lipid and starch components and phytochemicals present in the grains. Carrot is inexpensive and highly nutritious as it contains appreciable amount of vitamin B1, B2, B6 and B12 besides being rich in carotene and fiber. Therefore the developed cookie

will contain numerous biologically active compounds which will help consumers to maintain their health and keep them far from chronic diseases. To develop these cookies whole wheat flour, fresh carrot, oats and other ingredients like sugar,brown sugar, margarine, vanilla essence and milk powder were taken. Ingredients were mixed together. Butter was beaten and sugar was added to it during beating. Vanilla essence was added to this mixture. All the wet and dry ingredients were mixed together and non-sticky dough was kneaded. This dough was rolled and shapes were cut out using cookie cutter. Cookies were lined on an aluminium tray and put in the oven. They were baked at temperatures,viz 170 deg. C for 25 mins. Ten cooled for 20 mins. and packed in air tight plastic container at 25 deg. C. On the basis of preliminary experiment the level of all independent variable such as carrot, oats and brown sugar were decided to produce better quality product. 20 trials were analysed with help of sensory evaluation on the basis of 9 scale hedonics later on these data were input into minitab 17 software to get result of the level of carrot used in the range (18-120 g), oats in the range of (20-50 g) and brown sugar (30-80 g). To analyze the the effects of these independent variable on the responses like color, flavor, sweetness, hardness, fructurability and % DPPH inhibition were designed using Central Composite Rotatable Design (CCRD) with the help of minitab17 software. ANOVA table of independent parameters that affect color, flavor, sweetness, hardness, fructurability and % DPPH inhibition were also made. Final moisture content of the cookie was 1.8 g/100 g, total sugar content was 25.1 g/100 g, protein content was 7.032 g/100 g, fat content was 2.36 g/100 g, ash content was found to be 3.26 g/100 g.

CPO - 41

Influence of Moisture Content on Different Temperature Profile on Various Dough Based Biscuits during Baking

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The present study was conducted on different types of dough (Hard Dough/Soft Dough) according to which we can determine the moisture content during baking of biscuits. The hard dough fermented by yeast is elastic and extensible whereas soft dough cohesive and plastic. Temperature of baking and moisture content are strongly coupled. The moisture content of biscuits was found to be decreased with increase in temperature inside the oven having different zones (approx 7). As dough forms the sheet, the machine specifically cuts the dough blanks by a roller as per the requirement. The hard dough & soft dough sheet go through single head rotator cutter and moulding roller, respectively. The formed biscuit pass the transition machine and enter into oven where moisture content of the biscuits in different zones was determined. Control and experimental treatments were prepared with different kind of dough using (soft & hard dough). The data obtained during the study was analysed statistically, from zone1 to zone7 of the oven. Hard dough

and soft dough having average moisture content 1.6 per cent and 2.48 per cent, respectively. The hard dough is lean dough whereas in soft dough high level of shortening or fat was added which reduces the extensibility of dough. After baking moisture content of soft dough biscuits was more than that of biscuits prepared from hard dough. All these significantly influence the textural property of biscuits.

CPO - 42

Standardization and Quality assessment of Instant Chakli Mixes from Little Millet and Chickpea

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The objective of the study was to test the suitability and optimization of little millet (kutki) and Chickpea in instant chakli mixes. Instant chakli mixes were prepared following standard procedure and various formulations have been prepared by replacing rice with little millet and blackgram with chickpea. Various parameters i.e. sensory, physical, hunter colour values, functional, nutritional were analysed as well as storage studies have been conducted. The formulation containing 10%rice, 10%blackgram, 50%little millet and 30% chickpea was found best with excellent sensory qualities. Value added chakli fortified with kutki and chickpea were found nutritionally superior in terms of protein, fiber, ash and mineral contents (iron and phosphorus). Hunter colour analysis of instant chakli mix showed decreased in L-value with supplementation of little millet and chickpea flour. Polypropylene was found to be the best packaging material for storage of instant chakli mix up to 90 days. It is suggested that little millet and chickpea being the cheaper source of essential nutrients may be used to prepare common snacks like chakli to increase its nutritional value, acceptability and palatability. Development and consumption of such instant chakli mix will help in increasing the utilization of little millet and economic upliftment of millet producers hence will contribute for the health of the population.

CPO - 43

Assessment of physicochemical characteristics and modifications of rheological properties of different varieties of maize flour using additives.

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Maize cereal has potential to be used for food purpose but lack of viscoelastic behaviour limits its use for this purpose. Therefore, present study on modification of pasting properties of maize flour

using different additives was carried out. Three maize varieties such as PMH1, JL3459 and Buland were procured from Department of Director seed, PAU, Ludhiana and analysed for physico-chemical properties and pasting profile of maize flour (PMH1, JL3459 and Buland) with and without additives (guar gum, xanthan gum, whey protein concentrate and potato starch). Maize (PMH1) had maximum thousand kernel weight (312.67g), bulk density (0.80g/ml), force to rupture (2.69g) and contained highest starch (67.70%) and fat (4.97%) among the three varieties of maize. The additives such as guar gum (0-1 per cent), xanthan gum (0-1 per cent), whey protein concentrate and potato starch (0-15 per cent) levels were incorporated in flour of all three maize varieties flour. Results showed that guar gum 1%, xanthan gum 1%, whey protein concentrate 5% and potato starch 5% were best to modify the modified pasting properties of maize flour. Hence, these additives can be a future tool for binding maize chapatti and development of other maize products.

CPO - 44
Genotype diversity of physiochemical properties of Mung Bean Starch

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Eight cultivars of Mung bean were procured and the starches isolated from using wet milling method. Sodium hydroxide was used as steeping media for isolation of starches from the seeds of the cultivars namely Samrat, 1PM, Malviya 12, Malviya 14, Swati, Laxmi, Priya and Shweta. Amylose content as determined by iodine complexation method ranged widely between 8-31.0%. The swelling power of starches which is the ability of starches to bind with water without granule rupture showed an increasing trend with temperature. Starches also showed an increasing solubility tendency in water with temperature. The microscopic images revealed polyhedral shapes of starch granules. The loose and packed densities of starches ranged between 0.48g/ml-0.72 g/ml and 0.66-0.87g/ml.

CPO - 45
Development of processtechnology forpreparation ofHealthDal

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Indeveloping countries, alarge segmen to fthepopulationsufferfromproteinmalnutrition. As theconsequenceofthis,thereisanincreasingneedtoidentifyandevaluatenewpotentialfood sources.InIndia,theexpandingpopulationhascreatedtheneedforexploringcheaplyavailable new sourcesoffood tocombatthe proteinmalnutrition. Pulsesrepresentone ofthe most importantfoodcategoriesthathavebeenextensivelyusedasstaplefoodstocoverbasicprotein

andenergy needsthroughoutthehistory ofhumanity.Healthdalisaconceptproductwhich closely resemblesthenaturalproductinphysical,nutritional,organolepticandfunctional characteristicsofdal.Theconceptproductisproduced by extrusiontechnology andisbased onaproteinsource. Inthisresearch,theformulationisdonebybalancingessentialaminoacid (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine)ofdalascomparedtoegg protein.Inthemilling process,sizableamountofbroken pulses,whichdonotfindany goodmarket,isutilizedtomakehealthdal.Thevariable parameterlikemoisturecontent(18-27%)andbarreltemperature(90-110°C)are variedfor differentcombinations.Eachcombinationisanalyzedintermsof functionalandproximate properties which resultin reduction of cookingtime tofiveminutes meetingallthenutritional parameters and finally, the extruded health dal hashigh protein content of about 27%.

CPO - 46

Influence of different organic treatments of nutrition on yield and yield attributes of rice (Oryza sativa L.)

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A field experiment was carried out during rainy (Kharif) season in 2014-15 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, to study the Effect of different organic sources of nutrition on nutrient uptake, yield attributes and economics of rice (Oryza sativa L.) cv. MTU 7029. 100% RDF+ vermicompost @5 t ha^{-1}+ Trichoderma compost @ 7.5 kg ha^{-1} significantly increase yield attributes, nutrient uptake and economics in comparison to other treatments and this was followed by 100% RDF+ vermicompost @ 5 t ha^{-1} + Trichoderma compost @ 5 kg ha^{-1}. 100% RDF+ vermicompost @5 t ha^{-1}+ Trichoderma compost @ 7.5 kg ha^{-1} increase yield attributes viz. Panicle length (25.05cm), Panicle weight (3.50 g), Number of panicle (133.20m^{-2}), test weight (22.93g), grain yield (54.0 qha^{-1}), straw yield (70.0 qha^{-1}), harvest index (43.56%), nitrogen uptake in grain (72.41 kgha-1) and straw (45.47 $kgha^{-1}$), phosphorus uptake in grain (18.90 $kgha^{-1}$) and straw (10.50 $kgha^{-1}$) and potassium uptake in grain (17.32 kgha-1) and straw (108.47kgha-1) over control. The lower yield, yield attributes, gross return and nutrient uptake was recorded in control. Rice is life for thousands of millions of people. In Asia alone, more than 2,000 million people obtain 60 to 70 per cent of their calories from rice and its products. Recognizing the importance of this crop, the United Nations General Assembly declared 2004 as the "International Year of Rice" (IYR). Rice (Oryza sativa L.) is a staple food for more than 60 % of the world's population and plays a crucial role in the economic and social stability of the world. India is the second largest producer of rice only after China. In India, area under cultivation of rice is around 45.0 m ha with production of 106.29 million tonnes (Anonymous, 2014). Uttar Pradesh is the

largest rice growing state only after West Bengal in country, in which it is raised over an area of about 5.29 m ha with the production of 14.41 million tonnes (Anonymous, 2014) which is 13.80% of total Indian rice production. The conjunctive application of organics with inorganic sources of nutrient reduces the dependence on chemical inputs and it not only acts as a source of nutrient but also provides micronutrient as well as modifies the soil physical behaviour and increases the efficiency of applied nutrients (Pandey, et al., 2007). Utilization of indigenous organic sources, viz. farmyard manure (FYM), obnoxious weeds and green leaf manures may serve as alternatives or supplements to chemical fertilizers, and help in increasing the productivity of the rice-based cropping system in all zones of the country. Organic manures play a vital role in sustaining higher productivity in intensive agriculture and irrigated rice in particular. Complementary use of organic and biological source of plant nutrient along with chemical fertilizer is of great importance for the maintenance of soil health and productivity. However, the availability of organic manures like compost, FYM, green manure and crop residue is a major limiting factor for their use. It is widely recognized that neither use of organic manures alone nor chemical fertilizers can achieve the sustainability of the yield under the modern intensive farming. Contrary to detrimental effects of inorganic fertilizers, organic manures are available indigenously which improve soil health resulting in enhanced crop yield. However, the use of organic manures alone might not meet the plant requirement due to presence of relatively low levels of nutrients. Therefore, in order to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers to obtain optimum yields (Sarangi, et al., 2013). Results have also shown that integrated nutrients management increases the yield and nutrient uptake (Mohanty, et al., 2013). The efficiency of nutrient use may be raised by the combined use of organic and inorganic fertilizers. Organic fertilizers not only act as the source of nutrients, but also provide micronutrients and modify soil-physical behaviour as well as increased the efficiency of applied nutrients.Integration of organic sources such as vermicompost and FYM may also help in the restoration of soil health (Pillai, et al., 2007). It may be concluded that application of 100% RDF+ vermicompost @ 5tha^{-1} + Trichoderma compost @7.5 kg ha^{-1} gives higher crop yield and higher productivity besides enhancing monetary returns.

CPO - 47
Characterization and Antioxidant Properties of Germinated Sorghum

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Germination is a natural processing technique for ameliorating the nutritional and functional qualities of food grains. The present investigation was carried out to characterize the effect of germination time and temperature on the germination characteristics, antioxidant activities and

functional properties of sorghum. The sorghum was soaked (10 hrs, 25°C) and germinated at 25, 30 and 35° C for 12, 24, 36 and 48 hrs followed by drying at 45° C (8% m.c). Significant variations were assessed with increase in germination temperature and time with respect to germination capacity and dry matter loss of grains. Increase in germination time and temperature significantly intensify the rate of germination. Peak and final viscosities of the germinated sorghum decreased progressively with increment in germination time and temperature. Lower pasting viscosities also cause a diminution in water absorption capacities of the sorghum. Antioxidant activity and total phenolic contents of sorghum augmented as the germination time and temperature progressed and reached its higher value after 48 hr of germination. Germination of sorghum can be used as a natural way to produce modified flour with improved functional properties and enhanced antioxidant activities.

CPO - 48
Functional properties and cooking quality of pasta from potato-cereal-legume blends

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Potato (Solanum tuberosum) being a good source of phytonutrients like flavonoids, carotenoids, caffeic acid has potential to be used as ingredient of pasta. The present study is based on the potential utilization of potato in semolina based pasta and its effect on various functional properties and cooking quality of the product. Potato flour was incorporated into semolina in varying levels (6%, 12% and 18%) and pigeon pea flour (10%). Quality of the prepared pasta was assessed in terms of cooking quality, texture, color and sensory acceptability. Luminosity and yellowness index of the pasta containing pigeon pea flour enhanced with increasing level of potato flour. Addition of potato flour to semolina enhanced the cooking quality of pasta as it reduced the minimum cooking time, increased the water absorption and volume expansion. The solid gruel loss was also affected by the potato flour levels. Textural properties of pasta varied considerably with the different levels of potato flour. Therefore, potato flour can be used in development of value added products like pasta.

Poster Presentations

Recent Advances in Functional and Value Added Food Product

Section - E

International Conference on Recent Advances in Food Processing and Biotechnology - Centre of Food Science and Technology, I. Ag. Sc., BHU, Varanasi - April 5-6, 2016

IAS - BHU

Abstracts
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FFV - 01
Fermented Foods and Beverages for improved basic necessities

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Fermented products can play an important role contributing to the necessities of rural and urban alike through enhanced food security, and income generation via a valuable small-scale enterprise option. Although harvesting or substrate may be seasonal, fermentation itself is largely independent of weather, and by-products can be recycled into livestock fodder. Fermentation activities are highly combinable with a variety of other traditional and domestic activities, and can make a particularly important contribution to the necessities of women, the disabled and landless poor who, with appropriate training and access to inputs, can increase their independence and self-esteem through income generation. In the world there are a large variety of fermented foods such as Tofu, Yoghurt. The diversity of such fermented products derives from the heterogeneity of traditions found in the world, cultural preference, different geographical areas where they are produced and the staple and/or by-products used for fermentation. Some of the most popular fermented products derive from grain, fruit and vegetables and are alcoholic- based – most notably and popularly a variety of traditional beers and wines. There are also many fermented food products which are extremely important in meeting the nutritional requirements of a large global population. Fermented foods make a major contribution to dietary staples. They can improve digestion, help protect against disease, and enhance immune function.

FFV - 02
Shelf life enhancement and utilization of Probiotic Potential through Microencapsulation

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Probiotics find important applications in human health and therauptic benefits. Curd has been utilized as a traditional food with cultural association since Vedic period. Recent advancements utilize immobalization and cell entrapment techniques in form of microencapsulation using sodium alginate, chitosan, carragennan as the chief coating materials which effects the viability of the micro-organism. Modified coating applications and control use of theses matrices with species specific coating material can enhance shelf life period that will be worth wile for storage and consumption. Functionally probiotics are known to provide many benefits in bowel syndrome, diarrhoea and treatment of cancer in some cases. Antibiotic resistance has been an area of challenge in recent chemotherapies attracting probiotics as a major option leading to development

of probiotic foods where the viability and the bacterial strains so involved is still an arena of continuous biotechnological investigation. With the growing ethics of GRAS and modified use of species specific matrices can significantly effect the viability of the microorganism. Hence, it should be formulated to find such a matrix which can lead to maximum survival of strains so selected. Commonly the strains utilized for probiotics include Bifidobacterium spp. and Lactobacillus acidophillus which have huge potential besides their antibiotic resistance, antimicrobial resistance and antioxidative potential. During ageing the probiotics colonies are deeply reduced. Microencapsulation provides succeeding atmosphere in tolerating the harsh gastric conditions and acidic environment of the GI tract for targeted delivery to obtain probiotic efficiency of 10^6 cfu/g in food samples.

FFV - 03
Food Derived Bioactive Peptides and their antihypertensive effect

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Biologically active molecules play vital role in reducing and regulating the onset of chronic degenerative diseases such as cardiovascular diseases, diabetes, cancer etc. Many dietary proteins apart from their basic nutritional role, contain different peptide sequences encrypted within their primary structure, that exert beneficial effects upon human health. Such effects are shown after release by digestive enzymes during gastrointestinal transit or by fermentation or ripening during food processing. Hypertension is commonly treated with blood pressure lowering drugs, in particular with the inhibitors of the angiotensin I converting enzyme (ACE; EC 3.4.15.1), which plays an important rolein regulating blood pressure in the renin-angiotensin system (RAS). Food derived bioactive peptides show antihypertensive property through ACE- inhibition and can become a promising alternate for synthetic drugs. Inhibitors bind tightly to the ACE active site, competing with angiotensin I for occupancy; consequently, ACE cannot convert angiotensin I to angiotensin II. Milk from different species is the main source of ACE-inhibitory peptides. Other animal protein sources of these peptides are muscle, ovalbumin, blood and fish proteins. Plant protein sources include, among others, pea, garlic, rice, soybean, wheat and amaranth proteins.Such peptides can be introduced into functional foods or dietary supplements. Integrity, absorption and bioavailability are the major issues to be considered while supplementation.

