AMITY INSTITUTE OF FOOD TECHNOLOGY



## 5<sup>th</sup> AMIFOST – 2022 FOOD SUSTAINABILITY : CHALLENGES AND OPPORTUNITIES FOR THE FUTURE PROCEEDINGS & ABSTRACTS

(ISBN: 978-93-91535-31-5)





**29<sup>th</sup>-31<sup>st</sup> March 2022** Amity University Noida (Uttar Pradesh) www.amity.edu/AIFT/AMIFOST2022/

SPONSORS:







#### **ABOUT THE CONFERENCE**

As the world population grows, much more effort and innovation are required to sustainably increase agricultural production, food processing, improve the global food supply chain, decrease food losses and waste, and ensure that all have access to nutritious food. The World leaders reaffirmed the right of everyone to have access to safe and nutritious food. The challenges for achieving the targets set forth for United Nations' Sustainable Development goals (SDG-s) are interconnected and cannot be addressed in isolation. Policies addressing priorities will be needed, but the prevailing governance model assigns malnutrition to the health sector and food insecurity to agriculture, resulting in a disjointed and uncoordinated framework, which may work at cross-purposes. The food system concepts has gained prominence in recent years amongst both scholars and policy-makers. Experts from diverse disciplines and backgrounds have particularly discussed the nature and origin of the "unsustainability" of our modern food systems.

A sustainable food system lies at the heart of the SDGs. The 17 SDGs provide a blueprint for current and future generations sustainable global development. In particular, SDG-2 focuses on Food Security and Nutrition (targeting zero hunger), achieving food security, eliminating malnutrition in all its forms, and promoting sustainable agriculture. SDG-12, a related goal, calls for responsible production and consumption. Our ability to achieve these goals will demand on some introspection concerning the current and future food production, fulfilling the global nutrition, and health demands. Therefore, the focus of this conference is on food sustainability SDGs, to disseminate and discuss the strategies of food and agriculture systems, achievement of food security, improved nutrition, and promote sustainable agricultural practices. It will seek to set Global Food Systems transformation stage to achieve the SDGs by 2030.

Thus, understanding the research and developments in food science and technology is vital in assessing the **Food sustainable systems**. This conference shall provide the platform to discuss trends and innovations in the field. In this context, Amity Institute of Food Technology announces, International Conference," Amity Conference of Food Scientists and Technologists- AMIFOST-2022 on the theme "**Food sustainability:** challenges and opportunities for the future", scheduled to be held on **29-31 March 2022 at Amity University Uttar Pradesh, Noida.** The conference will be hosted in online mode.

The Conference will bring together Food Laureates, Scientists, Researchers, Entrepreneurs, Academicians, Chemists, Dietitians, Nutritionists, Engineers, and Technologists from all over the world develop to discuss the sustainable solutions for improving food production, processing, security, quality, focusing on sustainable food production, and supply chain resilience.

#### **OBJECTIVES:**

The conference aims to provide a platform for ambitious new actions, innovative solutions, and plans to transform food systems and leverage these shifts to deliver progress across SDGs. It is envisioned that the conference will have objectives including to:

- To raise awareness of food systems with sustainable development goals and transforms Food Systems, particularly in the wake of a global pandemic.
- To strengthen the food system framework to achieve the 2030 SDGs agenda.
- To recognize the need for inclusivity and innovation in food systems governance and action
- To motivate and empower stakeholders who support food systems transformation by developing improved tools, measurement, and analysis
- To catalyze, accelerate, and enlarge rigorous actions to transform food systems by all communities, including countries, cities, companies, civil society, citizens, and food producers.

## The conference will focus on most recent challenges, and the newest updates on the following themes:

- Theme 1: Sustainable Green food processing technologies
- Theme 2: Technologies for Food safety, and quality analysis
- Theme 3: Climate change and sustainable food production
- Theme 4: Valorization of food by-products and food waste
- Theme 5: Food diversity and food security

- Theme 6: Advances in food formulations and packaging introducing sustainable food products and technologies
- Theme 7: Responsible consumption and sustainable diets
- Theme 8: Conservation and promotion of Traditional Food Culture
- Theme 9: Food and Function: achieving bigger goals

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#### **Convener:**

 Dr. Monika Thakur, Amity Institute of Food Technology, Amity University Uttar Pradesh

## **International Conference on**

# Food Sustainability: Challenges and Opportunities for the Future

## 5<sup>th</sup>AMIFOST 2022 (29<sup>th</sup>- 31<sup>th</sup>March 2022)



## **PROCEEDINGS BOOK**

#### **EDITORS:**

Dr. V K Modi Dr. Monika Thakur

#### **Co - EDITORS:**

Dr. Sunayan Sharma Dr. Ashok Pathera Dr. Renu Khedkar Dr. Ashish Mohite

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Website: https://www.amity.edu/AIFT/AMIFOST2022/; e-mail: amifost@amity.edu



## FOUNDER PRESIDENT'S MESSAGE

It is a matter of immense pleasure that Amity Institute of Food Technology (AIFT), Amity University Uttar Pradesh (AUUP) is organizing 5<sup>th</sup> Amity International Conference of Food Scientists and Technologists (AMIFOST-2022) on the theme "Food sustainability: Challenges and Opportunities for the Future" from Tuesday, 29<sup>th</sup> March to Thursday, 31<sup>st</sup> March, 2022 in hybrid mode.

Sustainable food systems are paramount in the fight to ensure planetary health and end malnutrition in all its forms. Transitioning to a sustainable food system that can deliver healthy diets for an estimated 10 billion people by 2050 is an unprecedented challenge and demands urgent action at the government, industry and agriculture levels. Recognizing the importance of sustainable food systems, the United Nations General Assembly under SDG-2 focuses on Food Security and Nutrition and promote sustainable agriculture while addressing the key issues such as malnutrition, climate change, dwindling biodiversity etc.

I extend my hearty welcome to all eminent speakers, distinguished subject experts and worthy participants from the industry, prestigious National and International Universities, Institutions and research establishments. I am sure that their deliberations on such an important topic would pave the way for forging bonds, undertaking joint projects/ collaborations and joint publication for achieving longterm goals and contacts for mutual benefits. It will be an enriching experience for brilliant faculty members, scientist, research scholars, students and other participants. I compliment Dr. V.K. Modi, Conference Chairperson & Director, AIFT and all members of Organising Committee including Dr. Monika Thakur, Convener, Dr. Renu Khedkar, Organising Secretary as well as dedicated faculty members, Ph.D fellows and brilliant students who under the most able guidance of Dr. Balvinder Shukla, Vice Chancellor, AUUP, have made all praiseworthy efforts in ensuring the success of this event. The most strategic and visionary leadership of Dr. Atul Chauhan, Chancellor, AUUP and President, Ritnand Balved Education Foundation (RBEF),

would lead to outcome based and result oriented success of this competition.

I wish AMIFOST-2022 great success.

Ashop k. Charlen

(Dr. Ashok K. Chauhan) Founder President Ritnand Balved Education Foundation (RBEF) (The Foundation of Amity Institutions and the Sponsoring Body of Amity Universities)





ಸಿ.ಎಸ್.ಐ.ಆರ್-ಕೇಂದ್ರೀಯ ಆಹಾರ ತಾಂತ್ರಿಕ ಸಂಶೋಧನಾಲಯ, ಮೈಸೂರು सीएसआईआर-केन्द्रीय खाद्य प्रौद्योगिक अनुसंधान संस्थान, मैसूरु CSIR-CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSURU

Ministry of Science & Technology and Earth Science, Govt. of India

ಡಾ. ಶ್ರೀದೇವಿ ಅನ್ನಪೂರ್ಣ ಸಿಂಗ್ <sub>ನಿರ್ದೇಶಕರು</sub> डॉ. श्रीदेवी अन्नपूर्णा सिंह निदेशक Dr. Sridevi Annapurna Singh Director

#### MESSAGE

I am glad to know that Amity Institute of Food Technology, AUUP, Noida is organizing an International Conference 5<sup>th</sup>AMIFOST – 2022 on a very meaningful and appropriate theme "Food Sustainability: Challenges and Opportunities for the Future".

According to United Nations, Food Sustainability is the key element for the Food & Agriculture Industry. Food sustainability depends on sustainable food systems based on farming, waste management, and supply systems, which interact with trade, energy, and health systems. The World Food Programme reported that more than 1 in 9 people worldwide i.e. 821 million people go hungry every day. To tackle the problem of hunger and malnutrition, a profound change of the global food and agriculture system is needed. This change should include striving for the sustainable production of food.

It is estimated the 65% more food, than produced today, is required to feed the world by 2050. Wastage of food accounts for 30% agricultural land area and 3.3 gigatons of CO<sub>2</sub> equivalent apart from huge water resources. Thus, for food sustainability, it is important to have climate resilient crops, use greener processing technologies and prevent wastage. Further, we need to intervene along the food supply chain for cost effective nutritions foods that cater to poorer sections of society and also influence consumer behaviour towards diet to have a positive impact on human health and environment while ensuring sustainability.

I congratulate the Institute for recognizing the need and holding an International Conference on such an important subject. I am hopeful that the deliberations and suggestions made in this conference shall benefit all stakeholders.

I extend my good wishes to all the guests, speakers, participants and students for an enriching experience during the conference.

I wish the conference a great success.

Sniteri Aurafina S (Dr. Sridevi Annapurna Singh)

Place : Mysore Date : 24<sup>th</sup> March, 2022

Contact : Director, CSIR-CFTRI Cheluvamba Mansion Opp. Rail Museum Mysuru 570 020



#### MESSAGE FROM THE VICE CHANCELLOR

I am delighted to know that Amity Institute of Food Technology is organising the **5th International Amity Conference of Food Scientists and Technologists (AMIFOST)** on the theme **"Food Sustainability: Challenges and Opportunities for the Future"** on 29 - 31 March 2022.

A Sustainable Food System provides a blueprint for current and future generation's sustainable global development. It embraces the inter-connectedness of all the food-related activities and the environment within which these activities occur. The production, distribution and consumption of food is a dynamic process involving multiple inputs, outputs and stakeholders. Furthermore, sustainable food systems need to increase agricultural productivity, improve climate resilience, and reduce greenhouse gas emissions for agriculture and related land-use change. Achieving an effective sustainable food system, depends on the success of the other Zero Hunger elements, such as zero food waste, 100 percent access to food and increasing smallholder's income.

I am sure that the deliberations and suggestions made during the conference by the renowned experts will benefit all participating students, academicians, researchers, practitioners, scientists, and technologists.

I also appreciate the remarkable efforts of the organizing committee of the conference under the stewardship of Dr. V K Modi, Director, Amity Institute of Food Technology. The dedication and perseverance of each member of the organizing committee to achieve excellence for creating a global platform of knowledge and ideas is highly commendable.

My best wishes for the grand success of 5<sup>th</sup> AMIFOST 2022!

**Prof. (Dr.) Balvinder Shukla** Professor – Entrepreneurship, Leadership & IT Vice Chancellor, Amity University Uttar Pradesh





**DR. W. SELVAMURTHY, Ph.D., D.Sc.** FAMS, FABMS, FIMSA, FIANS, FIAY

#### President

Amity Science, Technology and Innovation Foundation(ASTIF), **Director General**, Amity Directorate of Science & Innovation **Chancellor**, Amity University Chhattisgarh and **Chair Professor** for Life Sciences (Former Distinguished Scientist and Chief Controller R&D(LS), DRDO) Tel: 91(0)120-4392045 / 91-9871372441 / 91-9818801028 Fax: +91 (0)-120-4392114, E-mail: wselvamurthy@amity.edu



#### **MESSAGE**

It is with immense pride and pleasure we welcome all national and international Food Technology Academicians, Scientists, Professionals, Researchers, Students and all other dignitaries for **5th AMIFOST-2022** an **International Conference** on **"Food sustainability: challenges and opportunities for the future**" being conducted by Amity Institute of Food Technology (AIFT) during **29-31 March, 2022**.

Building on the success of previous Conference, the theme for 2022 is forward looking and will provide an excellent platform to address all major concerns related to food sustainability. Food safety and security are two complementing elements for our sustainable future. Hence, we need novel solutions for those challenges. Therefore, the role of Scientific Community and Food Technology Institutions are indispensable. As always Amity come up through AMIFOST-2022 to find out scientific and technological solutions to problems of Food Sustainability that not only Indians face but also those which plague the global citizens.

I look forward to learning new ideas, recent advancement from the participants on the theme of the conference and related deliberations.

The program has already been formulated very well aiming at fruitful outcomes. The networking opportunities during the event will also bring synergy among the participants leading to consortium approach.

Best wishes for a successful and fruitful Conference.

Dr. W. Selvamurthy



**Prof. V K Modi.** Ph. D. (Food Technology), PDF (UK), UNUF, FAFST Head of Institute *Former Chief Scientist, Professor AcSIR and Head CSIR-Central Food Technological Research Institute, Mysore* 



#### <u>Message</u>

I am pleased to know that Amity Institute of Food Technology has taken initiative in organizing International Conference 5<sup>th</sup> AMIFOST on the theme "Food Sustainability: Challenges and Opportunities for Future".

The world population is predicted to grow to around 10 billion in 2050 with corresponding food demand predicted to increase by 60 per cent. The production and consumption of sufficient, affordable and nutritious food, while conserving the natural resources and ecosystems on which food systems depend, is vital. Food systems play a central role in all societies and are fundamental to ensuring sustainable development. Sustainable food systems are critical to resolving issues of food security, poverty alleviation and adequate nutrition, and they play an important role in building resilience in communities responding to a rapidly changing global environment. An integrated multi-sectoral approach across the whole food supply chain is required to address global food and nutrition insecurity.

I wish all success to the conference and trust that it will churn the minds of scientists, academicians, industry and policy makers alike and would see fruitful outcome of the conference.

I wish a great success for 5<sup>th</sup> AMIFOST 2022.

Prof. V K Modi

Head of Institute Amity Institute of Food Technology Amity University Uttar Pradesh – 201303



**Dr. Monika Thakur** Associate Professor *Amity Institute of Food Technology Amity University Uttar Pardesh* 



Food security is a basic human right. However, for hundreds of millions of people, it is not being met. Food security, nutrition and sustainability are integral to the strategies for achieving the UN sustainable development goal of hunger free world. Sustainability is very relevant to food security. It is the precondition to achieve long term food security. The three dimensions of Sustainability- Social, economical and environmental ensure the stability of food systems. Sustainable food systems have to deliver nutrition and food security to everyone in a way that is economically viable, socially beneficial and make positive impact on the environment.

Food sustainability is a matter for both present and future generations around the globe. It is a window into whether society will provide for itself now, but also its future later.

International Conference 5<sup>th</sup> AMIFOST- 2022 on "Food Sustainability: Challenges and Opportunities for future" plans to address the issues, strategies and solutions relevant to the topic.

We are sure that the deliberations and discussions made in the conference would be beneficial to all the stakeholders.

We are thankful to the esteemed speakers and participants from all over the globe to have shown great interest in the conference.

**Dr. Monika Thakur** Convener – 5<sup>th</sup> AMIFOST 2022 Associate Professor Amity Institute of Food Technology Amity University Uttar Pradesh

### **International Conference on** Food Sustainability: Challenges and Opportunities for the Future

5<sup>th</sup> AMIFOST 2022 (29<sup>th</sup> - 31<sup>th</sup> March 2022)



DAY 1 (Tuesday, 29<sup>th</sup> March 2021) Timing as per Indian Standard Time (IST)

INAUGURAL SESSION		
Joining Link: https://amityuni.live/81731050924		
10:30am– 10:40am	Joining of Panelists & Participants	
10:40am– 10:45am	Welcome address by <b>Dr. Monika Thakur,</b> Associate Professor, Amity Institute of Food Technology, Amity University Uttar Pradesh, Noida, India	
10:45am-10:50am	Lighting of lamp & Saraswati Vandana	
10:50am– 11:00am	Address on the theme by – <b>Dr. V K Modi,</b> Professor & HoI, Amity Institute of Food Technology, Amity University Uttar Pradesh, Noida, India	
11:00am – 11:10am	Address by <b>Dr. Nutan Kaushik</b> , Director General, Food & Agriculture Foundation, Amity University Uttar Pradesh, India	
11:10am – 11:20am	Address by <b>Dr. W. Selvamurthy</b> , President - Amity Science, Technology & Innovation Foundation, Director General - Amity Directorate of Science & Innovation, Amity University Uttar Pradesh, India	
11.20am – 11:30am	Address by <b>Prof. (Dr.) Balvinder Shukla</b> , Hon'ble Vice Chancellor, Amity University Uttar Pradesh, India	
11:30am- 11:50am	KEYNOTE ADDRESS - <b>Prof. Giancarlo Cravotto</b> , Department of Drug Science & Technology, University of Turin, Italy	
11:50am-12:10pm	Inaugural address - Chief Guest Dr Sridevi Annapurna Singh, Director, CSIR, Central Food Technological Research Institute, Mysore, India	

12:20pm – 12:30 pm	Blessings by the Hon'ble Founder President, <b>Dr. Ashok K Chauhan</b> , Ritnand Balved Education Foundation & Chairman, AKC Group of Companies, India
12:30 pm – 12:35pm	Release of e-Souvenir – AMIFOST 2022
12:35pm -12:40pm	Vote of Thanks <b>Dr. Monika Thakur</b> Convener, AMIFOST 2022