FFV - 04

Formulation of Ginger enriched mix vegetable soup to promote health and combat metabolic diseases"

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Ginger is a herb which is anti – inflammatory, anti – vomiting, excellent carminative, decrease excessive platelet stickness, protects heart and support normal blood clotting and is rich in potassium, magnesium, copper, magnese and vit.B6. The bottle gourd is excellent for the treatment of insanity, epilepsy and other nervous diseases, acidity, indigestion and ulcers. Carotene present in carrots is a known anti-oxidant, which can prevent degenerative processes in the cells and has great anti-aging effects. Tomatoes are low in carbohydrates and help control the glucose level.Since soups can be a good alternative to junk foods so a soup prepared by the combination of bottle gourd, tomatoes, carrot enriched with ginger can impart therapeutic advantages.This research was carried out with objective to prepare ginger incorporated mix vegetable soup of bottle gourd, carrot and tomatoes and assess its sensory acceptibility and nutritional value. The experiment was carried out in the foods laboratory, Nutrition Research Laboratory of Foods and Nutrition Department, Ethelind School of Home Science, SHIATS, Allahabad . The basic recipe was standardized and served as control (To) three treatment i.e. incorporation of Vegetable soup as different level was referred to as T_1, T_2, and T_3 respectively. The highest score obtained for over all acceptability of vegetable Soup with incorporate ginger extract was recorded in T_2 followed by T_0, in T_1, in T_3, T_3 (51.55kcal) was high in content of energy (kcal) followed by T_2(48.2kcal) followed by T_1 (44.85kcal), T_0(41.kcal5) and also in terms of protein, fat, riboflavin, VitaminA,Vitamin C,Ironand Calcium.The nutritional content of vegetable soup in ginger extract Vitamin A is the highest of the increase level nutrient content where T_3 followed (1,047mg) and lowest of the decrease level T_0 was (1,041mg). This is good for therapeutic purposes and can be included in the diets of people with various degenerative diseases.

FFV - 05

Nutraceuticals from fruits and vegetables and their potential for nutrient mediated healthcare

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Earth is rich in variety of plant species including the beneficial one having some medicinal properties. The use of herbal medicines for the treatment of various diseases like hepatitis, arthritis, chronic heart diseases, skin disorders, wounds and even cancer have been mentioned in our 'ayurveda' and proved scientifically by many researchers of modern times. Nutraceuticals are "naturally derived

bioactive compounds that are found in foods, dietary supplements and herbal products, and have health promoting, disease preventing and medicinal properties." Nutritional therapy and phyto-therapy have emerged as new concepts of health aid in recent years. Vegetables and fruits or horticultural crops in general represent the best examples of edible plant harvest having functional food properties with a potential to develop nutritional ingredients or supplements. The perception of horticultural crops and products only as food, pulps and juices in various forms is now changing with developments in nutrition research. The chemistry of horticultural crops including edible and non-edible plant biomass is gaining importance for their metabolic capabilities to compete with conventional medicinal plants constituents for preventive health care (Khanuja & Shukla, 2011). Among fruits, berries are the most common. True types represent the fleshy fruit produced from a single ovary called bacciferous berries. Many other fruits are classified as epigynous berries. These include diverse examples including bananas, cranberries and blueberries, and the cucurbitaceous species like cucumbers, melons and squash. Therefore, the berries whether bacciferous (true berry) or epigynous ((False berry), represent a huge diversity and metabolic potential to be used in or as functional foods. Important case examples are grape (Vitis vinifera), watermelon (Citrullus lanatus), banana (Musa spp.) and tomato (Solanum lycopersicum). Strong recommendations for consumption of nutraceuticals from plant origin have become popular to improve health, and to prevent and treat diseases. Some popular phyto-nutraceuticals include glucosamine from ginseng, epigallocatechin gallate from green tea, lycopene form tomato etc. Apart from this, fruits and vegetables also supply additional vitamins and minerals to the diet and are important sources of phytochemicals that play important role as antioxidants, phytoestrogens and anti-inflammatory agents and through various protective mechanisms. Fruits and vegetables have the potential to develop nutritional ingredients and supplements, causing a change in the perception of horticultural crops and products and helps in anaerobic digestion.

FFV - 06

Extraction of polyphenolic compounds from black grape (Vitisvinifera) and formulation of polyphenols fortified yogurt

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Black grape possesses a huge amount of nutraceuticals in form ofhealth-promoting polyphenols,which showsantioxidant, antibacterial,antifungal, anti-inflammatory, anti-carcinogenic properties etc. Yogurtis another famous fermented functional productwith multiple benefits like hypertension reduction, mineral absorption improvement, weight management etc.In thisstudy,peel, depeeled and whole grapes were subjected to solvent(water, ethanol, acetone and methanol) extraction of polyphenols and then the dried black grape extract was fortified to form

value added fruit yogurt.For the formulation of grape extract yogurt, extracts were evaluated and optimized to use on the basis of antioxidant, antibacterial and antifungal activities.Antibiotic resistant strains of Staphylococcus aureus, Enterococcus faecalis andEnterobacter aerogenes were screened for the antibacterial activity of different grape extracts. Mycotoxin producing molds like Penicilliumchrysogenum, Penicilliumexpansum, Aspergillus niger and Aspergillus versicolorwere screened for the antifungal activity.As compared to other solvent extracts,methanol extracts possessed high antioxidant, antibacterial and antifungal activity. Maximum zone of inhibition was found in case of Staphylococcus aureus i.e. 22 mm followed by Enterococcus faecalisand Enterobacter aerogenes i.e. 18 and 21mm respectively, at 1080 mg Tannic acid equivalent/ml of methanol peel extract.The maximum and minimum percent of growthinhibition was shown byPenicilliumexpansum and Aspergillusniger as 73% and 15% at 1080 Tannic acid equivalent/ml concentration of methanol peel extract, respectively.Methanol peel extracts possessed high functional properties; they cannot be incorporated into yogurt as they are toxic in nature. Therefore, dried grape peel ethanol extract was subjected to formulate yogurt.Based on the functional, textural and sensory properties, the optimized level of ingredients of yogurt was as follows: grape peel ethanol extract-1%, milk fat- 4 % and sugar-10 %.

FFV - 07
Vegetables: the Storehouse of Nutraceuticals

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In the stressful society of today, almost every third individual is suffering from the chronic health problems like diabetics, arthritis, allergy, cardiovascular disease, fatigue and even cancer. Recently, there is decline in the physical and mental capabilities along with the social values. So this certainly should raise the alarms that what are the changes in life style that might have a direct/indirect role in evolution of such declinesfi Nutraceuticals have been explored recently as sustainable alternatives for the control and prevention of large number of diseases. They have received considerable attention because they are safe, efficacious and have potential nutritional value as well as therapeutic effects. Among natural dietary supplements, vegetables being low in calories are packed with vitamins, minerals, antioxidants and phytochemicals. There is considerable epidemiological evidences indicating association between diet rich in vegetables and decreased risk of many diseases and therefore these are commonly known as protective foods. Vegetables like tomato, carrot, brinjal, broccoli, amaranthus etc. are major sources of biologically active nutraceuticals. The beneficial health effects of vegetables are mainly attributed to diverse antioxidant compounds such as vitamins, carotenoids, phenolics, alkaloids, nitrogen containing compounds, organo-sulphur compounds etc. Now-a-days people are more health conscious as a result there is an increased global interest in nutraceuticals. So there is a tremendous scope for future prospects of nutraceutrical enriched vegetables.

FFV - 08

Antioxidant Activity of Red Rice (Oryza rufipogan) as Affected by Various Processing Methods

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This study aimed at assessing the impact of various processing methods like soaking, roasting and microwave treatment on antioxidant activity of red rice (Oryza rufipogan).Red rice was processed by various processing methods, namely soaking, microwave treatment and roasting. The results indicated that because of all the processing methods there was a significant increase in antioxidant activity; Total phenolic content (TPC), radical scavenging activity (DPPH) and reducing power. Soaking of red rice has found the increased TPC, DPPH % and decreased Reducing power i.e. 905 mg/100 g Gallic acid eq., 47.67 % and 0.668 respectively as compared to the same of raw red rice i.e. 815 mg/100 g Gallic acid eq., 39.17% and 1.78 respectively. Roasting of red rice had significantly increased the TPC, DPPH % and decreased the reducing power i.e. 1201 mg/100 g Gallic acid eq., 41.71 5 and 0.772 respectively. Same way Microwave treatment of red rice has also shown the increased TPC and DPPH i.e. 1327 mg/100 g Gallic acid and 52.48 % respectively and decreased reducing power 0.816 as compared to raw sample. Thus the results have demonstrated that significant changes occurred in antioxidant activity of red rice as affected by various processing methods.

FFV - 09

Antioxidant Properties of Processed Dried Peels of Citrus Species And Its Application in Food Product Development

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Citrus and citrus products are a rich source of vitamins, minerals and dietary fibre that are essential for normal growth and development. Citrus fruits are particular high in a class of phytochemical known as limonoids and these components are the principle factor for bitterness in citrus fruits. These bitter substances (limonoieds, carotenoids, flavonoids and dietary fibers) have been shown to prevent a variety of cancer and cardiovascular diseases. Many studies have shown that citrus

peels have high mutagencity reducing activity than citrus juice. On the other hand, citrus peels are also nutritious but goes waste as do not fetch economical price to any industry. These are discard as a waste and it causes the pollution problem also in environment. These by products have commercial importance like citric acid and pectin etc. could be prepared and other useful option is to utilize the peel waste in making many types of food produts. The study involved the preparation of peel powder by different processing (boiling, blanching and steaming) and drying (sun and oven drying) method as well as antioxidant properties of processed kinnow (citrus reticulata) peel powder and processed mosambi (citrus limetta) peel powder. Analysis of antioxidant properties showed that vitamin C content was higher in kinnow peel (17.7-35.5 mg/100g) than mosambi peel (15.6-28.4mg/100g), total phenolic content high in mosambi peel than kinnow peel ferric reducing antioxidant properties was found high in mosambi peel (0.25-0.53 OD) then kinnow peel (0.37-0.47 OD). The acceptability of products (Biscuits, cake ice cream and pudding) was judged by 9 point hedonic scale by semi trained panel members. all the products incorporated with kinnow and mosambi peel powder in different concentration (2%, 4% and 6%).

FFV - 10
Physicochemical properties of Pectins from Kinnow peels (Citrus reticulata Blanco) obtained using different extraction conditions

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Kinnow peel is the waste of the citrus fruit processing industry and its disposal is becoming a major problem as it causes environmental pollution which can be used to make pectin. Pectins were extracted from fresh kinnow peels using two methods (i) acid slurry method (ii) pretreatment of peels by adsorption followed by acid slurry method. Analysis of chemical composition showed that the pectin with adsorption treatment contained higher methoxyl content and anhydrounic acid, and higher degree of esterification than the untreated pectin. The adsorption treatment gives lesser yields when compared to untreated pectins.

FFV - 11
Value addition in beverages with papaya leaves extract (carica papaya)

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Various parts of papaya have been traditionally used as ethno medicine for a number of disorders, including different diseases. The nutrient dense products can be helpful from therapeutic point of

view for people suffering from different deficiencies disease. Its mainly effects on dengue fever. Dengue fever is one of the life threatening disease caused by virus (flavivirus). The effect of papaya leaf juice improved the health of patient by increasing the number of platelets.The objectives of the study is to determine the nutritive value and asses the organoleptic evaluation of prepared beverages.The present study was carried out "Value addition in beverages with papaya leaves extract (Carica papaya)".Products i.e. Banana shake and pomegranate juice by incorporation of papaya leave extract mix at 5 %, 10 % and 15 % and served as treatments T_1, T_2 and T_3 respectively,T_0 served as control. Beverages were replicated three times and data obtained from analysis of variance (ANOVA) and critical difference (CD) techniques. Chemical analysis was analyzed by the procedure of AOAC (2005).The result also indicated that the papaya leaves extract incorporated in Banana shake and Pomegranate juice of the products were well acceptable on the basis of sensory evaluation. In banana shake Treatment T_1 (60:45:5) and in pomegranate juice also T_1 (95:5) found to be the best treatment followed by T_2 and T_3. The result of nutritional composition of prepared beverages, banana shake was found rich in calcium content i.e. (147.33mg±0.83) and protein content i.e. (3.38g±0.28). Iron content was found rich in pomegranate juice i.e. (4.49mg±0.51).On the basis of findings it is concluded that the addition of papaya leaves extract increased nutrient density of all prepared beverages.

FFV - 12
Role of microalgal metabolites in novel functional food products

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Microalgae have a long history of use as foods and for the production of food ingredients. There is also increasing interest in their exploitation as sources of biologically active ingredients for use in the formulation of novel functional foods and nutraceuticals. In order to survive in a highly competitive environment, algae have to develop defense strategies that result in a tremendous diversity of compounds from different metabolic pathways. Over 15, 000 novel compounds have been chemically determined. Healthier foods and beverages containing whole algae are being designed which are having huge commercial market. Prebiotic properties of algae and algae-supplemented products are also being exploited. Algal hydrocolloids are used for the production and delivery of probiotic bacteria. Algal bioactive metabolites like algal polysaccharides, algal lipids, fatty acids and sterols, algal proteins, phlorotannins, and pigments and minor compounds possess antioxidant, antimicrobial, anticancer, anti-inflammatory, anti-obesity and anti-diabetic properties,

gastric and hepatic protective effect. Thus, the growing use of algae biomass for nutraceutical purposes is expected to provide an attractive revenue stream for algae producers.

FFV - 13

Nutritional composition and antioxidant property of Machilus edulis: An underutilized wild edible plant of the Sikkim Himalaya

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This study was undertaken to investigate Machilus edulis fruits for minerals, total phenolic and flavonoid contents, and antioxidant activity.Mature ripened fruits of Machilus edulis was collected from plant growing at Kalimpong, Sikkim and brought to the GBPIHED, Sikkim unit. Fruits of uniform size and colour were chosen and washed in water. Thereafter, fruits were dried in shade and seeds were manually separated. Air dried samples of M. edulis were powdered using blender and subjected to extraction using different solvents viz. methanol, ethanol and ethyl acetate and the extraction yield was calculated. Total phenolic and total flavonoid contents were determined according to the Folin–Ciocalteu and aluminum chloride calorimetric methods, respectively. Antioxidant activities were determined using two different methods (DPPH free radical scavenging activity and ABTS assay). Mineral analysis was performed using Atomic absorption spectrophotometer.Results showed that extraction yield varied considerably as a function of solvent nature and ranged from 7.6 to 22.6%. The ethanol extract afforded the highest yield (22.6 %) while the lowest yield was obtained by ethyl acetate (7.6 %). In comparison to methanol and ethyl acetate extracts, ethanol extract also contained the highest total phenolic content (80.55±6.63 mg GAE/g extract) accompanied with strong antioxidant activity in DPPH (IC50 value=140.64 µ g/ mL of extract) and ABTS (IC50 value=6.63 µ g/ mL of extract) assays. Thus, these results suggest that ethanolic extracts of Machilus edulis fruit may serve as a potential source of natural antioxidant for food and nutraceutical application.

FFV - 14

Protective effect of Nigella sativa against diabetes in rat models

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The present investigation was aimed to study the effect of Nigella sativa supplementation on streptozotocin induced diabetic rats.Twenty-eight Wistar rats (weighing 100-250 g) were divided into four groups: Control, Diabetic, Nigellasativa supplemented group and Nigella sativa

supplemented diabetic group. Diabetes was induced by streptozotocin (45 mg/kg body weight), intraperitoneally. Diabetic rats were given aqueous extract of Nigella sativa seeds (100 mg/kg body weight), orally up to 16 days. At the end of the study, the animals were sacrificed and blood samples were drawn to determine Blood glucose level, Plasma Alkaline phosphatase (ALP) levels, Plasma Cholesterol levels, Creatinine, Plasma Thiobarbituric acid-reactive species (TBARS) content and erythrocyte malondialdehyde (MDA) content.Blood glucose level, plasma cholesterol level, ALP, Creatinine, TBARS content and erythrocyte MDA content which were found elevated due to diabetes, were reduced significantly and reached to normal levels aftersupplementation with aqueous extract of Nigella sativa.Nigella sativa seeds may therefore be recommended as a therapeutic agent for the management of diabetes mellitus.

FFV - 15
Nutraceuticals in Vegetable Crops

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Technological advancement leads to changed lifestyle and diseases. Nutritional deficiency is a major concern now days and we can overcome from nutritional deficiencies by daily consumption of vegetables. According to W.H.O daily requirement of vegetables per day per capita is 285 g. Vegetables occupy an important place in our daily meal so nutraceuticals in vegetable crops could help us modern people to manage our daily nutritional requirement. Nutraceuticals is a broad umbrella term- these are the products that range from isolated nutrients, dietary supplements and herbal products, specific diet and processed food such as cereals, soups and beverages. Basic idea is to supply natural building blocks of body and provide extra health benefits naturally. The objective is to let food be thy medicine and medicine be thy food. Global sales of nutraceutical in year 2010, 2013 and 2015 are Rs.13000 187.40, Rs. 17300 and Rs.25000 respectively. The global nutraceuticals market is estimated to Rs.1548 billion. As per as India is concerned the global share is just 1%.Thus India has a wide scope for development of nutraceutical market. Some of the vegetable crop important as nutraceutical point of views. Tomato contains lycopene, folate, vitamin A vitamin C and Alpha carotene. Root crops contain beta carotene. Broccoli contains isothiocynate and kale is rich in lutien. From above we can conclude that in this age of self-medication nutracueticals are destined to play a crucial role in future therapeutic development but their success will be governed by control of purity, safety, efficacy including innovation. Nutraceuticals efficiently congregate nature and science for human welfare.

FFV - 16
Nutrigenomics: The Way of Producing Personalized Functional Food

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Nutrigenomics is the segment of genomics that studies the effect of various food constituents on gene expression of an individual. This emerging branch of nutrition and health care is aiming towards providing a personalized diet, exercise and lifestyle recommendations based on DNA analysis of a person to reduce the risk of certain diseases. Person's genotype is analyzed for getting guidelines regarding the distribution of macronutrients, micronutrients, supplementations, stress and environmental factors that are impacting health. From the information available through the study of individual's genetic makeup, the exact essential nutrient may be identified which would provide excellent healing and preventive effects over the body. So, the lifestyle and diet choices can easily be made. Nowadays, functional foods are being developed and utilized with medicinal properties. But while implementing the knowledge of nutrigenomics, the goal of medicinal bioactive component is to prevent rather to cure. Nutrigenomics will thus be providing good tasting food with formulations to achieve specific targets. Some ethical problems regarding appropriateness of claims made, scientific evidences, social and cultural values, financial implications, awareness, confidentiality, privacy, accessibility etc. still remain unresolved for which regulatory guidelines and control is going to be essential.

FFV - 17
Antioxidant and Antimicrobial activity of Chaurai (Amaranthus viridis) and Makoi (Solanum nigrum) leaves

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Chaurai (Amaranthus viridis) and makoi (Solanum nigrum) leaves have been used as anti-tumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic and anti-pyretic agent. The aim of the present study was to investigate the effect of processing on the proximate composition, antioxidant and antimicrobial activity of Chaurai and Makoi leaves.The effect of processing methods such as dry heating, blanching and pressure cooking on the proximate composition and antioxidants activities of Chaurai and Makoi leaves was studied. Antimicrobial activities were also observed in terms of Inhibition zone and Minimum Inhibitory Concentration (MIC) for various processed samples of Chaurai and Makoi leaves.The fiber content was maximum in the raw samples of Chaurai (9.86%) and Makoi leaves (9%). It was observed that the antioxidant activities increased after processing like dry heat, blanching and pressure cooking of Chaurai and Makoi leaves. TPC is higher (257.87mg

GAE/g) in the blanched sample of Chaurai and Makoi leaves. Tannin content is maximum (0.66mg tannic acid/g) in the raw sample of Chaurai leaves whereas Makoi leaves have (0.74mg tannic acid/g) higher tannin in dry heated sample. DPPH is highest (92.78%) in blanched sample of Chaurai leaves and Makoi leaves (93.17%). The antimicrobial activity against the microorganisms like S. aureus, Salmonella, Shigella and E.coli. was found maximum in blanched and raw samples of Chaurai and Makoi leaves. The methanolic extract of various processed samples showed MIC of 20 and 40mg/ml against selected pathogens.

FFV - 18

Role of Viscous Soluble Fiber (β-glucan) in the metabolic control of Diabetes mellitus: A review

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Diabetes mellitus (diabetes) is a chronic condition characterized by high blood glucose level (hyperglycemia). There are 171 million people worldwide suffering from diabetes in 2000 according to World Health Organization (WHO) statistics and this number would be more than double by 2030 (WHO 2008). The disease is responsible for 3.2 million deaths every year (WHO 2008). Studies shows that Cereals such as barley or fractions of oat bran are particularly high in the soluble fiber □-glucan, which when taken with a meal improve the glucose response in patients.The purpose of this review was to critically evaluate current research on the effect of Role of Viscous Soluble Fiber (□-glucan) in the metabolic control of Diabetes mellitus Methods: An extensive literature search was performed using a variety of medical and scientific databases including Medline, Pub Med, Google scholar, Science Direct, and Ovid, to identify relevant articles.A 50% reduction in glycemic peak can be achieved with a concentration of 10% □-glucan in a cereal food. Substantial research has demonstrated that Glucose responses were reduced after test meals by both oats and barley □-glucan, although more by barley (29-36% by oats and 59-65% by barley). Insulin responses after test meals were significantly reduced only by barley (44-56%).The effect of beta-glucans to reduce blood glucose could be mediated possibly by delaying stomach emptying so that dietary glucose is absorbed more gradually. Diabetic individuals can benefit from diets that are high in □-glucan, which, as a component of oats and barley, can be incorporated into breakfast cereals and other products.

FFV - 19

Nutraceuticals and functional foods and their role of in human diet

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Nutraceuticals, is a blended word of two words i.e. nutrition and pharmaceutical, was coined in 1989 by Stephen L. DeFelice, founder and chairman of the Foundation of Innovation Medicine, is an enriched food with minerals and vitamins that provides health benefits besides to its basic nutritional value. While functional food is a one of the type of nutraceuticals and is enriched food with minerals and vitamins rather than they are given through concentrated capsule or liquid to perform additional functions which are related to either growth, development or for increasing resistance and immunity power against disease, are collected from existing sources. This process is called nutrification. It doesn't alters the quality of food and maintain as before processed besides adding of some complementary nutrients e.g. fortified milk with vitamin D, Lactobacillus from yoghurt, flavones in fruits and vegetables. Nutraceuticals and functional foods play vital role in the generation of people especially in developed countries, who prefers fast foods, high energy foods, and unbalanced diets which are deficient in essential food components, invites various types of diseases like obesity, osteoporosis, chronic disease and cancer. Vitamin E, selenium, vitamin D, green tea, soy, and lycopene are examples of nutraceuticals widely studied in human health (Brower, 1998). In a such a way nutraceuticals and functional foods provides with balanced amount of vitamins, fats, proteins, carbohydrates, etc. to body required for healthy life. Hence, nutraceuticals and functional foods have lion's part in the balanced food diet in present generation.

FFV - 20

Neutraceuticals: Therapeutic Perspective

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Neutraceutical can be defined as a foodstuff (as a fortified food or dietary supplement) that provides health benefits in addition to addition to its basic nutritional value. Nutraceuticals have received considerable interest because of their presumed safety and potential nutritional and therapeutic effect. Pharmaceutical and nutritional companies are aware of the monetary success taking advantage of the more health-seeking consumers and the changing trends resulting in a proliferation of these value-added products aimed at heart health to cancer. Some popular nutraceuticals include glucosamine, ginseng, Echinacea, folic acid, cod liver oil, omega-3 eggs, calcium-enriched orange juice, green tea etc. Majority of the nutraceuticals are claimed to possess multiple therapeutic benefits though substantial evidence is lacking for the benefits as well as

unwanted effects. In this presentation we have collected the information which is devoted towards better understanding of the nutraceuticals based on their disease specific indications. With the rapidly increasing interest in the nutraceutical revolution, we need to establish a vibrant nutraceutical research community which is absolutely necessary to convert the majority of potential nutraceuticals to established ones thereby truly delivering their enormous benefits to all of us. The list of nutraceuticals being studied is changing continually and reflects ongoing research, market developments and consumer interest.

FFV - 21
Development of some nutritious snacks for school going children

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Kids are hungry, tired and exhausted after coming back home from the school. Children seem to have the biggest appetites at this time. They need some good heavy snacks that contain some amount of protein along with carbohydrates to refuel their body. After school, snacks also contribute to the daily nutritional needs.The present study was carried out to prepare the nutritious snacks by using multigrain like pearl millet, maize, oat, Besan and whole wheat flour. The products were churma, biscuit, sev, suhali, barfi and shakkarpara. The methods of prepration were same as traditional methods. Organoleptic tests and proximate analysis was done to determine the acceptance level over controls products and their nutritional composition.The nutrient analysis and organoleptic tests of food is an important part of quality assurance. The overall acceptability level of all products was significant.All products were analyzed for total ash, protein, fat,carbohydrate,energy and fiber content and the results were presented per 100gm cooked weightbasis.After conducting the sensory and nutrient analysis it can be concluded that all the products the most acceptable levels of fortification was whole wheat flouri.e.30%,corn i.e., 25%, and remaining fortification of oat, besan and bajra was 15%. According to the nutrient composition among all the products experimental products was found to have maximum amount of protein, least amount of fat, calories but with good amount of fiber than control or traditional products. This can be a nutritious and tasty food supplement for children over junk foods.

FFV - 22
Development of Functional Gulabjamun from Soya Fortified Milk"

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The present study was undertaken with the objectives"Development of Functional Gulabjamun Using Khoa from Soya Fortified Milk" to develop suitable technology for preparation of functional khoa, to assess the feasibility of using functional khoa for the preparation of functional gulabjamun, to evaluate the organoleptic quality, chemical quality, microbiological quality, rheological quality, energy value of functional gulabjamun and cost of the product. Five different ratios of buffalo milk and soya milk i.e. 1 : 0, 1 : 1, 1 : 2, 1 : 3 and 1 : 4 indicated as T_0, T_1, T_2, T_3 and T_4 respectively and three different levels of maida i.e. 30 per cent, 33 per cent and 35 per cent indicated as M_1, M_2 and M_3 respectively were used in the present study. Fifteen treatment combinations used in the study i.e. T_0M, T_1M_1, T_1M_2, T_1M_3, T_2M_1, T_2M_2, T_2M_3, T_3M_1, T_3M_2, T_3M_3, T_4M_1, T_4M_2 and T_4M_3 were replicated six times. Sensory evaluation of the 179 prepared functional gulabjamun was carried out by using nine point hedonic scale. Products were tested for moisture, fat, protein, carbohydrate, ash, total solids, coliform, yeast and mould, hardness, adhesiveness, cohesiveness, gumminess, springiness and Chewiness. Yield and cost of the product was also worked out for different treatment combinations. The data obtained during investigation were statistically analyzed by using factorial design and critical difference between treatment combinations.Highest overall acceptability of functional gulabjamun was found in T_0M (8.35) and T_1M_1 (8.49). Amongst the different treatment combinations the highest flavour and taste score of 8.25 was found in T_0M followed by T_1M_1 (8.37). The treatment combination T_1M_1 was most acceptable in terms of body and texture as it has the highest score of 8.47. For colour and appearance the treatment combination T_0M (8.31) was found to be most acceptable followed by T_0M_1 (8.64) and T_1M_1 (8.64).Treatment combination T_3M_3 contained the highest percentage of total carbohydrate (45.15), ash (1.99), total solids (69.82), yield (54.16) and the production cost of this treatment combination was also less as compared to others. The treatment combination T_2M_1 contained highest percentage of fat (13.99). The treatment combination T_4M_2 contained highest percentage of protein (9.14). The energy value of gulabjamun (T_4M_3) was highest (340.82 kcal/100 gm).

FFV - 23

Nutritive value of value added products prepared from Jamun seeds powder and Fenugreek seeds

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Herbal medicine is the oldest form of healthcare known to mankind. Jamun seeds powder have good nutritive value and were quite rich in carbohydrate. Fenugreek seeds are rich source of minerals, vitamins and phytonutrients, calories and very good source of soluble dietary fiber.To study the nutritive value of value added products prepared from jamun seeds powder and fenugreek seeds.Jamun seeds and fenugreek seeds were oven dried. Jamun seeds were ground and powder was prepared and fenugreek seeds were roasted. Value added sweet biscuits amd salty biscuits were prepared in which jamun seeds powder and fenugreek seeds were added in refined flour in the ratio of 60:36:4, 60:32:8, 60:28:12 and 60:24:16 respectively. After that, products were prepared using jamun seeds powder and fenugreek seeds viz. sweet biscuits and salty biscuits. These products were analyzed for its nutritive value.Nutritive value of prepared products revealed that IV (60:24:16) incorporated sample of sweet biscuits and salty biscuits contained high amount of protein and fat, moderate amount of crude fiber and ash, I (60:36:4) incorporated sample of sweet biscuits and salty biscuits contained high amount of carbohydrate.This study suggests that how to prepare and take advantage of medicinal properties of value added products from jamun seeds powder and fenugreek seeds.

FFV - 24

Pomelo Fortified Bread for its Antidiabetic and other Biofunctional Properties

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Pomelo fruit has been recommended in traditional herbal medicine as a remedy for diabetes. Due to its limited cultivation and astringency nature, it cannot be consumed in higher amounts. Pomelo is rich in bioactive compounds like naringin which exhibits anti-diabetic property. Hence it has been used in developing products for health beneficial purpose.Breads were prepared using fresh segments at 10, 20 &30% and dry segments of pomelo at 2.5, 5 & 7.5% using maida (100%) and a blend of maida:atta (1:1). The samples were analysed for its physio-chemical properties, sensory profiles, retention of bioactives (naringin), anti-diabetic property (a -glucosidase assay) and phytochemicals.Increase in fresh segments in the formulation, the crumb firmness value decreased from 436 to 298 g force, whereas with dry segments the value increased from 314 to 424 g force.

Breads prepared using 5 and 7.5% of pomelo dry segments using maida (100%) showed highest inhibition against a -glucosidase. Naringin, a bioactive compound which is responsible for anti-diabetic property was found to retain in breads ranging from 1-18mg. Physio-chemical properties and sensory characteristics were better in breads prepared from 100% maida. Fresh pomelo segments at 20% and dry pomelo segments at 5% were sensorially acceptable. Phytochemicals such as flavonoids, carotenoids and phenolics retained to a greater extent in bread containing dry pomelo segments. Hence fortified bread prepared from 5% dry Pomelo fruit segment is recommended to gain nutritional value and to decrease the risk of diabetes.

FFV - 25
Nutraceutical Application and Value Addition of Banana Chips

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The banana is an edible fruit, botanically a berry, produced by several kinds of large herbaceous flowering plants in the genus Musa. Banana popularity is on the rise due to its high nutraceuticals and pharmaceutical value. Banana is unique because each of its parts—fruit, pulp, peel, seed, leaves, flowers and the bark are utilizable. Banana is the second largest after citrus and it accounts around 15% of global fruit production. India's participation in the world banana production is 27% and it also contributes about 37% of the total fruit production in India. Though raw banana has many health benefits but due to its unfavorable taste it's not accepted by the people as their daily diet, so by converting the raw banana into tasty crispy chips form it can easily increase consumer acceptability. The main by-product of banana processing industry is peel, which represents almost 30% of fruit. However, nobody pays attention to banana peel, which is unfortunate because they could be helpful in many medicinal applications. As a natural source of various polyphenols and bioactive molecules, it possesses many curative properties and able to cure many kinds of illnesses.In this study the polyphenol content (mg GAE/gm) of hot air and microwave dried banana chips with and without peel were measured. Sensory analysis showed good acceptability of banana chips with peel. The investigation of the antioxidant potential and phyto-chemical content of different types of banana chips showed that the content of total phenols were higher in banana chips with peel compared to other varieties. Hence the huge amount of phyto-chemical content of banana peel indicates that consumption of banana chips with peel may be useful to combat free radical mediated diseases.

FFV - 26
Nutraceutical and Functional aspect of Water chestnut Pudding With Honey

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Water Chestnut (Trapa bispinosa) popularly known as Singhara in local language is highly nutritive fruit contains carbohydrate , protein , and essential minerals and also contains a plentiful B vitamins including B_1, B_2 B_5 and B_6 ,E, A and vitamin C. In wake of growing demand of the consumers for natural foods having good therapeutic values, water chestnut offers excellent opportunity. The high consumption values of the fresh fruit are probably linked to the high nutritional and organoleptic value, and also to the increasing interest of the consumers towards organic products. Non-conventional food resources and their value addition have attracted attention in the recent years for their potential use as functional ingredients in food formulations. The whole plant is used in gonorrhea, menorrhagia, and other genital affections. It is useful in diarrhea, dysentery, ophthalmopathy, ulcers, and wounds.. Honey is rich in phenolic compounds, which act as natural antioxidants and are becoming increasingly popular because of their potential role in contributing to human health. A wide range of phenolic constituents is present in honey like quercetin, caffeic acid phenethyl ester (CAPE), acacetin, kaempferol, galangin which have promising effect in the treatment of cardiovascular diseases .In this paper, the recent reports on nutritional, and functional aspects of water chestnut (Trapa bispinosa) pudding, as a medicinal and nutritional food, are reviewed.