Technical Session -1	Theme - Climate Change and Sustainable Food Production	
Joining Link:	https://amityuni.live/87598048453	
	29 <sup>th</sup> March 2022 (1:00pm pm to 3:00pm)	
<b>INVITED SPEAKERS</b>	INVITED SPEAKERS	
1:00pm- 1:20pm	Prof. Anli Geng; Ngee Ann Polytechnic, Singapore	
1:20pm – 1:40pm	Prof. Jai Prakash Verma; Banaras Hindu University, India	
1:45pm – 2:05pm	<b>Dr. Deepak Mudgil</b> , Mansinhbhai Institute of Dairy and Food Technology Mehsana, Gujarat, India	
<b>PRESENTATION BY</b>	CATION BY PARTICIPANTS	
2:05pm - 3:00pm	Oral Presentations (participants) (8 – 10 min duration)	
	<ol> <li>Mouandhe Imamou Hassani; Amity University Rajasthan, Jaipur India</li> <li>M Bhalerao, Kradbhajne, Karadbhajne; RTM Nagpur University, India</li> <li>Shalini Kumari and Jyoti Kumar; Ranchi University, Ranchi</li> <li>Usha Sharma, Saleem Siddiqui; Sharda University, India</li> </ol>	

<b>Technical Session - 2</b>	Theme - Technologies for Food Safety and Quality		
	Analysis		
Joining Link	https://amityuni.live/87598048453		
	29 <sup>th</sup> March 2022 (3:00pm – 5:30 pm)		
<b>INVITED SPEAKERS</b>			
3:00pm – 3:20pm	Prof. Xingyu Lin; Zhejiang University, China		
3:20pm -3:40pm	Dr. Miguel Angel Prieto Lage; University of Vigo, Spain		
3:40pm - 4:00pm	Dr. Brendan A. Niemira; Food Safety and Intervention Technologies,		
	USDA, United States		
PRESENTATION BY PARTICIPANTS			
4:00pm – 5:30pm	Oral Presentations (participants) (8 – 10 min duration) 1) QUAN Ma, XINWEI Wu, YANQUN Xu & ZISHENG Luo; Zhejiang University, People's Republic of China 2) Harsh Sable, Vaishali, Vandana Singh; Sharda University, Greater Noida 3) Ritu Tanwar, Anuradha Singh; Galgotias University, Greater Noida, Uttar Pradesh 4) R. B. Waghmare; Panjabrao Deshmukh Krishi Vidyapeeth, Yavatmal, Maharashtra, India		

Technical Session -3	Theme – Responsible Consumption and Sustainable		
Joining Link:	https://amityuni.live/87598048453		
	29 <sup>th</sup> March 2022 (5:30 – 7:30 pm)		
<b>INVITED SPEAKERS</b>			
5:30pm - 5:50pm	Dr. Florence Egal; Food Security and Nutrition Expert, Italy		
5:50pm – 6:10pm	Prof. Karuna Singh; Sharda University, Greater Noida, India		
6:10pm – 6:30pm	Prof. Joe Regenstein; Cornell University, United States		
<b>PRESENTATION BY</b>	BY PARTICIPANTS		
6:10pm – 7:30pm	Oral Presentations (participants) (8 – 10 min duration)		
	1) Abhay Tiwari, Satyawati Sharma, Vasudha Sharma, Rupesh Kumar Srivastava; Indian Institute of Technology, New Delhi, India		
	2) A. Silva, L. Cassani, C. Lourenço-Lopes, C. Grosso, J. Simal-Gandarra, M. A. Prieto, M. F. Barroso; University of Vigo, Ourense Campus, E32004 Ourense, Spain		
	<ul> <li>3) Adamu M.A. Ikya, J.K. Camila Rodriques Carneiro, Jane S.R Coimbra, César A.S da Silva; Kano University of Science and Technology Wudil, Nigeria.</li> <li>4) Ms. Jyoti and Dr. Shakun Tyagi; Mewar University, India</li> </ul>		

OFFLINE -POSTER SESSIONS - I		
VENUE: I1 BLOCK		
	29 <sup>TH</sup> March (10:00 am– 2:00 pm)	

## **DAY – 2 (Wednesday, 30th March 2022)** Timing as per Indian Standard Time (IST)

Technical Session 4	Theme – Conservation and Promotion of Traditional		
	Food Culture		
Joining Link:	https://amityuni.live/82748535215		
	30 <sup>th</sup> March (9:00am – 11:00am)		
<b>INVITED SPEAKERS</b>			
9:00am – 9:10am	Prof. Eram Rao, Delhi University, Delhi		
9:10am- 9:30am	Dr. Pratima Shashtri; LIT Nagpur, India		
9:30am – 9:50am	Mr. Abhishek Biswas; Sattvik Council of India		
<b>PRESENTATION BY</b>	PARTICIPANTS		
09:50am– 10:30am	<ul> <li>Oral Presentations (participants) (8 – 10 min duration)</li> <li>1) A. Nath, Shikha Sharma, Peyush Punia, R.P. Mishra and A.S. Panwar; ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut</li> <li>2) Q S Bahar, N C Shahi, U C Lohani, A Kumar, Om Prakash; G B Pant University of Agriculture and Technology, Pantnagar-263145, Uttarakhand</li> <li>3) Ringshangphi Khapudang &amp; Dr. Saleem Siddiqui; School of Basic Sciences and Research, Sharda University, India</li> <li>4) Dr. Jyoti Goyat and Dr. Payal Mahajan; School of Medical &amp; Allied Sciences, GD Goenka University, Gurugram</li> <li>5) SHRUT11 Mishra, MITHUL Aravind, CHAKKARAVARTHI Saravana; National Institute of Food Technology Entrepreneurship &amp; Management (NIFTEM), Kundli, Sonipat, Haryana, India</li> </ul>		

<b>Technical Session 5</b>	Theme – Sustainable Green Food Processing	
	Technologies	
Joining Link:	https://amityuni.live/82748535215	
	30 <sup>th</sup> March (11:00am – 1:00pm)	
INVITED SPEAKERS		
11:00am-11:20am	Prof. Hongshum YANG; National University of Singapore, Singapore	
11:20am – 11:40am	Dr. Alka Joshi; ICAR New Delhi, India	
11:40am-12:00 noon	Prof. Petras Rimantas Venskutonis; Kaunas University of Technology,	
	Lithuania	
<b>PRESENTATION BY</b>	Y PARTICIPANTS	
12:05pm-1:00pm	Oral Presentations (participants) $(8 - 10 \text{ min duration})$	
	1)S.S.Zambre, M. G. Bhotmange; Laxminarayan Institute of Technology, RTM	
	Nagpur University, India	
	2) Meghana Tripathi, Bhagat Singh, Charu Gupta and Girish Sharma; Amity	
	Institute of Biotechnology, AUUP, Noida	
	3) Shafat Ahmad Khan, Madhuresh Dwivedi, Aamir Hussain Dar, Sushil Kumar	
	Singh; National Institute of Technology Rourkela	
	4) N. Hans, A. Malik, S.N. Naik; Centre for Rural Development and Technology,	
	IIT, Delhi	

Technical Session 6	Theme - Food Diversity and Food Security	
Joining Link:	https://amityuni.live/82748535215	
	30 <sup>th</sup> March (1:00 pm – 2:00 pm)	
<b>INVITED SPEAKERS</b>		
1:00pm-1:15pm	Dr. Indra D Bhatt; G BPant National Institute of Himalayan Environment, India	
1:15pm-1:30pm	Dr. Somesh Sharma, Shoolini University Solan, India	
1:30pm - 1:45pm	Dr. Sapna Langyan; ICAR, NBPGR, India	
PRESENTATION BY PARTICIPANTS		
(Separate session)	31 <sup>st</sup> March 2022 (10:00-1:00pm)	

Technical Session 7	Theme - Advances in Food Formulations and Packaging	
	– introducing Sustainable Food Products and Technologies	
Joining Link:	https://amityuni.live/82748535215	
	30 <sup>th</sup> March (2:00 pm – 4:00 pm)	
<b>INVITED SPEAKERS</b>		
2:00pm-2:20pm	Ben (Yizhou) Ma; Wageningen University, The Netherlands	
2:20pm – 2:40pm	Prof. Ana Sanches; National Institute of Agrarian and Veterinary	
	Research, Portugal	
2:40pm-3:00pm	Prof. Srinivas Janaswamy; South Dakota State University, United States	
PRESENTATIONS BY PARTICIPANTS		
3:00pm-4:00pm	<ul> <li>Oral Presentations (participants) (8 – 10 min duration)</li> <li>1) A.S. Ghorband, Vidushi Mehta, Nitin Suradhkar and H.W. Deshpande; Collegeof Food Processing Technology &amp; Bioenergy, Anand, AAU, Gujrat, India</li> <li>2) P. B. Raul, S. R. Ushekwar; Rashtrasant Tukadoji Maharaj Nagpur University, Laxminarayan Institute of Technology, India</li> <li>3) Arshi Malik, Muskaan Khan, Prabhjot Kaur; Shaheed Rajguru College of AppliedScience for Women, University of Delhi</li> <li>4) Divyashree K, Mukta Hugar, Vaisiri V Murthy, Soumitra Banerjee; Jyothy Institute of Technology, Tataguni, Bengaluru, Karnataka</li> <li>5) Adil Jamal Ansari; Dr.Oetker India Pvt. Ltd., Noida India</li> </ul>	