FFV - 27
Trends on Functional Foods and Misleading Labelling Issues

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In a developing country like India we are witnessing fast changes in food habits and life styles. The functional foods and nutraceutical industry is rising very high in all nations across the globe. This would require partnerships between research institutions, private entrepreneurs, industry, government and common man. Many corporates have come up with newer products that fit very well into our traditional food habits i.e. Fe fortified flour, low sodium high fibre diets etc. But still majority of these diet supplements are beyond the reach of a common man due to very high costs, unavailability in remote places etc. All these issues shall have to be addressed in future to make these foods and food supplements really effective to change the lives of a common man. Certainly, a

success in this area shall divert government's health expenditure from disease cure to disease prevention. Further, the future of functional food industry would also be determined to a large extent by the type of legislation and regulatory mechanism established in different countries in near future. But for sure, the expansion of this industry would largely depend upon how best a product convinces the consumer for the health and nutrition claims made. In the race of developing products for variety of consumers the, many of the reputed food industries have taken advantage of less stringent regulatory mechanisms in India. An improvement in the situation would definitely require proper education of the consumer and making the law more stringent and acceptable at international level so as to derive real benefits of the functional food components.

FFV - 28
Antioxidant activity of Tamarind seed –a by-product of tamarind pulp industry

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Antioxidant recovery from solid by-products from food processing industry is gaining much interest recently. In this study, tamarind seed- a waste of tamarind pulp industry is explored as a source of antioxidant and phenolics. Different extraction conditions affecting antioxidant activity are also studied.Tamarind seed obtained from fresh tamarind fruit.Chemicals: Anthrone reagent, conc. H_2SO_4, dextrose, Na_2CO3, NaOH, $CuSO_4$,sodium potassium tartarate , Folin ciocalteu reagent,gallic acid, glacial acetic acid, sodium acetate, $FeCl_3$, $FeSO_4$, TPTZ, ethanol and chloroform.Whole tamarind seed was dried in hot air oven and blended to fine homogenous powder. Total carbohydrate, protein and fatcontent were estimated by Anthrone, Lowry and solvent extraction methods respectively. Antioxidant extract was prepared using water and ethanol assolvents with varying extraction conditions.The crude extracts were freeze dried. Total polyphenol and antioxidant content of the lyophilised extracts were estimated.Tamarind seed has been found to contain 55% total carbohydrate, 18.7% total proteinand 13.2 % total fat in dry weight basis. The antioxidant activity and polyphenol content of water extract of tamarind seed range between 672- 1242 µmol/g and 12- 22 GAE/g respectively . Whereas, the total antioxidant activity and polyphenol content of ethanol extract 1623- 2578 µmol/g and 23- 36 GAE/g respectively. Sample to solvent ratio, extraction time, extraction temperature have been identified as the factors affecting antioxidant activity and total phenolic content and encouraging results were obtained.

FFV - 29

Evaluation of nutraceutical composition of Phellinus allardii (Bres.) S. Ahmad

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Mushrooms have been receiving great attraction in nutraceutical and pharmaceutical field as they have appreciable flavor, medicinal and nutraceutical contributions being rich in various bioactive compounds. The genus Phellinus (Family: Hymenochaetaceae) in relation to its nutritive and medicinal properties is of immense importance as various species of the genus Phellinus have been used traditional folk medicine to cure different diseases like diarrhoea, stomachaches, inflammation, arithritis, hepatoprotection, detoxification, combating allergy and diabetes. Forest survey was conducted to collect the wild the specimen of Phellinus allardii followed by its taxonomic identification and by standard methodology. Then determination of proximate composition was done. The mineral constituents were estimated by WDXRF technique. The fatty acid profiling was done by GCMS method. In the present investigation, the powdered basidiocarp of the mushroom Phellinus allardii has been studied for its various nutraceutical properties in terms of its proximate composition, mineral constituents and fatty acid composition. The mineral composition of P. allardii has been determined by wavelength dispersive X-ray fluorescence (WDXRF) technique. The presence of various minor and major mineral nutrients having immense role in boosting human health like Ca, K, Fe and Mg have been detected. Fatty acids which are important nutritional and physiological components have been analyzed by GC-MS technique. The mushroom has been found to be rich in various nutritive and medicinally important saturated and unsaturated fatty acids such as Oleic Acid, Linoleic acid and Arachidonic acid. The present study revealed that the mushroom Phellinus allardii can be used in nutraceutical and traditional drug formulations.

FFV - 30

Effect of different drying techniques on polyphenolic, flavonoid content and antioxidant properties of mahua flower

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Mahua (Madhuca longifolia) grows naturally in many parts of the India and its sugar rich edible corollas have great nutrient value. The flowers are edible and rich source of sugar, protein, vitamin, polyphenols, flavonoids and minerals . The objective of this study was to compare the effect of drying techniques on phenolic content and antioxidant activity of mahua flower. Effect of

microwave-assisted hot air drying (MD) ; hot air drying (HD); vacuum drying (VD) and sun drying (SD) on total polyphenol content (TPC), total flavonoid content (TFC), Antioxidant activity (DPPH, FRAP, ABTS) of the mahua flower was evaluated. Analysis of data shows that phenolic content and antioxidant activity changes were affected by drying techniques. Drying destroyed flavanols, and polyphenols , and there was a significant decrease in antioxidant activity. This study has demonstrated that microwave -assisted hot air drying , can produce high-quality products, with the additional advantage of reduced processing times, compared to other processes such as hot air-drying and vacuum drying. The present study concludes that these flowers might be useful in the development of many nutraceutical or functional products as they are rich source of minerals and bioactive constituents.

FFV - 31
Preparation and Characterization of Value Added Banana Chips

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The medicinal properties of banana have been documented in ancient Indian literature and found to be effective in cure of many diseases. As a staple fruit, it is available thought out the year and provides livelihood security to thousands of people. The main by-product of the banana processing industry is the peel, accounting 30% of the fruit which constitute environmental hazard. High dietary fiber, polyphenolic and related bioactive compounds content of banana peels make them promising for variety of applications in nutraceuticals and medicinal purposes. According to the criteria established by the National Cancer Standard Institute, banana peel extract is classified as non-toxic to normal human cells therefore; it can be safely utilized as a natural source of antioxidants for value addition in banana chips. In the present study the banana chips with and without peel were prepared by drying (using tray dryer at 60^{0}C 70^{0}C, 80^{0}C) and microwave processing (360, 540,720,900 watt). The results showed that moisture loss and shrinkage loss of banana chips increased with increase in time of drying and temperature and wattage of microwave. All types of chips were accepted by sensory analysis with highest gradation was obtained by microwave processed chips without frying. Polyphenol content (mg GAE/gm) of tray dried and microwave dried banana chips with and without peel were investigated which showed that microwave processed banana chips with peel contain highest amount of polyphenols compared to other varieties. Hence consumption of microwave processed banana chips with peel may be useful to combat free radical mediated diseases.

FFV - 32

Scope for the Value Addition of Millet Crops for Nutritional Security

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Millets constitute an important component of diet of millions of people across the world. In India, a sizable population particularly in arid, hilly and tribal regions is dependent mainly on coarse cereals for their food and nutritional security. Millets have been classified as major millets which include sorghum and pearl millet and several small grain millets which include finger millet (ragi), foxtail millet (kangni), kodo millet (kodo), proso millet (cheena), barnyard millet (sawan) and little millet (kutki). Millets are miles ahead of rice and wheat in terms of nutritional value. They have more fibre than rice and wheat. Finger millet has thirty times more calcium than rice while every other millet has at least twice the amount of calcium compared to rice. Similarly they are rich in iron content and micronutrients as well. Unlike cereals, primary processing of millets poses some problems for want of proper machinery, particularly for small and medium scale enterprises. In recent years, a variety of traditional and non-traditional, millet-based processed foods and complementary foods have been developed which can become income generation activity for women in household industry. The present paper describes some of the important facts relating to nutritional properties of millets with few examples for their conversion into health and novel foods, which make their consumption acceptable to the common mass, particularly the urban population for nutritional security and income generation activity.

FFV - 33

Comparative Analysis of Antioxidant Properties of Aqueous, Methanolic and Ethanolic Extract of Wheatgrass

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This study was aimed to investigate the nutritional composition and mineral content ofwheatgrass, and to analyze antioxidant properties of aqueous, methanolic andethanolic extract of the sample. Nutritional composition and mineral content of wheatgrass have been analyzed by using AOAC method. Antioxidant properties were determined of aqueous, methanolic and ethanolic extract of wheatgrass. Wheatgrass powder was found to rich in protein, iron and calcium content and low in fat content. Methanolic extracts of wheatgrass showed highest total poly phenol content (TPC),FRAP value and DPPH radical scavenging activity whereas total flavonoid content (TFC), metal chelating activity exhibited highest in ethanolic extract of wheatgrass. Aqueous extract of

wheatgrassshowed highest ferric reducing power. Wheatgrass being a good source of antioxidantstherefore may be recommended against the treatment of various human diseases.

FFV - 34

Enhancement of the Nutritional Quality of Fermented Baked Products and its Organoleptic Evaluation

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The present study was an outcome of efforts to prepare incorporated fermented baked products and its assessment through organoleptic evaluation. For this purpose fresh red carrot were used for making carrot powder and then, the prepared powder were to be mixed with refined wheat flour in different proportions and baking were done by the oven. Three samples in different proportions of 10:90 (Product 1), 20:80 (Product 2) and 30:70 (Product 3) were kept for sensory evaluation of organoleptic attributes. The scores were found to increase with 10% of incorporated carrot powder in breads and biscuits and 20% in bun rather than control (samples without incorporation). The content of fibre was also increased in the developed product.

FFV - 35

Fermented Foods Value Addition Millet Flour Based Weaning Mix: A Value Added Product by Natural Fermentation

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Different value added products are being developed now a days from several unconventional sources. One of those approaches was development of weaning mix from underutilized crops of Uttarakhand (finger millet, barnyard millet, black soybean, amaranth grain). Different pretreatment methods were adopted to improve cereal protein quality and decreasing anti-nutritional property of the grains. The grains after pretreatment were grinded at a constant speed using a mixer and grinder, and sieved using mesh size 0.05 mm. Cereal and legumes were mixed in the ratio 60:40 and a total of 150 g sample was prepared for natural fermentation. Prepared sample was dissolved in distilled water up to 500 ml volume. Slurry concentration was fixed at 30% (w/v). Fermentation was carried out under ambient conditions by naturally present microorganisms on the grains surface. Slurry was kept in incubator for 24h. To avoid mold growth, 0.1% potassium Sorbate was added. After 24 h, the fermented slurry was transferred to aluminum trays and dried in tray dryer at 55-

65fi C for 13 h. Dried sample was grounded to powder form and sieved with a mesh size of 0.05 mm. 20% w/w skimmed milk powder was added to make final weaning mix. Functional, nutritional and anti-nutritional properties of weaning mix were determined. It is clear from the experimental data that fermentation resulted in significant increase in carbohydrate (2.4%), protein (25%), iron (150%), calcium (114%), total calorific value (79%), and water absorption capacity (81%) while 53% decrease was observed for fat, 33% for tannin and 78% for water absorption index.

FFV - 36
Development of ω-3 fatty acid incorporated hypocholesterolemic cheese spread

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Among various functional ingredients fi -3 fatty acid is very popular due to its several health benefits such as brain development; protection against thrombosis, atherosclerosis, inflammation, cancer, autoimmune disorders, aging, cardiovascular disease, rheumatoid arthritis, Parkinson's disease, Alzheimer's disease etc. In the present study, to develop a hypocholesterolemic processed cheese spread (PCS) fi -3 oil (contain 58% a -linolenic acid; derived from flax seed) was added in three different levels (2, 3 and 4%) in PCS. As the level of fi -3 oil addition increased, moisture, a_w and titratable acidity decreased and all textural parameters (firmness, work of shear, stickiness and work of adhesion) decreased significantly ($p<0.05$). At 3% and higher than that level of fi -3 oil addition there was significant ($p<0.05$) decrease in sensory acceptability. So, PCS at 2% level of fi -3 oil addition was optimized. The developed product was treated with nisin (400 IU nisin/g cheese) and stored for 6 months and observed change in some microbiological, physico-chemical, rheological and sensory attributes. It was noticed that product with nisin had higher sensory score as compared product without nisin throughout the storage period. To validate its hypocholesterolemic effect, developed product was fed to hypercholesterolemic rats and it was observed that serum total, LDL, VLDL cholesterol and Atherogenic index, triglycerides decreased and at the same time liver cholesterol and triglycerides decreased significantly ($p<0.05$). It was estimated that production cost of the nisin treated cheese spread without (control) and with fi -3 oil were Rs. 20.16 and 26.75, respectively.

FFV - 37
Shrikhand Fortification with Nutraceuticals Extracted from Broccoli

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Shrikhand was formulated with broccoli extract. Broccoli extract was incorporated in shrikhand which leads to the more appealing pale green coloured shrikhand possessed large amount of anticarcinogenic cardiovascular disease resisting and antibacterial properties along with health benefits of shrikhand. Different solvent like acetone, ethanol, methanol and water were used for extraction of bioactive compounds from broccoli. Highest yield was found in acetone followed by ethanol, methanol and water. Different levels of broccoli extract (0.1%-0.3%) and sugar (30%-35%) were used in the preparation of shrikhand. Response Surface Methodology (RSM) was applied to optimize the final product. Then the optimized formulation was analyzed for various physico-chemical and sensory attributes. Optimized recipe containing 0.30% dried broccoli extract along with 67% chakka and 35% sugar was found most acceptable by the sensory panellist. Proximate composition of the optimized broccoli extract shrikhand was 38.49% moisture, 42.53% sucrose, 11.35% protein, 10.78% fat, 0.65% ash and acidity of the product was 1.36. DPPH activity, ABTS activity and total phenol in the final product was found 76.4333, 51.2853, 5.4493 respectively. This fortified shrikhand possessed 15-18 days shelf life at 10 ^{0}C.

FFV - 38
Neutraceuticals and cancer prevention

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The term "neutraceuticals" combine two words –"nutrients" (a nourishing food component) and "pharmaceuticals (a medical drug). Neutraceuticals is used to describe any product derived from food sources with extra health benefits in addition to the basic nutrition value food in foods. Most often they are grouped in the following categories: dietary supplements, functional foods, medicinal food , pharmaceuticals. Depending on the jurisdiction, product may claim to prevent chronic disease, improve health , delay the aging process ,increase life expectancy or support the structure or function of the body. Association between dietary habits and disease shows that foods has a direct impact on health .Neutraceuticals reduces the toxicity associated with chemotherapy and radiation therapy and inhibits cell proliferation and induce apoptosis in cancer cells. Patients undergoing chemotherapy and radiotherapy treatment require more antioxidants. Combination of antioxidant vitamin and minerals may have the potential to protect the DNA damage that cause chronic diseases. Neutraceuticals and functional foods provide means to address the increasing burden on the health care system by promoting health through prevention rather then treatment.

FFV - 39
Value-added Products of Underutilized Fruits

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Fruits could be used to prepare various value-added products. These products are nutritious and high in fiber and antioxidants. However, the products prepared from underutilized fruits are different from those of mainstream commodities due to limited and seasonal availability and difficulties in harvesting/collection. Low availability, high costs, lack of awareness, and ideological aspects keep products away from daily diets and adversely affect underutilized fruit accessibility and business of its value added products. Under such conditions there is dire need to prepare and to market a number of long shelf-life products of underutilized fruits. Limited availability and seasonality, time and labor requirements for plucking and/or cleaning, and often smaller edible portions of the fruits make it cumbersome job but demand of value added products of underutilized fruits is very high. Many value added products were successful not only in national markets but also in international markets. The demand of value added products of underutilized fruits is increasing yearly.

FFV - 40
Food Fortification: Technology for Better Nutrition

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India has a high prevalence of micronutrient deficiency-related health risks, which can be improved by food fortification. The burden of micronutrient malnutrition is very high in India. Food fortification is one of the most cost-effective and sustainable strategies to deliver micronutrients to large population groups. Food fortification plays an important role to improving nutrition and prevent from micronutrient malnutrition. Fortification of widely distributed and widely consumed foods has the potential to improve the nutritional status of a large proportion of the population, both poor and wealthy.However, an obvious requirement is that the fortified foods needs to be consumed in adequate amounts by a large proportion of the target individuals in a population. From a public health viewpoint, micronutrient malnutrition is a concern not just because such large numbers of people are affected, but also because it has been a risk factor for many diseases. It can contribute to

high rates of morbidity and even mortality. Fortification of food with micronutrients is a valid technology for reducing micronutrient malnutrition as part of a food-based approach when and where existing food supplies and limited access fail to provide adequate levels of the respective nutrients in the diet. In such cases, food fortification reinforces and supports ongoing nutrition improvement programmes and should be regarded as part of a broader, integrated approach to prevent micronutrient malnutrition.