Special session for Joining Link: <u>https://amityuni.live/82748535215</u>		
<b>Research Scholars</b>		
'What I wish I knew during my Food Science studies'		
4:00 to 4:30 pm		
Dr. Abigail Thiel, Wageningen University, The Netherlands		

OFFLINE -POSTER SESSIONS - II		
VENUE: I1 BLOCK		
30 <sup>th</sup> March (10:00 am- 2:0	0 pm)	

## **DAY – 3 (Thursday, 31st March 2022)** Timing as per Indian Standard Time (IST)

Technical Session 8	Theme - Valorisation of Food by-products and Food	
	waste	
Joining Link:	https://amityuni.live/84106262598	
	31 <sup>st</sup> March (9:20am – 11:30 am)	
INVITED SPEAKERS		
9:20am – 9:40am	Ms. Tinia Pina; Re-Nuble New York, United States	
9:40am-10:00am	Prof. DONG Renjie; China Agricultural University, China	
10:00am-10:20am	Prof. Esra CAPANOGLU; Istanbul Technical University, Turkey	
10:20am- 10:40am	Prof. S.S.Lele; Institute of Chemical Technology, Mumbai, India	
PRESENTATION BY PARTICIPANTS		
11:00am – 11:30am	Oral Presentations (participants) (8 – 10 min duration)	
	1)Ruyuan Zhang, Lei Wang, Fatima-ezzahra Ettoumi, Miral Javed, Li Li, Xingyu	
	Lin, Yanqun Xu, Xingfeng Shao, Zisheng Luo; College of Biosystems Engineering	
	and Food Science, Zhejiang University, China	
	2) Monika Sharma, Abhishek Singh, Amanchi A Sangma, Devaraja HC, and Menon	
	Rekha Ravindra; Southern Regional Station, ICAR-NDRI, Bangalore, India	
	3)Dr. B. B Borse; UNU-KIRIN Fellow-Japan, prof AcSIR and Sr. Principal	
	Scientist SFS Dept., CSIR-CFTRI Mysore	

Technical Session 9	Theme - Food and Function: achieving Bigger Goals	
Joining Link:	https://amityuni.live/84106262598	
	31 <sup>st</sup> March (11:30 am- 2:00 pm)	
INVITED SPEAKERS		
11:30am–11:50am	Prof. Nenad Naumovski; University of Canberra, Australia	
11:50am – 12:10pm	Dr. Malgorzata Starowicz; Polish Academy of Sciences in Olsztyn, Poland	
12:10pm -12:30pm	Prof. Dr. Milen I. Georgiev; Bulgarian Academy of Sciences, Bulgaria	
12:30pm-12:50pm	Dr. Himani Agarwal; Polish Academy of Science Poznan, Poland	
<b>PRESENTATION BY P</b>	ARTICIPANTS	
12:50pm – 2:00pm	Oral Presentations (participants) $(8 - 10 \text{ min duration})$	
	<ol> <li>Gaodan Liu, Jiadan Yan, Di Luan, Simin Feng; Zhejiang University of Technology, People's Republic of China</li> <li>Anmariya Benny and Rituja Upadhyay; Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu, India.</li> <li>P. Otero, F. Chamorro, J. Echave, M. Carpen, P. Garcia-Perez, L. Cassani, M. Barral-Martinez, J. Simal-Gandara, M.A. Prieto; UNiversity of Vigo, Spain</li> <li>Prashant Dahal, Kyle Pfaffeneberger, Srinivas Janaswamy; Dakota State University Brookings USA</li> </ol>	

VALIDECTORY SESSION				
	Joining Link: <u>https://amityuni.live/83283849266</u>			
	Conference Report – Dr. Monika Thakur, Convener AMIFOST 2022			
	Guest of Honour, - Mr. Anand Chordia, Praveen Masalewale, Pune			
	Award distribution (Best Oral & Poster presentations)			
	Blessings by Hon'ble Founder President - Dr. Ashok K Chauhan, Prof. (Dr.) Balvinder Shukla – Vice Chancellor & Dr. W. Selvamurthy Director General- ADSI, Amity University Uttar Pradesh			
2:30pm – 5:30pm	Address by <b>Dr. Nutan Kaushik</b> , Director General, Food & Agriculture Foundation, Amity University Uttar Pradesh, India			
	<b>Dr. V K Modi</b> , HoI, Amity Institute of Food Technology, Amity University Uttar Pradesh, concluding remarks			
	Vote of Thanks — <b>Dr. Renu Khedkar</b> ,			
	Organizing Secretary, AMIFOST 2022			

e-POSTER SESSION		
Joining Link: <u>https://amityuni.live/89664799496</u>		
31 <sup>st</sup> March (10:00 am– 12:30 pm)		
PRESENTATION BY PARTICIPANTS		

ORAL PRESENTATION SESSION (online)		
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#### **Recent Advances and Industrial Perspectives in Sustainable Extraction Processes**

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Over the last two decades, the literature has highlighted the considerable effort made by research laboratories to find efficient and environmentally friendly extraction processes that comply with the principles of green and sustainable extraction. Improved heat and mass transfer lead to lower solvent and energy consumption, increasing yields and extract quality while minimizing degradation. Finding the most appropriate technique with which to obtain high quality bioactive from vegetal matrices can be a challenging task, in particular because of the huge ecological and economic impact of processes. Relevant advances have been made with the use of non-conventional technologies and green solvents. Among the most effective technologies, we can list extractions assisted by microwaves, by ultrasound and hydrodynamiccavitation, by pulsed electric fields and by enzymatic treatment. An important role is played by supercritical fluid extraction, in particular supercritical CO2, and subcritical water extraction. The latter is in rapid diffusion due to the new industrial reactors. Under these conditions hydrogen bonds are broken and water change the polarity and dielectric constant, improving the extraction power, mimicking the behavior of hydroalcoholic mixtures. In all methods reported, the definition of crucial extraction parameters and conditions, at laboratory and pilotscales, with a careful analysis and modeling of heat, mass transfer and the corresponding energy consumption is of paramount value for scale-up engineering toward sustainable industrial protocols.

**Keywords:** Green extraction, supercritical CO<sub>2</sub>, subcritical water, microwaves, ultrasound, hydrodynamic cavitation.

# <u>TS-01</u> <u>Climate Change and</u> <u>Sustainable Food Production</u>

#### Zero- waste Upcycling Food By-products through Fermentation

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Food industries produce large number of residues or by-products every year along the entire food processing and storage chain. These include pomace, fruit, and vegetable peels, husks, bran, and germ of cereals. They account for about 30% of the processed raw material mass. They are rich sources of high value components such as polysaccharides, sugars, proteins, dietary fibres, fatty acids, flavours and aromas, and bioactive compounds. Upcycling of such byproducts to food and food ingredients is very critical for sustainable food production. Chemical, physical and biological methods were adopted. Among them, bioconversion, or fermentation, is playing an important role. Fermentation is a well-known technique for the production of fermented food, such as bread, wine, beer, yogurt, cheese and pickles etc. It enhances food flavour and increases food nutrient level and digestibility. In addition, it lengthens food shelf life. For the valorization of food and agriculture by-products, fermentationconverts them to higher value products, such as enzymes, microbial proteins and lipids, fuels and chemicals, and animal feed. In addition, fermentation also extracts the nutritional value and decreases the toxicity of these by-products. This presentation provides a comprehensive overview on the roles of fermentation on the upcycling of food by-products and its contributionto sustainable food production.

Keywords: food byproducts, upcycling, fermentation, sustainable food production

#### Phyto-microbiome helpful for Enhancing Nutritional Quality and Sustainable Productivity Under Changing Climate

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In future, for food and nutrient security, the global demand for agriculture production will increase due to an ever-increasing population. Therefore, there is a need of enhancing farm production within the cultivable land under increasingly harsh climatic conditions without further damaging soil and water quality from agrochemical pollutions. Additionally, we also need to protect farms from endemic pest, and pathogens. Harnessing Phyto microbiomes is considered as one of the effective and environmentally sustainable solutions to these challenges. A diverse number of important microbes are found in various parts of the plant, i.e., root, shoots, leaf, seed, and flower, which play significant roles for improving quality and quantity of food produces. The plant microbiome or Phyto microbiome plays a significant rolein supporting plant health and it serves as a pool of additional genes that plants can access when required. In other way, sustainable agricultural practices are only the solution of recharging themicrobial population in soils and plant to make healthier for crop productivity and suppression of soil borne Phyto-pathogen. Microorganisms use several direct mechanism activities e.g., production of plant hormones (indole-3-acetic acid), ammonium, siderophore and nutrient solubilization, and indirect mechanism activities e.g., hydrogen cyanide, chitinase, protease and antibiotic for plant growth promotion. The impact of Phyto microbes on plant growth and development is well studied but postharvest Phyto microbiome and its functional importance are manly unexplored while postharvest loss is big issues and challenges in worldwide. Manipulation of the Phyto microbiome has a great potential to increase agricultural production and reduce plant diseases, chemical inputs, and greenhouse gases emission. In this topic, we have tried to explore the different type's Phyto microbiome and their functional properties for enhancing sustainable agricultural production as well as soil fertility and health under the changing climate.

Keywords: Phytomicrobiome, Sustainable agriculture, green revolution, crop productivity

#### Partially Hydrolysed Guar Gum as Sustainable Source of Dietary Fiber

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Partially hydrolyzed guar gum (PHGG) is water soluble gum which is obtained after partial hydrolysis of native guar gum. This hydrolysis can be achieved via enzymatic hydrolysis, acidhydrolysis, irradiation, microwave and ultrasonication techniques. Besides its molecular weight and viscosity, it is similar in structure and functions to native guar galactomannan. It has around 10 times lesser molecular weight as compared to native guar gum. PHGG preparedvia enzymatic hydrolysis has been extensively studied for its food applications as dietary fiber.PHGG can be used for dietary fiber fortification of food products due to its less viscosity, watersoluble, tasteless, colorless, and odorless behavior. Hence, it can also be utilized in liquid foodproducts like beverages. Its fortification in food products not only increases the dietary fiber content but also improves their physicochemical and sensory characteristics. Partial hydrolysis f guar gum does not interfere with its functional nature hence its use in food products leads to certain health benefits such as diabetes, cardiovascular disease, prebiotic effects, satietycontrol, digestive problems, etc. similar to native guar gum.

Keywords: dietary fiber, guar gum, partially hydrolyzed guar gum, enzymatic hydrolysis

#### **Plant-Based Protein: Opportunities and Challenges**

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Plant-based proteins are the food sources of protein that are derived from plants. They are designed to substitute animal-based proteins. For many decades, researchers have been discussing the formulation of meat analogs using various sources including plants. The present review intends to demonstrate the importance of plant-based protein, as well as the challenges confronted during its manufacture and its marketing. The need for such products is increasing worldwide due to numerous reasons. Global warming, animal welfare, human health, and religious concerns are the principal driving forces causing consumers to shift from traditional meat products to plant-based proteins products. Furthermore, malnutrition and protein deficiencies occurred among vegetarians can be relieved by consuming plant-based products that are highly rich in proteins. However, these products pose certain challenges from the selection of protein sources to the processing and consumer acceptance. They are generally ultra-processed and hence they may be possessing nutrient deficiencies. The requirement of imitating certain aesthetic qualities and chemical characteristics of animal-based proteinultimately leads to the addition of food additives and food preservatives. In fact, the addition of chemicals raises issues about the safety of the final product. Plantbased proteins are quite popular nowadays in western countries and have also been introduced in the Indian market. Meat alternatives such as tofu, tempeh, seitan, and pulses are commonly consumed in developed countries. Therefore, the development of plant-based proteins is of crucial importance nevertheless technological and regulatory factors should be considered.

Keywords: Plant, meat analogs, nutrition, quality

#### **Modification and Isolation of Non-Traditional Oils**

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Cooking oils are imported and still these are used in various food industries for their derivatives. This research is intended to highlight the utilization of non-traditional oils in a newer way. Main objective of the research is to develop modified non-traditional oil to improve the functionality of oil, by developing technique so as to eliminate the limitations of these oil used currently. These modification processes can be a single step modification or required as in multiple steps like Structuring of Fatty acid to be used as intermediate or finished products into food industry, to work on bio active compounds, present in oil, Nutritional values, and nutraceutical properties of non-traditional oil. Charoli seed oil has unique compositions hence modified oil gives an excellent product to be as emulsifier. Modification includes isomerization and blending. This blending is beneficial to food industries to give better choiceto diabetes patient with cardiovascular disease in patients. This will increase the nutritional value because adopting this non-traditional oil as part of cooking will take time for the society. Therefore, finished product with these blends and modification will provide health benefits. Also, the modification process is beneficial to industries. Isolation of antioxidants, bioactive compounds, leads to formulation of fatty acid distillate. Also increment in nutraceutical properties enhances the oil. This conversion of oil into value added products will be easy to market and consumer friendly.

Keywords: non-traditional oils, modifications, bioactive compounds, nutraceuticals, nutritional value

## Mineral Composition of Some Neglected Wild Edible Plants Consumed by Munda Tribe of Jharkhand, India.

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Jharkhand (land of forest) is endowed with a variety of indigenous greens, which are consumed by the various ethnic groups for different reasons. Currently, there is global outcry over food insecurity due to pandemic, wild edible plants make a substantial contribution to food security and dietary diversity. In this study leaves of four neglected wild edible plants consumed mainlyby Munda tribe namely Senna tora, Boerhavia diffusa, Commelina benghalensis and Alternenthera paronychioides were analyzed for their macro-mineral and micro-mineral composition by using Atomic Absorption Spectrophotometer (Agilent 200 series AA) according to the standard method described by AOAC (19th Edition, 2016, Ch.9, 999.11). Nitrogen and Chloride by titration method, titrated against standard 0.02N H2SO4 and standardize silver nitrate solution respectively. Result of the study revealed that the macro- minerals content in mg/100gram in selected wild edible species varies from nitrogen (1323.2±31.54 - 1803.2±43.26), potassium (1187.99±9.41 - $1525.67\pm23.34$ ), calcium (25.43 $\pm0.26$  - 325.4 $\pm2.96$ ), magnesium (64.25 $\pm1.2$  - 161.33 $\pm2.11$ ), phosphorus  $(94.32\pm1.34 - 103.04\pm0.79)$ , sodium  $(25.88\pm0.75 - 89.13\pm0.64)$  and chloride  $(267.2\pm7.8 - 376\pm6.12)$ whereas micro-mineral content in mg/100 gram in selected wild edible species varies from iron $(1.13\pm0.11 -$ 8.61±0.4), manganese (0.61±0.15 - 3.69±0.17), zinc (0.45±0.17- 2.61±0.14) and copper (0.28±0.06 -0.57±0.06). Result indicate that the mineral content of these neglected wildedibles was comparatively higher than that of commercial veggies like Spinacia oleraceae. Due to shortage of fertile land, rise in food prices, high rate of population growth, there is hugedifference between demand and supply of foods which leads to hunger and malnutrition. Thesewild edibles can erase the gap and can favorably be used as a substitute for most of the commonly used vegetable.

*Keywords:* Mineral composition, neglected wild edible plants, Munda tribe, Jharkhand, Atomic absorption spectrophotometer

#### Seaweed - A Sustainable Food Source in The Food Industry

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Seaweed demand is increasing globally due to its high nutritional quality and ecological importance. There are more than 600 recognized edible seaweeds around the world. The well-known seaweed species in Asia is Porphyra/Pyropia spp. (Nori), Laminaria/Saccharina spp. (Kombu), and Undaria spp. (Wakame). Seaweed is abounded with protein (phycobiliproteins), essential minerals (such as calcium, iron, iodine, magnesium, and potassium), and bioactive compounds (such as polysaccharides, pigments, fatty acids, polyphenols, and peptide). It possesses antibacterial, antioxidant, and anti-inflammatory as well as, therapeutic properties against diabetes, hyperglycemia, cancer, aging, obesity, metabolic disorders, and cardiovascular disease. Due to its potential functionality, it is widely used as a functional ingredient in the food industry to develop "noble food" products. In recent years, the food industry widely used seaweed polysaccharides isolate such as agar, agarose, alginate, and carrageenan, which act as thickening, gelling, emulsifying, and solidifying agents, etc., to extend the shelf-life and improve the quality of food. Apart from this whole seaweed like Ascophyllum nodosum and Undaria pinnatafida @ 5% and 10% have also been used in makingbread and pasta. Other than this, whole seaweeds have also been added in meat products to improve water retention and gel formation. Gracilaria domingensis has been used as a texture modifier in fermented milk. Alginate oligosaccharides obtained from Laminaria hyperborean act as preservatives in yogurt, while Ascophyllum nodosum and Fucus vesiculosus have been used as functional ingredients in milk to improve milk quality and extend their shelf life. Gluten-free fresh pasta has been developed with Laminaria ochroleuca.

Keywords: Anti-inflammatory, food Products, Gluten-free, Nutritional quality, Seaweeds, Shelf-life.