FFV - 41

Microwave Assisted Extraction of Polyphenols from Apple peel of the Indian variety

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The microwave assisted extraction (MAE) technique is emerged with great advantages over other conventional technique. Apple peel are the potential source of polyphenols, apple of Simla variety was subjected to extract polyphenols by using microwave assisted technique and solvent extraction (SE) technique using methanol, ethanol, acetone and water as solvents. While comparing the extract obtained the MAE showed the highest value for Total phenolic content and antioxidant activity (DPPH inhibition, ABTS inhibition, SOSA inhibition). The extract showed the 108.78mg/100g Gallic equivalent per gram of total phenolic content, 82% of DPPH inhibition, 51.8% of ABTS and 46.3% of SOSA inhibition for MAE and showed the 90.19mg/100g Gallic equivalent per gram of total phenolic content, 66% of DPPH inhibition, 46.97% of ABTS and 36.13% of SOSA inhibition with SE. Apple peel extract also had antimicrobial and antifungal activity against pathogenic bacterial strain named S. aureus, E. coli. and Salmonella spp. more over apple peel also showed the potentiality to check the growth of Fusarium verticillioides and Aspergillus niger which are human pathogenic fungi.

FFV - 42

Evaluation of Antioxidant and Antimicrobial Capacity of Indian Pomegranate seed extract

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The Indian Pomegranate (Punica granatum), is a preponderant member of Punicaceae family. It is a fruit-bearing deciduous shrub possessing high nutritional and phytochemical medical value. Reports suggest that the fruit bears significant antioxidant activity and can contribute to free radical scavenging and reduction of oxidative stress. Therefore, an attempt has been made to screen the

phytochemical, antioxidant and antimicrobial properties of pomegranate seed using ethyl acetate (polar) and petroleum ether (non-polar). The yield of the extract from both the solvents was satisfactory. The overall experiment was done in three successive steps. Firstly, the phytochemical content of both the extracts were analysed and the presence of various bioactive compounds were confirmed. Secondly, free radical scavenging activity of Pomegranate seed extracts was tested by the DPPH method. Both the extracts exhibited closely similar radical scavenging activity. Ethyl acetate extract exhibited better reducing power activity in comparison to petroleum ether extract and the results were confirmed using reducing power assay. Eventually, growth curve studies were performed to examine the antimicrobial activity of the petroleum extract against Pseudomonas aeruginosa and Staphylococcus aureus. The extract showed very potent bacteriostatic activity against Staphylococcus sp.

Hence, the extract of the plant can be further subjected to confirmatory analysis for the detection of functional bio-compounds.

FFV - 43
Sea Buckthorn: The Miracle Plant of Higher Hills

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Sea buckthorn is known to be the miracle plant of higher hills due to its unmatched profile of vitamins, minerals, polyphenols, flavonoids, Omegas 3, 6 and 9 as well as over 190 phytonutrients and provides many benefits to human body. This miracle berry also features the rare Omega -7 fatty acid and has a high content of antioxidant. Botanically it belongs to genus Hippophae and family elaeagnaceae and is a deciduous shrub growing naturally in cold desert trans-Himalayan region. Three species, namely Hippophae rhamnoides subsp. Turkestanica, H. Salicifolia and H. Tibetana are generally found in Indian Himalayas. Despite its highly acidic nature and exotic flavour, sea buckthorn berries are having good potential for producing various processed products like ready to serve beverage, squash, syrup, jam and jelly. Delicious blending of sea buckthorn juice/ pulp with other fruits such as papaya, apple and orange in different ratios could be a promising way for the processing of sea buckthorn and minimisation of juice astringency. The oil extracted from the seeds of the sea buckthorn plant contains about 90.7% of the polyunsaturated fatty acids and 3 mg/ gm of vitamin E. The juice of berries contains more amount of ascorbic acid and carotene as compared to the apple, orange and papaya juices. The citric acid content varies from 4.8-8% and the each berry has 70-80% of juice. The local people have so far reaped a small fraction of its benefits on account of huge possibilities of utilizing this hidden treasure of the Himalayas.

FFV - 44
Utilization of by-products from Egg and Egg product Industries

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This study was conducted to find out the multiple uses of eggshells in nutrition and medicine.Eggshells can be utilized for various purposes that minimize their effect on environmental pollution. Eggshells and eggshell membrane are probably the best natural source of calcium. One whole medium sized eggshell makes about one teaspoon of powder, which yields about 750-800 mgs of elemental calcium plus other micro elements. Eggshell powder hasbeen reported to increase bone mineral density in people and animals with osteoporosis. In laying hens in the late production phase, eggshell powder has been found to increase egg production and improve thequality of shells. Discarded eggshells are often used as a plant fertilizer. This is because eggshells contain calcium that raises, or neutralizes, the pH level of overly acidic soil. Chicken eggshells can be used as an alternative soil stabilizer like lime since they have the same chemical composition. Such stabilized soil can be used as subgrade materials in road construction works. Eggshell membrane consists of collagen as a component. Collagen has been isolated mainly from bovine and swine skins and bones. Collagen used in medicine, biochemical, pharmaceutical, food and cosmetics industries. After the outbreaks of bovine spongioform encephalopathy, foot and mouth disease, autoimmune and allergic reactions, restrictions on collagen uses from these sources were enforced. Eggshell membrane collagen is very low in autoimmune and allergic reactions as well as high in bio-safety and is of similar characteristics to other mammalian collagen. Eggshells/shell membranes have multiple usesinnutrition, medicine.

FFV - 45
Process Technology for Preparation of Grain Based Probiotic Beverage Mix

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Probiotics are defined as "live microorganisms which when administered in adequate amounts confer a health benefit on the host". Probiotics can play an important role in immunological, digestive and respiratory functions. With the aim to develop functional and nutritionalrich probiotic drink, sprouted and roasted green gram and roasted maize powder were used along with soy protein isolate/skimmed milk powder and sugar giving a powder premix. The formulation for the powder

premix was done using linear programming. Premix was mixed with water (ratio 1:2 and 1:2.5 (w/v)) to give a high protein grain based beverage. Physio-chemical and microbiological properties for the beverage were found to be acceptable. The beverage was then inoculated with the probiotic bacteria Lactobacillus plantarumwith inoculum level 1-10% and at temperature range of 37-42 °C. Fermentation was carried out until the pH for the inoculated beverage reaches to 4.5 (low acid foods). The probiotic beverage was then freeze dried to make it in powder form. The reconstituted probiotic beverage (22-24 °bx) was tested for its functional properties and the microbial count which was found to be upto 10^7log cfu/ml. It had good sensory qualities and was highly acceptable with a sensory score of around 7.5

FFV - 46

Value Addition and Nutritional Enrichment of Chhana Spread Prepared from Cow Milk on Account of Milk Various Coagulation Temperatures and Different Levels of Salt

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Chhana is heated and acid coagulated indigenous milk product which forms the base of several popular Indian sweets like Rasogulla, Sandesh, Rasamalai and Chumchum etc Chhana or paneer, means the product obtained from cow or buffalo milk or a combination of them by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70% of the moisture, and the milk fat is not less than 50% of the dry matter (PFA, 1976). In this study cow milk as (M_1) were used for making chhana spread and three different coagulant temperature 60°C, 65°C, 70°C asT_1 T_2 T_3 and three salt levels 1%,1.5%, 2% S_1, S_2, S_3 were used in the present experimental work. 9 treatment combinations used in the experiment namely $M_1T_1S_1$, $M_1T_1S_2$, $M_1T_1S_3$, $M_1T_2S_1$, $M_1T_2S_2$, $M_1T_2S_3$, $M_1T_3S_1$, $M_1T_3S_2$, $M_1T_3S_3$ and replicated three times. The experiment treatment combination ($M_1T_1S_3$) chhana spread contained highest percentage of moisture (65.61). The experiment treatment combination ($M_1T_3S_1$) contained highest percentage of fat (19.30).The highest percentage of protein (17.14) was found in the treatment combination ($M_1T_2S_1$).The highest percentage of lactose (3.08) was found in the treatment combination ($M_1T_2S_1$). The treatment combination ($M_1T_3S_1$) contained highest percentage of ash (3.08).The highest percentage of calcium (479.63) was found in the treatment combination ($M_1T_2S_1$). The highest energy value of (253.26) was found in the treatment combinations ($M_1T_3S_1$). Chhana spread is still in its infancy and needs various parameters to be fixed and tested before its commercial use and large scale productions by organized sector.

FFV - 47
Bael enriched shrikhand

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The present research work was undertaken for the development of Bael enriched shrikhand (BES). The response surface methodology was used for the optimization of the process. The variables taken for present work were concentration of bael pulp powder and powdered sugar in the range of 5-15% and 25-35%, respectively. Thirteen trials were performed & analysis was based upon the effect on the responses for instance color, flavor, sweetness, body & texture and overall acceptability (OAA) scores. Optimized result were obtained with bael pulp powder and powdered sugar with 15 & 25% respectively showing huge impacts on colour (8.29), flavor (8.52), sweetness (7.98), body & texture (8.14) and OAA (8.34). The overall desirability was 0.89. The developed bael enriched shrikhand (BES) provides maximum sensory attributes which poses higher impact on the consumer acceptability of the product as well as ensures promising health benefits.

FFV - 48
Medicinal preponderance of Ben oil (Moringa oleifera. Lamm.)

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Moringa oleifera, commonly called the horseradish tree, drumstick tree, miracle tree and Mother's Best Friend known for its multi-purpose attributes, wide adaptability and ease of establishment. The leaves, fruits, flowers and immature pods of this tree are edible and they form a part of traditional diets in many countries of the tropics and sub-tropics. Moringa oil got a special name that is Ben oil because it has high amounts of behenic acid. It has an impressive range of medicinal uses with high nutritional value. Mature seeds yield 38–40% edible oil. The refined oil is clear, odourless and resists rancidity and this oil exerts many therapeutic and emollient properties for hairs as it simply lifts dirt out of the hair and naturally cleanses the scalp. It contains three varieties of vitamin E i.e a -tocoferol (105 mg/Kg), fi -tocoferol (39 mg/Kg) and d -tocoferol (77 mg/Kg) because of its various antioxidants and skin rejuvenating qualities it can also be used and included in soaps, shampoos, body washes and skin scrubs doing wonders for ageing and skins lacking nutrients. It also have antiseptic and anti-inflammatory properties and has been used to treat and heal minor skin abrasions; scrapes, burns, insect bites, sunburn and skin infections. Small amounts of Moringa oil

added to the diet of young children can provide them with a more varied and nutritious diet. This oil is rich in vitamins and unsaturated fatty acids, it has 68.9% oleic acid, 3.8% of linoleic acid, 1.5% myristic acid, 3.6% palmitic acid and 10.8% stearic acid, 6.3% behenic acid and 0.13% lignoceric acid. Ben oil is used for hysteria, scurvy, prostate problem and bladder trouble and especially the villagers in Oman use this oil to treat stomach problems. Moringa oil can also be applied in the production of expensive and natural perfumes and fragrances. Moringa oil's high oleic level, ability to absorb and retain even the most volatile scents combined with its enduring shelf life, make it a popular choice for traditional perfume production. Because it contains powerful antioxidants, it is absorbed rapidly into the skin, making it is a good choice for beauty products that are rinsed off the skin, such as soaps and shampoos. This oil has antimicrobial properties due to which it has also been used in Sudan to purify water and reduce bacterial counts.

FFV - 49
Therapeutic potential of Alfalfa: A miracle herb

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Alfalfa (Medicago Sativa) is a perennial forage legume species with a high production of leaf protein. alfalfa's name is rooted in the Arabic word that means "Father Of All Foods". It is native to a number of different countries in temperate climates throughout the world. Some of the alfalfa health benefits have been known for 1500 years or more. It was a popular herbal medicine among many traditional healers. In early Chinese medicines, physicians used young alfalfa leaves to treat disorders related to the digestive tract and the kidneys. It has been widely used as antihypertensive, hypocholestromic, liver tonics, diuretics, digestive, antidiarrheal, appetite stimulant, analgesics, antibacterial and in skin disorders. Extensive studies on Alfalfa have been carried out by various researchers and a wide spectrum of its pharmacological actions have been explored which may include antidiabetic, anticancer, immunomodulator, analgesic, antimicrobial, antiinflammatory, hepatoprotective, renal protective, gastroprotective, antioxidant properties, etc. Due to its miraculous power of healing, Alfalfa has got the place among the top ranked evidence based herbal medicines. Leaves and young shoots can be eaten raw or cooked. The leaves can also be dried for tea good for stimulating your appetite or used in soups. Alfalfa seeds can also be ground into a powder mixed with cereal flours for making nutritional breads and other baked goods. It can be a dietary supplement supporting the human body in fighting malnutrition.

FFV - 50
Importance of Nutraceuticals derived from Horticultural Crops

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The word Nutraceutical is formed by two words "nutrition" and "pharmaceuticals" and are naturally derived bio active substances that may gives the beneficial effect to human health. Phytochemicals are non-nutritive plant chemicals produced by the plants to provide them protection. Phytochemicals from horticultural crops have either defensive or disease protective properties. Phytochemicals and antioxidants from fruits and vegetables provide prevention from diseases like cancer, diabetes, heart disease and hypertension. Fruits and Vegetables are also regarded as protective foods. Horticultural crops are the best examples of edible plant harvest having nutraceutical potential to develop nutritional ingredients and supplements. Horticultural crops like bael (Aegle marmelos), bananas (Musa spp.), pomegranate (Punica granatum), carrot (Daucus carota), ginger (Zingiber officinale), vanilla (Vanilla planifolia), chilli (Capsicum annuum), garlic (Allium sativum), amla (Phyllanthus emblica), broccoli (Brassica oleracea var. Italica), cranberry (Vaccinium spp.) and citrus fruits like orange (Citrus sinensis) and lemon (Citrus limon) etc., having important nutraceutical potential. Raw leafy vegetables are rich in mineral, vitamins and roughage and it Prevent constipation and enhances gastrointestinal function. According to Epidemiological studies, the diet rich in fruits, vegetables and whole grains reduces the oxidative stress and chronic disease. The diet rich in antioxidants like Carotenoids, lipoic acids, ascorbates, tocopherols and polyphenols is associated with a lesser occurrence of degenerative diseases due to free radical scavenging effect. Consumption of Fruits and vegetables as green salad plays an important role to improve the immunity system. It is also recognized as major cause to get rid of obesity by controlling the appetite. Nutraceuticals are classified into following categories viz. dietary supplements, functional foods, medicinal herb, enriched food, nutritional food and noval food. Nutraceuticals provides all the essential nutrients and supplements that should be present in human balanced diet. Now a days, the awareness among the peoples for prophylactic and therapeutic role of nutraceuticals are increasing day by day.

FFV - 51
Okra seeds as new potential source of nutrients

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Okra (Abelmoschus esculentus) is one of the most widely known and utilized species of the family Malvaceae and grow as tropical to subtropical plant that is widely distributed from Africa to Asia, Southern European and America. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds. Nutritionally, the richest part of the okra plant is the dried seed. Although the oil of the okra seeds is edible and the residual meal after oil extraction is significantly rich in protein, the seed is not processed for either the oil or the protein as the seeds are produced only for seedling and regeneration purposes. There are only fragmentary accounts of the use of okra seed as a food. However, large quantities of seed are discarded as unfit for seedling purposes. The oil content okra seeds varying from 20% to 40%, which consists of linoleic acid up to 47.4%, a polyunsaturated fatty acid essential for human nutrition. Okra seed is known to be rich in high quality protein especially with regards to its content of essential amino acids relative to other plant protein sources. Okra seed is mainly composed of oligomeric catechins (2.5 mg/g of seeds) and flavonol derivatives (3.4 mg/g of seeds), while the mesocarp is mainly composed of hydroxycinnamic and quercetin derivatives (0.2 and 0.3 mg/g of skins). Pods and seeds are rich in phenolic compounds with important biological properties like quartering derivatives, catechin oligomers and hydroxycinnamic derivatives. These properties, along with the high content of carbohydrates, proteins, glycol-protein, and other dietary elements enhance the importance of this food stuff in the human diet. Moreover, okra seed oil has potential hypocholesterolemic effect.
Keywords: Okra, Nutritional, Oil and seed

FFV - 52
Development of symbiotic yogurt from Soyabean

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Preparation of symbiotic yoghurt from soyamilk utilising two different culture sources (Bifilac sachet and Probiotic yoghurt). The main objective of this study was to compare the physico-chemical and nutritional aspects of the developed yoghurts with respect to control. The work was also aimed at studying in-vitro effect of anti-microbial components on Escherichia coli and

Staphylococcus aureus. Soyabeans were soaked in hot water overnight and soyamilk was extracted in different solid to water concentrations. The trials were done with milk as control with different concentrations of mixed culture (Bifilac) and probiotic yoghurt (Mother Dairy, Calcutta) and the same is done with soyamilk. Thermal treatment was carried out for each trial and good manufacturing and hygiene practices were maintained. The variations of the culture sources that were included were 0.5%, 0.75% and 1% for Bifilac and 1%, 1.5% and 2% for probiotic yoghurt. Various trials were done at 37^{0}C for 4, 6, 8 and 16 hours. Storage was done in refrigerated condition for 5 days. The overall change in characteristics with respect to its gel strength, water binding capacity, acidity and pH were carried out. Special emphasis was given to evaluate its nutritional profile with respect to iron content, amino acids and soluble protein. The anti-microbial effect of the developed yoghurt was studied against E.coli and S.aureus. Among three concentrations of solid to water ratio,1:1, 1:1.2 and 1:1.5; 1:1.2 was the best medium for developing soy yoghurt. Comparing the two said culture sources, the soy yoghurt having 1.5% culture taken from probiotic yoghurt came out best in the criteria of its setting and flavor. The acidity of the said yoghurt was recorded 0.7% in terms of lactic acid. Recorded gel strength of this yoghurt was 0.0714 kgf where as for control it was 0.0408 kgf.

FFV - 53
Hypoglycemic and hypolipidemic effects of barnyard millet

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Barnyard millet (Echinochloa frumentacea) is one of the important nutritious minor millet. Major producers of barnyard millet are Uttarakhand and Tamilnadu. Uttarakhand is the leading state with respect to production of barnyard millet. Barnyard millet is rich source of phytochemicals like dietary fiber, resistant starch, polyphenols and antioxidants. Along with this barnyard millet also contain appreciable amount of minerals. Several studies have revealed the hypoglycemic and hypolipidemic effect of barnyard millet consumption. Consumption of barnyard millet for a period of 28 days among diabetic and normal volunteers revealed a significant reduction in blood glucose (139.2 to 131.1mg/ dl), LDL-C (from 167.7 to 162.9 mg/dl), VLDL-C (from 24.0 to 23.2 mg/dl), ratio of TC: HDL (from 4.7 to 4.6) and LDL: HDL (from 3.2 to 3.1) in the experimental diabetic groups. Similar, but marginal changes were observed in experimental non diabetics (Ugare et al., 2014). Traditionally the barnyard millet was consumed in form rice only. Various studies suggest the use of barnyard millet for making variety of food products. A health mix using barnyard millet was formulated by Surekha et al., (2013). Its efficacy was studied on normal subjects. The results revealed a reduction in blood glucose level (7%), triglycerides (10%) and total cholesterol (8%). An increase in high density lipoprotein cholesterol (5%) was also observed. In addition, improvement in the ratios of TC : HDL (12%) and LDL : HDL (13%) was noted. In several other studies, food products like burfi, noodles,

dhokla, uppma, laddu, khichri mix, batti were developed using barnyard millet (Bisht and Srivastava (2013), Surekha et al., (2013), Pathak et al., (2000), Arora and Srivastava, (2002)). All these products were under low glycemic index foods. In conclusion the low glycemic index of food is due to presence of dietary fibre and resistant starch which is responsible for the hypoglycemic and hypolipidemic effect of food.

FFV - 54
Role of probiotics in altering gut microbiome and anti-obesity potential

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Obesity is a major public health issue as it is causally related to several chronic disorders, including type-2 diabetes, CVD and cancer. The etiology of obesity reflects complex interactions among genetic and environmental factors, with current high energy diets and sedentary lifestyle considered to be foremost among the latter. Obesity has also been correlated with reduced bacterial diversity, altered expression of bacterial genes, and metabolic pathways. When compared with their lean counterparts obese individuals were found to have a differential proportion of particular phyla in their gut microbiota, i.e. fewer Bacteroidetes and more Firmicutes. Thus, any agent modulating gut microbiota may produce an influential effect in preventing the pathogenesis of disease. As functional food, probiotics are a live microbial food supplement that beneficially affects the host animal by improving its intestinal microbial balance. The anti-obesity potential of probiotics is gaining wide attention but the underlying pathways governing the anti-obesity effects of probiotics still remain unclear. One possible mode of action of probiotics may be an improvement of the barrier functions of the gut mucosa. Several strains of Lactobacillus and Bifidobacterium as well as structural components, and microbial-produced metabolites are able to stimulate epithelial cell signaling pathways. Probiotics have also been shown to interact with the resident bacterial members already present in the gut by altering their properties, which may also affect the metabolic pathways involved in the regulation of fat metabolism. A study reported that supplementation with the probiotic bacteria Lactobacillus plantarum 299v significantly lowered serum LDL cholesterol concentrations and fibrinogen in hypercholesterolemic patients. Another study used probiotic yoghurt as a supplement with L. acidophilus 145, B. longum 913 and oligofructose that increased HDL cholesterol concentrations and decreased the ratio of LDL:HDL cholesterol in hypercholesterolemic women. In addition, probiotics are able to prevent cytokine and oxidant-induced epithelial damage thereby promoting cell survival. Therefore development of probiotics, as a dietary strategy, targeting the gut ecosystem is emerging as an additional preventive tool to control metabolic disorders.

FFV - 55
Process Optimization for the preparation of phalahari muffins

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In order to develop the phalahari muffins with enhanced nutritional properties, refined wheat flour was fully replaced by sweet potato flour, which is rich in fibre, phytosterols and other phytochemicals. In the present study, levels of flours (35-45g sweet potato flour,15-20g sugar and 10-15g butter) were optimized using Response Surface Methodology (RSM). The product was optimized on the basis of textural and sensory attributes. Based on RSM experiments solutions, a formulation having 35g sweet potato flour, 20g sugar and 15g butter was optimized combination and showed the color of crust of 7.87, color of crumb of 7.939, texture of 8.025, aroma of 8.278, mouthfeel of 8.142, overall acceptability of 8.842, hardness of 897.563g, springiness of 0.611, cohesiveness of 0.499, gumminess of 386.608, chewiness of 554.212 and resilience of 0.241, was the best among all combinations. The desirability of optimized phalahari muffins is 0.86. The protein, fat, reducing sugar, dietary fibres, ash and moisture content in the optimized product was 2.62%, 6.33%, 14.17%, 0.80%, 2.84% and 32.06%, respectively.

FFV - 56
Role of Oats as Functional Food : A Review

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Functional foods provide positive health effects beyond nutrition. Oats differ from other food grains as it is one of the richest source of soluble dietary fibre □-glucan , linoleic acid which is an essential fatty acid as well as unique antioxidants avenanthremadides along with vitamin E. Oats highly reduces blood cholesterol levels by reducing LDL, a major cause of Coronary Heart Disease(CHD). It reduces post prandial glycemic response of food by as much as 50% by consuming meal containing(6-8.4g) □-glucan by reducing their absorption . □ glucan also forms short chain fatty acids in colon by fermentation which also reduces cholesterol biosynthesis as well as risk of colon cancer. The major health problems we are facing are diet dependent i.e. blood cholesterol, diabetes, hypertension, obesity and finally leading to CHD thus requires dietary intervention in which oats can be taken as a functional food which has potential to reduce mortality rates due to these severe diseases. It can be included in gluten free diets. Oat grains have mild pleasant taste which needs to be blend with other ingredients to get better consumer acceptability and market value which is not good over all segments of growing market.

FFV - 57
Nutraceuticals and Functional Foods: An Approach to Improve the Human Health

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Functional foods and nutraceuticals provide an opportunity to improve the human health, reduce health care costs and support economic development in rural communities. The tenet "Let food be thy medicine and medicine be thy food," espoused by Hippocrates nearly 2,500 years ago, is receiving renewed interest. Within the last decade, however, the term functional as it applies to food has adopted a different connotation—that of providing an additional physiological benefit beyond that of meeting basic nutritional needs. In particular, there has been an explosion of consumer interest in the health enhancing role of specific foods or physiologically- active food components, so-called functional foods (Hasler, 1998).While nutraceuticals, sometimes referred to as natural health products, are often used in medicinal forms as tablets, capsules or liquid. Among diseases of concern, cancer and coronary heart disease (CHD) are high on the list. In this respect, phenolics of plant origin, as an example, have been found to act as free radical scavengers, inhibitors of cholesterol oxidation and DNA breakage, among others, thus serving as potential cancer preventing agents. On the other hand, marine foods have often been considered as "heart food" because of the role of their omega-3 fatty acid constituents in lowering of triacylglycerol and cholesterol levels and hence the incidence of CHD. This article focused on some examples of the functional foods and nutraceuticals and their health benefits, like probiotics and prebiotics, proteins and peptides, oils and fatty acids, carbohydrates and fibers, catchine and lycopin.

FFV - 58
Optimization of process for lycopene fortified stirred yoghurt

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The objectives of present study were to develop lycopene fortified stirred yoghurt and its process optimization by standardizing the levels of fat, SNF and lycopene rich powder and to study their effects on various parameters such as rheological properties (cohesiveness, index of viscosity, firmness, and consistency), sensory properties (colour & appearance, flavour, body & texture, and overall acceptability scores) and antioxidant properties (lycopene content and antioxidant activity). The study principally aimed at maximization of the antioxidant potential of yoghurt by incorporating lycopene without decreasing its acceptability. For preparing yoghurt, milk composition was standardized to achieve the desired fat and SNF contents (45 g/L fat and 120 g/L SNF). The milk was pasteurized at 95 °C for 10 min. The milk was cooled to 37 °C to bring the yoghurt to the ideal growth temperature for the inoculation of starter culture. The starter cultures were mixed into the cooled

milk at a level of 10 g/L (1:1:: Lactobacillus bulgaricus : Streptococcus thermophilus). The milk was held at 37 °C until a pH of 4 was reached in approx. 8 h. Yoghurt was cooled to 4-7 °C to stop the fermentation process. Addition of sugar and lycopene rich powder was done @ 100 g/L and 50g/L, respectively. Yoghurt was then poured into polymer cups and stored under refrigerated conditions (7-10 °C). Addition of lycopene rich powder in yoghurt increased its antioxidant potential in proportion to the level of lycopene rich powder added. However, at high levels of fortification (> 5%), it adversely affected the rheological and sensory attributes of flavour and overall acceptability limiting the level of fortification. Sensory and texture profile of yoghurt was acceptable upto 5% level of fortification of lycopene rich powder. Optimized lycopene fortified yoghurt had 28.82 g cohesiveness, 38.82 gs index of viscosity, 26.27 g firmness, 36.256 gs consistency, 8.74 colour score, 6.90 flavour score, 8.90 body and texture score, 6.70 overall acceptability score, 2.25 mg/100 g lycopene content and 11.25% DDPH inhibition antioxidant activity. The results obtained in the present investigation suggest that good quality lycopene fortified stirred yoghurt with high antioxidant potential could be made with composition of milk as 85 g/L fat and 120 g/L SNF fortified with 50g/L lycopene rich powder.

FFV - 59
Divergence of Lactic Acid Bacteria in Tungrymbai- A Fermented Soyabean Product

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Fermented food product viz. Tungrymbai, fermented soybean finds its native recognition in the East Khasi Hills of Meghalaya, where it is prepared conventionally by the local communities. Tungrymbaiis a hub of dominant microflora and several enterococcus species. It has ben considered as a health promoting foods of local tribes.ThirtyTungrymbaisamples were collected from East Khasi Hills district of Meghalaya. All the samples were analyzed for isolation of Lactic Acid Bacteria (LAB)using specific media in the department of RDAP, NEHU,Tura campus and isolates were furthertested fortheir microbiological and biochemicalparameters. The average viable count of enterococcus species was 8.95 to 11.30 Log CFU/mL at an incubation period of24 hours at 37^{0}C, whereas for LAB it was found 6.46 to 10.89 Log CFU/mL at 37^{0}C for 48 hours. The API CHL 50 Kit was used toidentifythe diverse varieties of LAB as Lactobacillus plantarum, L. fructivorans, L. brevis, L. collinoides, L. pentosus, Leuconostocmesenteroides, sub. spcremoris. Further, apart from LAB, Tungrymbaialso owns Aerococcusviridians and enterococcus faecalis which affect the rate of fermentation.The identified species of LABand enterococcus mayprovide excellent health benefits and probiotic qualitiesfor several fermented foodswhich unlocks the doors of further research.

FFV - 60
Development of protein bar using whey protein and ghee residue

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The Protein bars are snacks of good sensory and nutritional characteristics due to their high carbohydrates, proteins, lipids, and minerals contents. Increasing demand from consumers for nutritious snacks has provoked the food manufacturers to develop food bars that provide nutrition and convenience. The aim of this work was to develop Protein bar by incorporation of ghee residue and to evaluate the organoleptic characteristics, proximate composition and shelf life. Ghee is an important constituent of Indian meal. Ghee is prepared using different methods. The SNF part of cream was coagulated out during ghee preparation is known as ghee residue. Ghee residue was utilized for preparation of protein bar. On the basis of sensory evaluation2.5%, 5%, and 10% ghee residue had sensory scores of 7.92, 7.77 and 7.12 points for overall acceptability on 9 point hedonic scale and liked by the panel of judges. Proximate composition revealed that addition of Ghee residue and whey protein improved the nutritional profile of protein bars. Protein level, texture, and taste were considerably improved by incorporating 2.5 %, 5% and 10% ghee residue without affecting any sensory characteristics during storage. Protein level increased as 7.41% ,9.80% , 10.49 % respectively. Storage study of the products packed in polyethylene bags revealed significant changes in free fatty acid from 1.400 to 1.531% in 5% ghee residue protein bars , 2.4% to 3.10% FFA in protein bar containing 5% ghee residue and 3.5% to 5% FFA in protein bar containing 10 % FFA. However, increase in free fatty acid remained within desirable limits up to 30 days. Studies showed that 5% of ghee Residue can be successfully incorporated in protein bars preparation.

FFV - 61
Nutraceuticals and functional foods with special reference to mother and child care

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Foods and nutrition are indispensable companions of human since the very beginnings of his existence. Science has shown that diet affects human health; therefore, healthy diets promote good health. The suggestion that certain food components and nutrients are associated with the prevention / treatment of chronic diseases has encouraged consumer's interest in functional foods and natural health products. A nutraceutical is a product, isolated or purified from foods that are generally sold in medicinal forms not usually associated with foods. A functional food is similar in appearance to, or may be a conventional food, is consumed as part of a usual diet, and is

demonstrated to have physiological benefits and or reduce the risk of chronic disease beyond basic nutritional functions. The creation of nutrigenomics and nutrigenetics, two fields with distinct approaches to elucidate the interaction between diet and genes but with a common goal to optimize health through the personalization of diet, provide powerful approaches to unravel the complex relationship between nutritional molecules, genetic polymorphisms, and the biological system as a whole. Child bearing and propagation of culture through the generations are central to any society. There are significant traditional practices related to antenatal care for managing range of conditions and symptoms. Maternal education is acknowledged to be one of the most important criteria for determining good public health. Imbalances in maternal nutrition can adversely affect normal foetal growth and development. So this paper will emphasize on various nutraceuticals and functional foods specially designed and or recommended for maternal and child health and care.

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What's in your Cup? Examining coffee from chemistry point of view

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"Good ideas start with brainstorming; Great ideas start with coffee." One thing I've experienced from student life is, there's a phase where majority students succumb to the situation and prefers nocturnal studies. WhyfiMainly because there is a lesser uproar as compared to the day, in my opinion. And what helps the mostfi Foodfi No! Cokefi No! Coffeefi Yes! Coffee is not just a brewed drink prepared from roasted coffee beans, which are the seeds of berries from the Coffea plant but also a life saver for most city dwellers. According to legend, ancestors of today's Oromo people in a region of Kaffa in Ethiopia were believed to have been the first to recognize the energizing effect of the coffee plant, though no direct evidence has been found indicating where in Africa coffee grew or who among the native populations might have used it as a stimulant or even known about it, earlier than the 17th century. Coffee processing is quite rigorous. As it starts from Plantation then harvesting then hand picking beans then airing then storage then hulling then roasting and lastly packing!In 2013, world production of green coffee was 8.9 million tonnes, with Brazil as the leader in production followed by Vietnam, Indonesia, Colombia and India. This research looks at the pure chemistry aspect of coffee. What all sorts of compounds are present in in that coffee mug along with Milk, Sugar & Water. 98% of the cup comprise of water and the rest 2% is the good stuff, next thing one should know is its earthly aroma. Some of the compounds in coffee would be pretty repulsive if present in high concentration like 2-Ethylphenol which has a tar like medicinal odour. It also happens to be cockroach pheromone. The bugs use it to warn each other of the danger. There is also Dimethyl Disulfide which is barely detectable in that cup, which is lucky since it smells a bit like rotting meat.Acetylmethylcarbinol ends up enhancing its buttery taste. Trigonelline gives coffee its sweet earthy taste and it also battles

cavity causing bacteria Streptococcus Mutans. 3,5 Dicaffeoylquinic Acid which protects brain from free radicals. Yes! Coffee is an anti-oxidant. Once you had a few slugs your favourite ingredient kicks in i.e. Caffeine, it's actually an alkaloid plant toxin like Nicotine and Cocaine. In your brain it blocks receptors for the neuro transmitter Adenosine. Result, you stay AWAKE!