#### Novel Approach of Using LEDs to Grow Indoor Lettuce Hydroponically

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Lettuce-perennial shrub, is a green leafy vegetable that belongs to daisy family, Asteraceae. Due to its high nutritional values novel approaches to grow this vegetable is need of the hour. It is mostly found as well as consumed in China, United States of America rather than in India. Lettuce, being a winter crop, grows well at 15-20°C of temperature with 6-8 hours of exposure os sunlight every day. India being a tropical country, temperature is not very favorable for lettuce to grow on annual basis to a desired extent. One way to address this issue without any compromise in its nutritional values is the use of Light Emitting Diodes (LEDs)– a non-thermalsource of energy and propagating it hydroponically. Prior state of art cites the hydroponic cultivation of Lettuce with varied wavelengths and intensity of light (i) Red light (620-750nm)helps in growth, biomass accumulation, promote photosynthesis and anthocyanin accumulationin leaf and increase in concentration of phenolics, (ii) Blue light (460-495nm) exposure stimulates photomorphogenesis, controls stomata functioning and anthocyanin biosynthesis, (iii) Green light (495-570 nm) regulates leaf expansion, stem stretching and stomatal conductance. Lettuce cultivated under the irradiation of LED light yields higher number of leaves with healthy appearance, leaf area and it is not very unlike from naturally grown lettuceas nutrients and antioxidants are retained using organic or inorganic nutrient solutions in which lettuce grown hydroponically. Hence, LED lightning is beneficial and suitable for production of lettuce every season, quality of lettuce can be tuned by appropriate selection of LED light intensity and wavelength, thereby offering great nutritional facts irrespective of season is the outcome of this research.

Keywords: Lettuce, perennial shrub, hydroponic, LEDs, antioxidants, organic/inorganic nutrient solution
# Probiotics: Multiple Roles of Microbes from Conventional and Non-Conventional Sources: A Review

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The part of gut flora in human body plays a major role in meliorating human health. We all know human body consist of numerous beneficial live microorganisms which helps in fightingwith any unwanted foreign organism entering in our body. Similarly, during the time of intestinal discomfort or diarrhea. The recent development shows that how people, in these daysare more onto taking probiotics and treating intestinal discomfort rather taking medicines. Probiotics have a large variety of genera and species included such *as Lactobacillus, Streptococcus, Lueconostoc, Pediococcus, Propionibacter, Enterococcus, Bifidobacterium, Bacillus, Saccharomyces. cerevisiae, Candida pintolopesii, Aspergillus niger* etc. Out of all these the leading and most demanding genera is *Lactobacillus* as it is playing a very crucial part in food and feed industries throughout the world. Not only dairy but unconventional sources can also be rich in probiotic species. The most found are the Lactic Acid Bacillus strains in fresh fruits, vegetables, fruit Juices, cereals. Probiotics not only have contribution towards preventing diarrhea but also have made its stand in reducing coronary heart disease, obesity and acting as immunity booster. Soon the demand for probiotics will be increased for sure as it can treat numerous health issues. Therefore, coming up with new ideas to invent better strains would help in making the furthertreatment of different diseases by probiotic accurate and convenient.

Keywords: Probiotics; conventional and non-conventional sources

#### General Preventive Measures of Food Safety During the Pandemic COVID-19: A Public Outreach

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Today COVID-19 is considered a global pandemic that results in a rapid increase in the numberof infected patients, increased mortality globally. The COVID-19 pandemic has created an unprecedented crisis in terms of social, economic, and food crisis and its safety. It's really a challenge to safely shop, order, and prepare food to minimize transmission of the novel coronavirus. The governments and various health institutions globally tried to protect the livesof all their citizens during the pandemic, but this is not enough because it required preparednessto reduce the risk of coronavirus to prevent further spread between people, through effective response and planning. We do know that eating a healthy diet, being physically active, managing stress, and getting enough sleep are critical to keeping our immune system strong. As public outreach, it is essential that effective communication strategies be followed for public awareness about the causes of the outbreak and preventive measures regarding the COVID-19 pandemic. The easiest way to minimize the risk of infection from foods purchasedat a store or delivered to your home is just to let it sit in an out-of-the-way place for three days.Nanotechnology is taking root against COVID-19 through food prevention, packaging, and prevention of infections. The study has included effective management of food safety to controland handle packaging effectively to minimize the threats arising from the pandemic to safe peoples.

Keywords: World Health Organization, Preparedness, and COVID-19.

#### Food Security and Its Impact on Climate Change: A Review

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Climate change has the potential to interrupt efforts to achieve a world without hunger. Climatechanges have been found to have a strong and continuous global pattern on agricultural productivity, which could have ramifications for food availability. The search for long term solutions is complicated by climate change, increased prosperity, and changing food preferences. Climate change could have a wide range of effects on food systems, from direct effects on crop production (e, g., changes in rainfall leading to drought or flooding, or warmer or cooler temperatures leading to changes in the length of the growing season) to market and supply chain infrastructure changes. When food systems are challenged, food availability (production, distribution, and exchange), food access (affordability, allocation, and choice), and food intake are all damaged (nutritional and societal values and safety). In the long run, natural disasters and climate change pose serious concerns to food and nutritional security. These threats suffocate food production by reducing crop yields, seed reserves, cattle, fisheries, farm equipment, infrastructure, supply networks, and food trade, resulting in economic losses and disturbing domestic balances of vulnerable countries. Uncertainty about future effects, combined with evidence that climate change may result in more variable food quality, emphasizes the importance of preserving and strengthening existing structures and policies to regulate food production, monitor food quality and safety, and respond to nutritional and safety issues as they arise. We assess probable macronutrient and micronutrient adequacy in the year2050 using country-specific biophysical and socioeconomic scenarios. In 2050, the key food security problem will be providing nutritious diets rather than necessary calories. Climate change has the potential to undo the advances gained in the battle against hunger andmalnutrition thus far. Climate change exacerbates and amplifies risks to food security for the world's most vulnerable countries and populations, according to the Intergovernmental Panel on Climate Change's (IPCC) latest assessment report.

Keywords: Climate change, food safety, nutritional security, malnutrition, hunger

#### Banana Peel Drying Using Dielectric Heating Assisted with Carbonation and Ultrasonication

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Banana is very popular fruit in the world. It is utilized in various processed forms, but peel is discarded as waste. Banana peel rich in various nutrients, antioxidant and fibre can be utilized for value addition of food products. It can be stored for long period after dehydration. But selection of appropriate technique to minimize the quality losses is very important. Advanced techniques including hybrid drying can be utilized for dehydration of banana peel. In this studycombination of carbonation, ultrasonication and microwave was used to dry the banana peel. Dielectric heating with Microwaves is an emerging drying technique in which electromagneticwaves are used for drying. Unlike other conventional methods e.g., hot air drying, the rate of energy transfer is higher since the microwave drying takes less time for drying as compared to other techniques, but the hybrid drying resulted in lesser drying period, improvedflow properties of peel powder, enhanced the color of product.

Keywords: banana peel; dielectric heating; hybrid drying; carbonation and ultra-sonification

#### Feeding on the Way to Mars

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After the decades of safe and successful exploration in space, scientists are looking forward to such a successful exploration in space, scientists are looking forward to successful exploration in space. on mars. As this mission is going to be longest one will take 1-2 years for its completion, Scientists are very much concern about astronaut's health and the food they wouldcarry on this mission as till now we don't have food stuff that can last for this much duration of time without the loss in its nutrients, aroma, texture, flavor and spoilage. As the research going on we have some solutions including growing plants onboard that will reduce carry loadmoreover it provides astronauts with fresh and nutritive food but, the problem with growing plants in microgravity is that it reduces cell growth, alter gene expression due to radiation and change in root growth pattern but this problem is resolved when NASA conduct an experiment on ISS (International Space Station) of growing dwarf variety of plants in pillows filled with a porous growth medium Polyurethane coated pallets that contain nutrients and pillows that supply water to plants and allow air for roots this method is effective but can't provide all the essential nutrients to astronauts So, they need to carry dehydrated food with them to cover up other dietary requirements dehydrated food are stable for fairly long period of time(6-9 months) as water activity is very low, to consume these dehydrated food we need to add waterin the pouches in which food is sealed through specialized water gun then food are ready to consume but the issue is taste and aroma that are lost with time, another option is using algae, as we know algae produce most of our ecosystem oxygen and are good source of protein (species chlorella and spirulina are widely used) The researchers estimate roughly 30 percent of a astronauts food could be replaced by single cell protein(combination of algae, bacteria andfungi) due to its high protein content. All these options are still not able to sustain life for 2 years for that NASA is thinking of sending a capsule full of food stock on mars prior to human mission so that it reduces carry load as well as provide sufficient food for journey back on earth. NASA recently announces "Deep Space Food Challenges" rewarding people to give solution for space food challenges. At last, I would like to tell you that still much work neededin space food technology before mars mission and I'm positive that our scientists will work hard to make it out.

Keywords: feeding on mars, growing plants, use algae, dehydrated food

#### Millennial Food's - A New Trend in Future Food

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The market is rapidly evolving to keep up with millennials who are shifting their dietary habits. The economy is rapidly shifting to accommodate new demands, whether it's in terms of what meals people prefer or how they shop. Millennial households are purchasing more unprocessed meals like fruits and vegetables rather than processed goods, they are gravitating toward healthy, fresh, and organic foods. Fortunately, being the generation with the highest level of social media activity, millennials are willing to disclose a lot about themselves online, particularly when it comes to food. People are curious by how different generations and social groups communicate their eating habits and culinary preferences. The market for preservative-rich and canned foods is falling due to preferences for fresh, organic foods. As we continue to evolve and grow our choices do as well, and in doing so inculcate habits that help our body tomaintain a stable diet. Millennials also want convenience. This preference for convenience and quality has also opened the market to meal kit delivery companies and grocery delivery services, like Amazon Fresh and Blink It. Millennials are becoming more conscious and concerned about sustainability, many are looking at food options that are free of chemicals, fertilizers, and pesticides and overall take better care of their health. Because they grew up during the globalization era, they are more aware of global health trends and are more sensitiveto body impressions. Studies showing that 40 per cent of millennials have embraced a plant- based diet during the pandemic. The organic food space in India has changed much in the past15 years defining culinary trends. Younger millennials prefer to graze throughout the day. In addition to traditional chips and various solid products, liquid meal replacements, such as smoothies and protein drinks, play a growing role in the decreasing demand for three daily meals. Nowadays millennials are also focusing and promoting on the super foods present in the market like kale (green leafy vegetable rich in fibre and nutrient), berries (rich in antioxidants), green tea (rich in antioxidants and help in weight loss), nuts and seeds (full of fibres and healthy fats), kefir (fermented dairy beverage with multiple health benefits related to its probiotic content). Millennials account for 65% of India's population (18-35 years old). They are tech-savvy individuals who are routinely exposed to global trends and lifestyles, are well-read, have travelled widely, and have considerable purchasing power. They are also the ones who are driving the food industry's growth index. The evolving eating habits of millennials are increasingly prone to intentional excess. This implies that, while they want to dine out and eat well, they want to be cautious of what they eat and will choose their restaurants after careful consideration. Millennials are responsible shoppers who found it simpler to connect the links between their shopping habits and the individuals who make those things.

Keywords: vegan diet, superfoods, influencers, convenience, global trends

# <u>TS-02</u> <u>Technologies for Food Safety</u> <u>and Quality Analysis</u>

#### Nanofluidics For Direct Analysis of Hazards Materials in Unprocessed Food Sample

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In this work, instead of performing nucleic acid amplification in the bulk solution, we report anonporous PEG hydrogel with versatile functions for rapid, precise, and inhibition-free nucleic acid analysis in crude food samples. The cross-linked PEG hydrogel with nonporousstructures possesses adsorption, release, separation, restriction, and self-cleaning abilities. When digital loop-mediated isothermal amplification (LAMP) was performed inside this hydrogel, the surrounding nanostructure act as a temporary reservoir for reagents storage and release them on demand during the amplification. Meanwhile, the restricted nanoconfined environment of hydrogel also favor the enzymatic amplification process. Thus, an enhanced signal readout, robust anti-inhibition, faster amplification rate, more products yields and specific amplification without primer-dimers were obtained. Moreover, LAMP performed inside hydrogel demonstrated a high level of resistance to inhibition in various complex matrices. The underlying antiinhibition mechanism was also investigated. Digital quantification of Escherichia coli, Salmonella typhi and Listeria monocytogenes in whole blood were achieved within 20 min, with wide dynamic range, high specificity and low detection limit down to single bacterium. Visual counting via naked eye was also successfullyestablished with the help of a conventional LED flashlight. We believe the developed hydrogel nanofluidic system has an enormous potential for on-site direct analysis of complex, crude, and unprocessed samples in clinical, food, agricultural, and environmental fields.

Keywords: bacteria, rapid detection, isothermal amplification

#### Synergy and Antagonism: The Events Behind the Antioxidant Agents Used in Food Industry

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The food industry uses diverse chemicals and additives to improve the organoleptic properties and extend the shelf-life of food products. However, even though these compounds are added attending to their individual benefits, their combinatory effects are not evaluated or considered in most cases. This situation is probably worsened because of the time needed for carrying outall the assays. Nevertheless, a study based on binary combinations could predict the expected results is reasonable and help us to understand the possible implications of using these molecules. Synergy and antagonism are terms frequently used to describe these interactions; however, they are usually badly applied on simple relations and inadequately designed experiments and forget considerations of toxicological risk assessment. In this work, seven commercial antioxidant agents used by the food industry were evaluated for their antioxidant properties combined with trimethyl-quinoline (TMQ) or butyl-hydroxytoluene (BHT) or a combination of both (TMQ+BHT). Response surface methodology (RSM) was used to estimate the coefficients of the selected parameters if assuming independent action (IA) of theantioxidants or concentration addition (CA) of the compounds and quantifying the interactive effects of their application in terms of their resulting antioxidant activity. The results of the experiments showed statistically consistent responses of null, synergy and antagonism effects when characterizing the interactions between several pairs of individual and complex mixtures of chemical antioxidant agents. Furthermore, the results are directly expandable to other types of assays.

Keywords: Antioxidants, Food Additives, Synergy and Antagonism, Dose-Response Analysis

# Validation And Mechanisms of Cold Plasma Inactivation of Foodborne Viruses

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Cold plasma is a rapidly maturing nonthermal process used to improve food safety and functionality. One area of heightened interest is application for the control of foodborne viruses. This presentation will summarize the latest research on the efficacy of cold plasma treatment under different food processing conditions and will discuss the mechanisms by which several types of cold plasma systems can inactivate viruses on foods. Also, an overview of process validation will be provided, with specific application to cold plasma technologies as an anti-virus control strategy.

Keywords: Cold Plasma Inactivation, Food Safety, Plasma Technologies, Antivirus control

#### Establishment Of Lipidomics Applied in Strawberry-Gray Mold Interaction

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Strawberry is an important economic crop worldwide with 8,885,028 tones harvest per year and the price of 2671.3 USD per tones. Gray mold disease caused by Botrytis cinerea is a devastating disease of strawberry fruits with currently no efficient controlled approach, indicating the discovery of molecular mechanism is demanded. Here, we aimed to understandthe underlying mechanism from the perspectives of lipidic metabolism. Lipidomics is a promising approach that is able to reveal the molecular mechanism from the perspective of lipidic metabolism and to discover novel biomarkers for diagnosis. Current study applied lipidomic analysis to unveil the lipid-associated bioprocesses in postharvest strawberry-gray mold interaction. This investigation was designed based on comparison of mock and gray moldinoculated fruits. Among 114 commonly detected lipids, glycerophospholipids were the most abundant followed by fatty acids. Total 35 differently expressed lipids (DELs) were clustered into 6 groups with various trends. Wherein, 12 DELs were found distinct trends in mock and inoculated groups. Coordinately, 53 of 121 inoculated group-detected only lipids (IOLs) were highly correlated with the necrotrophic phenotype. Combined with HBMP 54:7|HBMP 18:2/18:2 18:3, TG 54:9|TG18:3 18:3 18:3 and 12 DELs, these 67 lipids are potential biomarkers of gray mold diagnosis in strawberry. Autophagy and biosynthesis of secondary metabolites are enriched pathways associated with variated expression of related genes. Collectively, lipidomics enabled the discovery of biomarkers utilized for gray mold disease diagnosis at the early stage, completed the understanding of molecular mechanism of strawberry-gray mold interaction and provided promising targets and compounds that can be applies for postharvest disease control in the future.

Keywords: Strawberry-Gray Mold, Lipidomics, Phosphoinsitide, Biomarkers, Mass Spectromete

#### Adulteration Of Cadmium Heavy Metal in Food: Potential Health Risk for Humans

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Food is one of each existing being's necessities, and it is a vital element of life. Food is any material made up of carbohydrate, water, fat, and protein that people, and animals can consume or drink for nourishment or as a vital component of life. Most of the foods we consume are vulnerable to food fraud, adulteration, and environmental contamination with heavy metals such as Cadmium. Cadmium heavy metal is a component with a high relative atomic mass and a density that is at least five times that of water and because its toxicity and their ability to accumulate in the human body, it is vital to check their levels in the diet. Cadmium has long been recognized as a dangerous environmental pollutant to humans and their life. Cadmium is a cause for worry since practically everyone in the general population is exposed to it through food and the element's potential to build in the body over time. Its levels in food vary, depending on the geographical region, bioavailability from soils, agricultural genetics, agronomic strategies utilized, and post - harvest procedures. Constant openness (lowlevel throughout a drawn-out timeframe) of cadmium can bring about kidney, bone, and lung problems. The maximum allowable Cadmium values is 0.2 lg/g, which is recommended by the World Health Organization (WHO) and the United Nations Food and Agriculture Organization(FAO). Dose of 1mg/m is considered immediately fatal for humans. This article is mainly emphasizing on the toxicity of cadmium along with its entrance in food chain, food products and its fatal effectiveness to the human Health.