FFV - 63

Antimicrobial Activity of Lactobacillus Strains Isolated from Indian Milk Sweet Confectionary (Burfi) Against Various Strains of E.coli

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Lactic Acid Bacteria (LAB) exhibit a significant role in synthesizing fermented foods and are also used for food preservation. They possses health promoting salubrious features in form of probiotics and have anti-mutagenic, anti-carcinogenic properties and immune modulation effects. They have antagonistic action that can restrain intestinal and food borne pathogens. In the present work we have isolated Lactobacillus strains from two different samples of Burfi which is Indian milk based sweet confectionary. The bacterial isolates were morphologically and biochemical characterized and were further tested for their antimicrobial activity against the pathogenic microorganisms. Few of these isolates showed inhibition of microbial growth. The Gram staining and catalase activity positive colonies were assessed for their antimicrobial activity through critical dilution assay method. Three lactic acid bacterial strains had earlier exhibited anti-microbial efficacy against pathogenic microbial species viz. L. Monocytogenes and B. Cereus and are now, here tested against E.coli 1233 and E.coli 9537 strains. The results showed higher anti microbial efficacy against both E.coli strains comparitively with the earlier species. Further studies such as bile tolerance, bacteriocin and lactic acid biomass production are required to be performed in order to characterize these strains so that these can be used as food preservatives as well as probiotics in future. Probiotics, anti-mutagenic, anti-carcinogenic, immune modulation, antagonistic, pathogens, Lactobacillus, Gram staining, catalase activity, anti-microbial activity, critical dilution assay method, Escherichia coli, Listeria Monocytogenes, Bacillus Cereus, bile tolerance, bacteriocins, biomass

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Analysis of antioxidant and antibacterial activities of selected underutilized green leafy vegetables and flower

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Analysis of antioxidant and antibacterial activities of selected underutilized green leafy vegetables and flower .The antioxidant activities of methanolic extracts of seven underutilized green leafy

vegetables ,including ,Pathri Boerhavia diffusa) Hazardana Phyllanthas niruri) Paker Ficus infectoria) Chirchita Achyrenthas aspera) Khattimitthi Oxalis corniculate) Palash Butea monosperma) and Kohar Bauhinia alba)were determined The measured antioxidant properties included Total phenolic content TPC) Total flavonoid content TFC) Free radical scavenging activity ,Ferric reducing antioxidant potential FRAP)Metal chelating activity and reducing power . TPC and TFC ranged from 2 to 95 mg TAE g and 0 2 to 0 72 mg QE g respectively .The result showed that the Kohar 94 4%)and Pakar 94%)contain higher DPPH radical scavenging activity in comparison to other selected underutilized green leafy vegetables .The correlation analysis showed that DPPH free radical scavenging activity FRAP ,Reducing power ,Metal chelating activity were significantly correlated with total phenolic content and Flavonoid content .Vitamin C content was positively correlated with metal chelating activity .The study indicates that the selected underutilized green leafy vegetables are potentially rich sources of dietary polyphenolic compounds and antioxidants and might contribute important health and nutraceuticals benefits to consumers .

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Poster Presentations

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Section - F

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Abstracts
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FSP - 01
Food Safety : Global Issue

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The food safety is most important point for consumer's health and for the bright future of food processing industry. Food safety laws and regulations are being updated and ensure consumer's safety. But the regulations are still not properly followed by the producers in some cases. It creates various food safety issues. The Food Safety Management System (FSMS) provides a preventative approach to identify, prevent and reduce food-borne hazards. This is to minimize the risk of food poisoning and to make food safe for consumption. A well designed FSMS with appropriate control measures can help food establishments comply with food hygiene regulations and ensure that food prepared for sale is hygienic and safe for consumers. The food safety management system includes ISO 22000, HACCP etc. The ISO 22000 family of International Standards addresses food safety management. The consequences of unsafe food can be serious and ISO's food safety management standards help organizations identify and control food safety hazards. As many of today's food products repeatedly cross national boundaries, International Standards are needed to ensure the safety of the global food supply chain.The ISO 22000 family contains a number of standards each focusing on different aspects of food safety management. It maps out what an organization needs to do to demonstrate its ability to control food safety hazards in order to ensure that food is safe.

FSP - 02
To Study the Content Analysis of Food Label Among Adolescent Girls in Varanasi

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Food label plays an important role in providing the relevant nutritional information to consumers. Food label is any tag, brand, mark, pictorial or any descriptive matter written, printed, stenciled, marked, embossed or attached to a packet of food products. A food label provides information from manufacture to consumer about particular food products. The information may include name of food, ingredients used its date of manufacture, nutritional composition, expiry date, use of color and preservatives, recommended storage condition, instruction for use etc. This information is useful as it assists consumer to make informed choices during purchase of food products.Data were collected through self designed and pre tested closed schedule. The study is mainly based on primary data, which was collected from 384 adolescent girls at Vasant Kanya Mahavidyalay of Varanasi city. The most commonly available and used food products, by girls were selected in the study. In the present study maximum61.7% of adolescent girls have partial knowledge about all the printed information on the label where as 22.4% had no knowledge at all and rest 15.9% had full knowledge about printed matters on the label of food products.

FSP - 03

Designing metallic grain storage bins (domestic level) for minimizing Aluminum phosphide application for food safety

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Food security is a very important aspect for societal development and human dignity. In developing countries like India agriculture sector not only contribute significantly to GDP but also provide livelihood to a large section of society. Grain production and storage being key components of food security assumes great significance in this context. It is reported that ~ 60% grain produce are stored and managed by rural people at home level/farm level. Since 80% of the total productions of aluminum phosphide formulation are used for stored grain protection, hence it is matter of great concern from view point human health as well as environment. In the present paper, for domestic level grain storage, new designs of metallic bins for minimizing 'hot spots' formation and application of aluminum phophide are discussed.A field study was conducted in rural areas of Haryana. In order to understand the food safety status in grain storage system managed by FCI, HAFED etc. and NABARD funded storage structures were also studied. A study was conducted to study hot spot formation in a metallic bin and quality parameters were also studied.All these systems were found to use various chemical pesticides/ fumigants such as Malathion, Deltanethrin, Aluminum phosphide, chlorpyrofos etc. Depending on the storage period, frequency of applying fumigant tablets may be increased up to several times. At domestic level, farmers store wheat in metallic bins and aluminum phosphide are used for insect-pest control .It was noted that recommended practices of using this fumigant are not followed by farmers so compromising on food safety.Preliminary investigation is a ray of hope for achieving food safety through stored grain protection .

FSP - 04

Dietary Oxalate Intake :risk of Stone Disease

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Oxalate is a common component of many foods of plant origin, including nuts, fruits, vegetables, grains, and legumes, and is typically present as a salt of oxalic acid. In food, oxalic acid is typically found as either sodium or potassium oxalate, which are water soluble, or calcium oxalate, which is insoluble. The highest levels of oxalate are found in chocolate, nuts, beans (including soybeans), rhubarb, spinach, beets, and black tea. Calcium-oxalate are the most common form of stones. Higher dietary intake leads to hyperoxalurea.The term oxalate bioavailability has often been used to refer to that portion of food-derived oxalate that is absorbed from the GIT. Oxalate absorption rates from different foods have been estimated to range from 2 to 15%. Oxalate bioavailability is likely dependent on a number of factors, including absorptive properties of the intestines, gut transit time, presence of

divalent cations such as calcium and magnesium that can bind oxalate within the GIT, and presence of oxalate-degrading bacteria. Since vitamin C can convert to oxalate, the use of vitamin C supplements may increase oxaluria and be associated with an increased risk of stone formation; therefore, the dose of these supplements should be limited to less than 1000 mg/d.

FSP - 05
Salicylic Acid And Food Safety

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Salicylic acid (SA) and methyl salicylate (MeSA) are endogenous signal molecules, playing pivotal roles in regulating stress responses and plant developmental processes including heat production or thermogenesis, photosynthesis, stomatal conductance, transpiration, ion uptake and transport, disease resistance, seed germination, sex polarization, crop yield and glycolysis (Klessig& Malamy,1994).Salicylic acid as a natural and safe phenolic compound exhibits a high potential in controlling post-harvest losses of horticultural crops. Salicylates delay the ripening of fruits, probably through inhibition of ethylene biosynthesis or action, and maintain post-harvest quality (Srivastava & Dwivedi, 2000). Decrease in ethylene production and action, induction of disease resistance, prevention of oxidative stresses, induction of crop tolerance to chilling injury, decrease in respiration rate, decrease in ripening and senescence rate, prevention of cell wall degrading enzymes and maintaining crop firmness are of main results obtained following SA treatment. Exogenous application of SA at nontoxic concentrations to susceptible fruits and vegetables could enhance resistance to pathogens and control post-harvest decay. SA prevents post-harvest oxidative stress and alleviates chilling injury during cold storage. It has been demonstrated that SA decreases ethylene production and inhibits cell wall and membrane degrading enzymes leading to decreasing the fruit softening rate. Thus, SA can be used as an appropriate alternative to chemicals in post-harvest technology of horticultural crops to assure food safety.

FSP - 06
Sustainable & Edible Packaging-- When food gets wrapped in food!

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Numerous organizations are attempting to reduce the utilization of plastic by encouraging consumers to use biodegradable plastic and to participate in recycling programs but these attempts cannot really contribute to the pollution that has already been created. Edible film has been trending

as an effort to minimize plastic usage in food wrappers and coatings. Potential applications of edible films are numerous e.g. internal moisture or solute barriers of heterogeneous foods, individual protection of food pieces, encapsulation of food additives, etc. Natural polymers such as lipids like acetoglycerides, polysaccharides like Chitosan and Alginate, surfactants like lecithin, proteins like egg whites and milk whey, plasticizers like corn syrup and sucrose and functional additives like antimicrobials and antioxidants are used to produce these environment friendly films. Mostly, the edible parts are made of isomalt, a kind of sweetener and the biodegradable parts are made of baggase i.e. the residue after the removal of sugar from sugarcane or tapioca. This biodegradable packaging method, made from entirely renewable natural polymers could contribute to solving environmental pollution. So, edible food packaging is an innovative technology in the market which will lead to a new phase in the food packaging industry. Not only these packaging methods have turned into a potential profit, but it adds values to the stakeholders and the community. This technology undeniably lessens the amount of plastic packaging waste. Therefore, this green technology model emphasizes the maximum benefits and minimum harm to the environment.

FSP - 07

Bioassay of Cuminum cyminum seed essential oil and its major components against Callosobruchus chinensis and Sitophilus oryzae

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Present study aims for assessing biological activities of Cuminum cyminum seed essential oil (EO) and its major components for their use as natural insecticide against infestation of Callosobruchus chinensis and Sitophilus oryzae in wheat and chickpea in storage condition. Chemical characterization of EO was done by GC & GC-MS analysis. Fumigant, repellent, ovicidal, oviposition deterrent, larvicidal and pupaecidal activities of EO were done. The essential oil and its major components -terpinene and (-)-pinene showed promising activity in all aforementioned parameters against both the insects. However, C. chinensis was much more susceptible than S. oryzae. Poor mortality was shown by insects against cymene and cuminaldehyde but both caused moderate repellency and oviposition deterrency at 100 l/L air. The practical applicability of essential oil against insect was tested over stored food commodity and exhibited 100% and 97% feeding deterrent index at 100 l/L air concentration against damage caused by C. chinensis and S. oryzae respectively without affecting viability of chickpea and wheat. Based on the findings, C. cyminum seed essential oil may thus be recommended as biorational and eco-friendly alternatives of synthetic pesticides for management of insect infestation of food commodities.

FSP - 08

Ensuring Quality and Safety of Food Products by Minimal Processing Using Novel Techniques

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The sales and consumption of minimally processed food products has grown up in recent years.This increase is due to a growing focus on health, which includes the consumption of fresh fruits and vegetables, and the increased preference for convenience. Consumers want healthy food products for their meals, available at a good value, convenient, safe, and having good quality. Minimally processed food products stand out as convenient novel foods that fit the many needs of a modern lifestyle. As a consequence, a wide range of minimally processed food products have been developed to meet consumer's needs for quick, convenient and healthy food products. Minimal processing gives additional value to food products in terms of convenience and time saving, although several problems are encountered due to the difficulty in preserving their freshness during prolonged periods. These products are characterized by a shorter shelf life because of higher susceptibility to microbial spoilage, increased respiration rate and ethylene production, weight losses and undesirable volatile production, thus reducing the shelf life. Minimally processed food products are highly perishable and therefore,novel processing techniques may help in maintaining the quality and safety of these products. Various traditional and simpler processing methods are employed at present but they don't seem to be sufficient to increase the safety and to extend the shelf life of the products. In this context, scientists have attempted to develop new novel technologies that may improve the quality and safety of minimally processed products.In this paper, the published research on the use of novel technologies to ensure quality and safety is critically reviewed. This paper in general provides information about different novel techniques which can be suitable in extending the shelf life and to minimize the risk of infection or intoxication associated with their consumption. It also gives an idea for future research directions in order to resolve existing issues related to the quality, safety and shelf life of these minimally processed food products.

FSP - 09
Impact of food processing industry on environment

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The food processing industries are one of the most important among all the industries, as it is clear to all that all of us will consume food for our survival. In developing country like India each and every industry has some adverse effect on environment. Talking about food processing industry which include water, raw materials and energy as there resource. Most of the food processing industry has a large water uses, major waste produce is liquid which result in water pollution. These industry also produce solid waste which may be organic or packing waste. The industry use heavy machine which cause noise and vibrations leading to noise pollution. These industry effect environment in many ways, highlighting the development of food processing industry in India there positive and negative impacts of industry on the environment. The need of environmental impact auditing and importance of environmental impact assessment were made.

FSP - 10
Why to consume organic food by pregnant women?

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With the growing concern of pollution and pesticides, many more people are shifting towards organic foods from inorganic foods. However, the question everybody wants to know is it safe for pregnant women to eat organic foodfiBaby food is one of the most in demand organic product today. The main reason for this is the concern that parents feel for their children, especially babies. There are actually many benefits of organic baby food which you have already understood since the term organic have since been touted around in many products labeling. There are standards with which the governing body of organic foods and products has set to ensure the correct standards are used. Babies are extremely sensitive to new: substance and ingredients to which they are exposed to when they learn to eat. Among the benefits of organic baby food , the one that tops the list is that organic means that there are little or no chemical substance in the products. Pesticides and other chemicals that are put in foods can be really harmful to your baby. The effect of exposure in pregnant women is unclear, but, the harmful chemicals in pesticides may be hard for your baby's system to process and release. You may not be concerned about what goes in your food, but now when you are pregnant, you are eating for two, and it's time to question what chemicals are safe for your baby. Expecting mothers are told to eat foods that are high on calcium, iron, and folic acids because it's helps the growth of baby's during pregnancy. Buy organic vegetables such as potatoes

to help lower the risk of your baby being exposed to high levels of pesticides. Organic whole soy beans , Apples ,beef, is best to eat . Omega-3 fatty acids play a positive role in fetal brain development during pregnancy, and organic feed cattle are more likely to have levels of Omega-3 acids than non-organic cattle . Even though studies have not shown that eating organic foods is the best way to eat during pregnancy, it's better to know your options. Other benefit of organic food are that you are actually helping your child to develop less disease connected to dangerous food containing chemical or those that have been processed using chemicals. Just remember that what you put inside your body will affect the growth of your unborn baby. Take the time and visit your physician to see what works the best for you and your baby.

FSP - 11
Consumer Trends in Food Packaging

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The food markets represent the largest consumption group for packaging materials and machinery. Packaging machinery consists of equipment for use in process such as canning, container cleaning, filling, forming, bagging, packing, check weighing wrapping, heat sealing and other products identification machines, encoding, palletizing, de-palletizing and related process. The research and development in food technology has resulted into production of safe and nutritious food. The food industries are in the throes of massive change. From manufactures to retailers, suppliers to all intermediaries, everyone is under pressure to perform in a relentlessly competitive arena. Innovative options that runs the gamut from eco-friendly packaging to designs, greet today's consumes that actually assist in the food preparation process. Food packaging has been playing such an important role in the preservation and marketability of a product that many companies are seeking a contract based packaging service to help them obtain the best quality packaging available.

FSP - 12
Effect of Ethylene on Controlled Atmosphere Storage of Onions

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Onion (Allium cepa L.) is the largest vegetable produced and consumed not only in India but also in the world. Although, it is classified as vegetable, it has special qualities, which add to taste and flavour to food. My research objectives are mainly to investigate the effect of Ethylene gas exposure concentrations and storage period on pungency, firmness, weight loss, decay, sprouting, TSS content, titrable acidity of onion in CA storage and Comparison between Control, CA storage and CA storage with Ethylene on quality attributes of Onion.The techniques employed and procedures

adopted for selection of onions, measurement of respiration rate and determination of heat of respiration of onion, maintenance of gaseous compositions, measurement of quality attributes of onions and determination of their shelf life are described in the research paper .Onions were divided into three groups, one group was stored at CA conditions (25^0 C, 2 % O_2, 5 % CO_2, 1000 ppm Ethylene) for 24 hr exposure time, referred as CAE 25^0 C, second group was stored at CA conditions without Ethylene (25^0 C, 2 % O_2, 5 % CO2), referred as CA 25^0 Cand third group was stored at room temperature and regular atmosphere referred as control. Studies were conducted on all the groups for quality attributes. The results of the research comprises of comparison between all the groups of the onion with the difference in their quality attributes, specially in Sprouting and abscisic acid plays a vital role.

FSP - 13

Study of antimicrobial properties of Annona squamosa (custard apple) peel and seed powder

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The resistance of microorganisms towards drugs has rendered us susceptible to life threatening diseases. In a bid to curb this, natural plants extracts may be a significant tool. The seed and peel powder of Annona squamosa, due to a large number of active compounds, show multi-factorial mode of action due to presence of antimicrobial compounds. The seed and peel powders were prepared by drying in a tray drier at 40°C for 6 hours and 35°C for 36 hours, respectively. The dried seeds and peel were then ground to a fine powder and stored in air-tight containers. Seed powder and peel powder extracts of A. squamosa, were prepared by solvent extraction using organic solvents such as methanol, ethanol, chloroform, ether, acetone and water at ambient temperature for 24 hours. The extract thus obtained were tested for their anti-microbial activity against pathogenic microbes like Klebsiella pneumoniae, Staphylococcus aureus, Escherichia coli, Salmonella typhi, Enterococcus faecalis, Pseudomonas aeruginosa, and Salmonella paratyphi by means of agar-disc diffusion method and by minimal inhibitory concentration (MIC). Antimicrobial compounds' chemical nature and concentration can be determined by GC–MS and HPLC. Physicochemical properties of powder show its crystalline behavior which can be determined by Differential Scanning Calorimetry (DSC) and the molecular weight of the antimicrobial compound by GPC. The microbiological and the chemical assays support the bactericidal abilities displayed by the seed and peel powder extracts and signifies their remarkable potential for exploration as effective natural antimicrobial agents.

FSP - 14
Assessment of Major Human Pathogens Present in Sugar Syrup Used in Sweets

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Objective: The study was conducted to assess the growth of microbial colony in the sugar syrup used in the sweets by local vendors of Varanasi.For this purpose five samples of sugar syrup from different location of Varanasi were collected. Required glass wares, chemicalsand instruments were used for the preparation of culture media. Samples were to be spread on the petridish containing culture media followed by incubation at 28^0C. By using Lapiz colony counter the microbial colonies were counted. The resultsrevealed that some samples were unhealthy and unhygienic containing food poisoning salmonella and vibrio species. The Colony Forming Unit (C.F.U.) of $2.26x10^7$ was an alarming range of increasing health risk. Unhygienic handling practices were considered one of the major causes of food contamination.

FSP - 15
Organoleptic Evalution of Nutritionally Enhanced Bread and Biscuits

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The present study was an effort to prepare incorporated fermented baked products, its comparison without incorporated fermented baked products and assessment of acceptability of incorporated fermented baked products through sensory evaluation and nutrient analysis. For the preparation of fermented baked products fresh red carrot were used for making carrot powder and incorporated with refined wheat flour in different proportions and baking were done by the oven. Three samples of each product were prepared containing carrot powder in proportion of 10:90, 20:80 and 30:70 respectively.Sensory evaluation of organoleptic attributes of samples of prepared incorporated fermented baked products in different proportions showed rising with 10% of incorporated carrot powder in bread and biscuits and 20% in bun rather than the control but the content of fibre increased respectively by the increasing amount of carrot powder.

FSP - 16
Anti-allergic compound isolated from Kaempferia kalanga L.

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Kaempferia galangal L(KG) rhizomes was used to be ingredient in food and also used in Thai traditional medicine for common cold treatment. This study evaluated the anti-allergic activity compound, isolated from Kaempferia galangaL(KG) rhizomes. KG rhizomes were extracted with ethanol and isolated anti-allergic compound by bioassay guided isolation with VLC method. The anti-allergic assay determined by inhibitory activity on □-hexosaminidase release. Chlorpheniramine (CPM) was used to be positive antihistamine drug. The percentages of yield of the ethanolic extract of KG was 3.6. The hexane: chloroform showed a highest inhibitory effect at concentrate of 50 µg/ml (80.17±2.32%).This appropriate fraction was isolate compound by CC method and obtained ethyl-p-methoxycinnamate (EPMC). The IC_{50} of KG extract and EPMC were 19.85 ±2.14 and 18.15± 0.36 µg/ml while CPM, showed the IC_{50} as 16.36 ± 0.16 µg/ml. Thus, EPMC was used to be an anti-allergic marker of KG extract. By the conclusion, the development of anti-allergic product from KG extract should be used EPMC as a marker for analysis product.

FSP - 17
Study on Product Awareness and Brand Image of Amul Product in Varanasi District of Uttar Pradesh

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The Amul product market in India has been one of the fastest growing sectors in India and contributing to the growth and development of dairy industry. Objective of this study was to analyze the Product Awareness & Brand Image of Amul product at Banaras Hindu University (Varanasi) region of east U.P. Research Methodology: a) Research Approach: Survey Method conducted for four months at B.H.U and its adjoining areas and the respondents were all retailers.1.Questionnaire: A structured questionnaire of 15 questions of mix type with opens ended, closed ended and multiple choice questions. 2. Sample Unit: Consumer visited Retail shop and Multiplexes. Result and conclusion: I have studied and analyzed the Amul product at Varanasi in BHU campus and other place besides of BHU, Results revealed that Amul products purchased by consumers when recommended by doctor near hospitals was more rather than outside of BHU .Youngsters like very much newly

introduced Amul products and most of them are aware about their personal health. All generation of people consumed Amul product .The logo of 'Amul' is required for more selling of Amul products.

FSP - 18
Prevention of spoilage and preservation of food

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Prevention of spoilage and preservation of food, principally requires exclusion of microbial activity. These may be achieved (1) by excluding or removing microorganism, (2) by hindering of growth and activity of microorganism and (3) by killing the microorganism. In commercial practice the killing of microorganism by high temperature treatment (pasteurization and sterilization) is the most common method. Drying (reduction of water content) is the oldest technology. The traditional sun drying has now been largely substituted by artificial drying with hot air. Preservation by using low temperature (chilling storage and freezing) reduces the number of microorganisms and at freezing temperatures stops their growth and activity. So freezing assures long term storability at temperature below freezing point. Chilling only reduces the activity of microorganism but does not exclude their slow growth and changes caused by them, so the storability is limited. Some chemical, called preservatives, inhibit (in some cases also kill)the growth and activity of microorganisms. Stimulated by efforts to increase food safety.

FSP - 19
Microbiological and chemical evaluation of different sweets in Kolkata

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The sweetmeats are wholesome, delicious and popular food items in Kolkata. This study was aimed to detect the presence of microbial contaminants (undesirable bacteria, yeasts, moulds) and chemical contaminants (non-permitted colours) in common sweets available in different types (renowned, non-renowned and street side) of sweet shops in Kolkata. 10 samples of Kanchagolla for microbial test and 24 samples of Ladoo, and Jalebi for chemical test were randomly collected from five zones (North, South, East, West and central) of Kolkata. Nutrient agar, EMB, TCBS, YEDP, Salmonella Shigella agar, Sabouraud agar were used as a media for microbial tests. The adulteration test was conducted to determine the presence of metanil yellow. In microbial test numerous yellowish and small white colonies were present in nutrient agar. Vibrio cholerae were found from

the renowned shops of different zones. The majority of the sweets from the medium shops had more yeast colonies and, at least, half of the large shop sweet samples had yeast colonies. Escherichia coli was found only in samples from renowned shops. Irrespective of shop type; fungus, Salmonella, and Shigella were not detected. In the chemical test, metanil yellow was found in samples from half of the non-renowned and street shops for one type of sweet; and in only one sample from a street shop for the other type of sweet.

FSP - 20
Alarming Adulteration Practices in Urban Area of Varanasi: a Survey and suggestions

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Currently food malpractices are increasing in various metro cities of India and all the measures taken by agencies are failed to detect rapidly and many times it becomes late when the adulteration is detected. Most bad scenario is the adulteration of the branded items of the children's and in the women such as milk cheese, ghee and oils. Therefore, Study for food practices and safety measures was done in selected are of Varanasi which was also validated by the wetlab methods. For this objective, questionnaire was prepared and distributed among selected people depends on their age group, sex and educational background. Statistical test were carried out on the basis of frequency of male and female respondents obtained in total respondents (n = 300). Chi square test were carried out and the calculated value were compared with value of t test (0.05) and on this basis, conclusion were drawn. Result shows that regardless of the age income and religion, all of the groups are well aware the food adulteration and educated people are less prone to the effect. In term of adulteration any how all the stores contains adulterated food however branded items contains less %age of adulteration than local item. This may be caused due to inactive agencies or longer process of legal system Studies show that there is lag in following the food practices by all the ages besides having good knowledge of food practices.

FSP - 21
Detection of Adultration in Khoa Collected From Different Sweetsshop and Dairy Shops of Varanasi City

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To detecet the adultration of khoa, collected from different popular sweetshop and dairy shops by using laboratory and also sensory evaluation.adultration of most common issue in the market

practised by shopkeeper,to earn more profit by lowering the quality of product. Some adultration of milk product can be detected easily by sensory evaluation , khoya generlly adultrated by boiled potato and ararot.detection of khoya using iodine solution in laboratory and also by sensory evaluation.sample of khoa collected from four popular sweet shop and khoyamandi of varanasi city were found to be adultrated,where as were pure khoa collected from three different sweetshop and khoamandi,out of total frequency of adultration of khoa in the market is 57% .adultration can be detect by sensory evaluation by tasteing and rubbing between to first two fingure and thomb

FSP - 22
Nanotechnology - An Intelligent Packaging

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Intelligent packaging involves the ability to sense an attribute of the product, the inner atmosphere of the package or the shipping environment. The techniques which are frequently used- Microelectronic technology, computer technology, Nanotechnology. Nanotechnology is a technique having potential to revolutionize the food industry in terms of food quality and safety. It has potential applications in all aspects of food sectors such as, Nano-sensors for pathogens and contaminant, Nano-scale freshness indicators, RFID (Radio Frequency Identification Circuit) for packaged food, Nano barcodes for track and trace. Such packaging systems would be able to repair small holes/tears respond to environmental condition such as temperature and moisture changes and alert the customer if the food is contaminated. Developing smart packaging is also targeted for beverage packaging. Improvement in fundamental characteristics of food packaging material such as strength, barrier properties, antimicrobial properties and stability to heat and cold are being achieved using non composites material. Nanotechnology provides solutions which will result in more safety for the food processing system providing schemes to prolong the product shelf life and freshness. Hence, there is an urgent need for regulatory systems capable of managing any risk associated with quality attributes of foods products.

FSP - 23
Effect of Modified Atmospheric Packaging (MAP) on the shelf-life of the kalakand

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To study of shelf life of kalakand using modified atmosphere packaging (MAP) at different storage temperatures in reference to the physico-chemical and microbial status during storage. Kalakand is one of the oldest and popular sweet all over the Indian sub-continent and is a heat desiccated Indian traditional milk based sweet. Kalakand was manufactured using standardized milk (6% fat and 9%

SNF) was taken in a jacketed vessel and heated to simmering temperature (85-90°C) with continuous stirring by a wooden ladle in a circular motion with occasional scraping of the heating surface. After 10-15 minutes of boiling, 0.02 percent of citric acid (in the form of solution) was added to the milk for the purpose of formation of granules. The kalakand samples were packed in polyethylene pouches (5 layers) using MAP equipment. Three different combinations of gases i.e. 98% CO_2, 98% N_2 and 50% N_2:50% CO_2 were used to pack the kalakand samples. The samples packed under air were kept as control. The samples were stored in incubators at 10, 25 and 37 °C and were analyzed for physico-chemical and microbial changes at an interval of 10 days. It was observed that the samples stored under air have a poor shelf life of 30 days, while MAP samples were acceptable upto 60 days. The control samples had a comparatively higher HMF, TBA, FFA and microbial load. Therefore, MAP could be considered as a better option for the storage of kalakand.

FSP - 24

Practice of using plastic bags to parcel cooked food items by street food vendors & shopkeepers in Dashashwamedh and Chowk area of Varanasi under the Act against use of plastic bags by merchants & vendors in the state

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Plastic, one of the most preferred material to parcel food items by street food vendors and shopkeepers. Standard ingredients used in manufacturing of plastic bags are host of carcinogenic, neurotoxin, and hormone disruptive chemicals such as phthalates, polystyrene, biphenyl A, PVC, polyethylene etc. These chemicals may lead to cancer, heart diseases, diabetes, infertility, etc. When hot & cooked food is packed in plastic bags these chemicals filtrate into the food and the rate of filtration is maximized by high temperature & nature of the food. Result has been obtained by conducting survey through Questionnaire cum interview method. The obtained result is 70 per cent vendors out of 30 are still using plastic bags to parcel food items due to unawareness about adverse health effect of it in them and consumers too. Some vendors and shopkeepers are using plastic bags because plastics are economical, light in weight and easy to parcel liquid food. Whereas 30 per cent are not using plastic bags because they are afraid of punishment and fine mentioned in the Act against use of plastic bags. It has been concluded that maximum vendors are still using plastic bags.

FSP - 25
Novel Ideas In Food Packaging

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In the 19th century, pioneers such as NicholarAppert and Louis Pasteur developed the concept of food packaging and preservation that still maintain relevance today. Increase in the economy of many countries, increased the demand of processed food, over staple food. This has forced food packaging industriesto investigate newer and more advanced packaging solutions.In the 20thcentury inventions such as glass bottles, cellophane wrap, aluminium foil and plastics had greater utility and flexibility in food packaging but still other advancedpackaging developments of the 20th and 21st century includenanotechnology, packages incorporating antimicrobials and oxygen scavengers,for prolonging the shelf life and protecting the food from environmental influences. Today packages are becoming smart, active and intelligent that control oxidation, moisture, spoilage and also facilitates monitoring of food quality. Oxygen scavengers are used to enhance the shelf-life of crackers packaged in hermetically sealed tin cans, stored at 15, 25 and 35ºC for up to 52 weeks. Pizza crust, which moulds in 2–3 days at 30ºC could be made mould-free for over 10 days using an appropriate 02 scavenger. Nanotechnology applications in packaging include sensors that can detect food deterioration, nano-clay-nylon coatings and silicon oxide barriers for glass bottles that impede gas diffusion, metalized films, and antimicrobials incorporated in packaging. The recent advances in packaging technologies have improved things both from a consumer safety perspective and for manufactures as well. However, there are several areas that require further explorationincluding development of non-toxic, degradable or edible packaging materials. Further research into regulations governing the assessment and use of these technologies worldwide are going on.

FSP - 26
Study the Impact of Growth in Livestock and Fish Products of Chhattisgarh

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Agriculture including livestock is the main source for the rural livelihood in the Chhattisgarh. About 80% of the state population live in the rural areas and majority of small and marginal farmers, posses one or another species of livestock; which contributes to poverty reduction in many ways (nutrition, income, risk coverage etc). Livestock contribute 23% of the agriculture output has been identifying as an important source equitable livelihood for the rural poor in Chhattisgarh. A water resource available in the state has a distinctive place in terms of fish farming. A total of 1.63 lakh hectare of

water area exist in Chhattisgarh state, out of which 1.51 lakh hectare of water area has been develop under fish farming, which is 93% of total water area. It is powerful and employment oriented means to do away with unemployment in rural areas. It is very popular subsidiary work for earning income with low cost and minimum time. To review closer relationship of Animal Husbandry & Fish production, we tested average growth rate model for Animal Husbandry & Fish production for secondary collected time series data of Chhattisgarh and found that average growth rate of total animal husbandry products, during 2006-07 to 2013-14 was highest in 2013 (13.57 %) & lowest in 2007 (1.07), which is highly influencing growth period. The average growth rate of total fish production, during 2006-07 to 2013-14 was highest in 2013 (20.5%) & lowest in 2007(2.437). there we have also found the highest growth of fish production in the year 2013. This is because of good implementations of policies by the government and adopting the new technology and extension by the farmers.

FSP - 27
Food Security & Its Impact on Malnutrition Status in India

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Food security through ages defines the availability and abundance of food for the adequate requirements of an individual. The fear of starvation and fear of hunger walks down the aisle when an individual has a sense of security regarding the availability and quality of food. Contrary to this Malnutrition refers to an unbalanced diet that hampers the regular or healthy growth of a person, which generally occurs due to lack of quality as well as quantity of food. In India where a majority of population is deprived of quality food, the nation ranks 3rd at the Global Hunger Index. Though a larger portion of the population still below the National Poverty Line, India ranks in as one of the fastest growing economies with a great rate of 1.5% - 1.7% indicating at the much underutilized potential of the country. The National Food Security Act,2013 also known as Right to Food Act has emerged as a silver lining for India which aims to provide quality subsidized grains to at least 2/3rd of India's 1.2 billion population thereby impacting one of the major problem which hinders the overall growth that is malnutrition. This study is to highlight, compile and compare the major endeavors and impacts of The National Food Security Act 2013 on the malnutrition status in the country.

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