Keywords: Toxicity, Bioavailability, Agronomic, Adulteration, Cadmium

#### **Review On Various Food Safety Analytical Techniques for The Prevention of Foodborne Illness**

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Nowadays, food-related diseases caused by pathogenic bacteria, viruses, and parasites are rapidly increasing throughout the world. These microbes can contaminate food and cause food-borne illness. Food safety is the scientific methodology that assures the proper handling, preparation, and storage of food to prevent foodborne illness. The regulatory authorities and the various Government laboratories not only use the analytical techniques to analyze food anddetect toxic substances but also ensure that the food is safe for consumers. Therefore, nourishment manufacturers should take all the preventive measures to terminate these harmfulsubstances from meals. Some techniques are used for the evaluation of food products. These analytical techniques are used to provide data about the variety of different characteristics of foods, including their composition, structure, physicochemical properties, phytochemical properties, and sensory attributes. Conventional nourishment safety analytical techniques involve gas chromatography (GC), quantitative real-time polymerase chain reaction (qPCR), pulsed-field gel electrophoresis (PFGE), and enzyme-linked immunosorbent assay (ELISA). The present review focus on food safety analytical techniques like gas chromatography (GC) and enzyme-linked immunosorbent assay (ELISA) that increases the shelf-life of the nourishment during the storage. Foods are safe from spoilage and microorganisms by the analyses. It improves the quality of aliveness for people with allergies. This enlightenment is critical to our rational understanding of the factors that determine the properties of food as wellas the ability to economically produce nourishment that is consistently safe, nourishing, and recommendable and for consumers to make informed choices about their edibles.

Keywords: GC, nourishment, physiochemical properties, conventional, analytical techniques.

#### Physicochemical And Nutritional Characterization of Gluten-Free Snacks Based on Flaxseeds

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The present study is based on the development of gluten-free Mathri enriched with flaxseeds (Linum usitatissimum). Different samples of Mathri were prepared by incorporating flaxseed powder at 10, 20, 30 and 40 % levels with chickpea flour and control Mathri was prepared by using 100% chickpea flour. The developed products were packed in metalized ziplock bags and stored for 60 days at room temperature to ascertain the physico-chemical, microbiological, and sensory quality. The protein, fat, fiber, and ash of all samples incorporated with flaxseed powder were significantly higher as compared to the control samples. The calcium, iron and phosphorous content of developed Mathri samples ranged from 400-601 mg/100 gm, 2.34-6.36mg/100 gm and 245.34-814.51 mg/100 gm. The moisture content decreased with increase in level of flaxseed powder. From the results it was concluded that the mineral content, phenolic content, and antioxidant activity decreased slightly with the increase in the storage period. Maximum peroxide value was found in Mathri supplemented with 40% flaxseeds i.e., 8.72 meq/kg. Among all the samples, the Mathri incorporated with 10% and 20% flaxseed powderwere found to be highly acceptable having overall acceptability scores of 7.49 and 7.32 respectively. No microbial and fungal growth was found in the Mathri supplemented with flaxseed powder packed in metalized zip lock bags during the 45 days of storage. The findings of the present study strongly support flaxseed is a treasure trove of nutrients which can be successfully incorporated in food products.

Keywords: Gluten-free, flaxseeds, mathri, shelf-life, traditional food

#### Role Of Plant Extracts to Control Post-Harvest Food Wastage Caused by Pathogens

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The demand for food has increased gradually and the root cause of this is surge in population. Even though the production capacity is high nevertheless a lot of food is spoiled globally. Foodspoilage acts as a crucial problem affecting public health, environment, and the economy in the conditions where the population is on a high rise accompanied with degradation of natural resources. On an average nearly 470 million small scale farmers lose 15 percent of their grossincome due to food spoilage across developing countries. Spoilage of food can arise at each of the food production stage from harvesting till it reaches to the consumer. Degradation of the food is largely dependent upon the existence of the moisture and the food pathogens. Conventional techniques such as the use of synthetic additives which are being followed by the industries for food preservation are not only expensive, but they also have potential adverse side effects on human health and environment. Therefore, there is a demand to explore an eco-friendly alternative way by which we can not only inhibit the food pathogens and prevent foodwastage, but we can also improve the shelf life. Plant extracts do have possibility for this purpose as it includes numerous phytoconstituents which shows antimicrobial properties and act as a boon for in agriculture and food sector. Phytoconstituents extracted from different plant species which are still left unexplored can be used further to produce biopolymer-based coatings. The biofilm production from plant extracts needs to be further investigated as it can serve as an opportunity to reduce food wastage, improve shelf life and nutritional quality of food.

Keywords: food wastage, pathogen, plant extract, biofilm.

#### Lead Toxicity and Its Adverse Effects by Food Packaging on Human's Health

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Over time, the adulteration of food has exceeded to such an extent that it has started diminishing the health of people. It is a common practice running for years. Food is essentially adulterated by numerous adulterants such as flavors, colors, preservatives, additives, etc. and it is solely for the shelf-life inclination of the packaged food. Food is not majorly adulterated by heavy metals, but the amounts increase during the manufacturing, processing, and packaging process. After packaging, the food is in contact with the plastic, paper, or glass for a certain amount of time that leaches out the heavy metals into the food present inside. Lead as heavy metal is with a higher density among the periodic table and due to its density and atomic weight, settles downin tissues and cells causing adverse acute and chronic effects to the human body. Lead and other heavy metals enter the food chain via soil, water, as well as air. The crops consume leadreadily from the soil that is abundant with toxic metals. Water contamination through municipaland industrial wastes is used in irrigation and other anthropogenic practices. The increasing environmental pollution that is inhaled on daily basis, has a high number of heavy toxic metalsespecially lead, which is assimilated by the growing plants as well as by humans. All these natural and unnatural sources leach out toxic chemicals and metals that deteriorate the organ system of people. These metallic adulterations are by numerous sources but majorly, the metalsleach out from the plastics and glass that the food is packaged in. Among these heavy metals, lead is the most common and very hazardous element that affects practically all the body's organs. In both children and adults, the nervous system is the most impacted target f lead poisoning. The focus of this article is on lead poisoning, as well as its introduction into he food chain, food items, and fatal effects on human health.

Keywords: Lead toxicity, metallic adulteration, food packaging, hazardous

#### Food Safety Challenges in Indian Street Foods

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Street foods often reflect traditional local cultures and is very diverse. The street foods play animportant socioeconomic role in meeting food and nutritional requirements of consumers at affordable prices to the lower- and middle-income people. Street food vending also provides a livelihood for many workers. It offers business opportunity for developing entrepreneurs, but the major concern is their safety. The number of food poisoning cases are emerging steadily worldwide since the inception of E. coli O157:H7 outbreak in the 1980s to date. This may be partly attributed to improved surveillance, increased global trade and travel, changes in modern food production, the impact of modern lifestyles, changes in food consumption, and the emergence of new pathogens. Consumer's knowledge and attitude may influence food safety behavior and practice. Besides, availability of basic infrastructure and services, potable water, resources for inspection and laboratory analysis and food safety measures play an important role in deciding the safety of street foods. In the COVID-19 pandemic the safety concern of street food has made regulators to find the strategies for ensuring the delivery of healthy food to consumers. For the sake of public health, it is important ounderstand the epidemiology of foodborne illnesses that help in prevention and control efforts, appropriately allocating resources to control foodborne illness, monitoring and evaluation of food safety measures, development of new food safety standards, and assessment of the cost-effectiveness of interventions.

Keywords: COVID-19, food poisoning, food safety, health, street food

# Untargeted Lipidomics Analysis Identified the Biomarker of *Penicillium Digitatum* inResponse to Nano emulsion

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Eugenol, Cinnamaldehyde and Carvacrol have used to prevent fungal invasion due to their prominent inhibitory effect. However, essential oils are hydrophobic, volatile, lowbioavailability, nano emulsion as the delivery system can overcome these drawbacks. Previousresearch showed that cytomembrane lipids are vital regulator in fungal infection and pathogenesis. Alteration of lipid domains have been demonstrated could interrupt the orientation of virulence determinant and affect the pathogenicity of fungi. Comprehending the lipid metabolic pathway and regulation of *Penicillium digitatum* is essential to understand its pathophysiology. Herein, untargeted lipidomics was utilized to profile lipid variation when *Penicillium digitatum* were exposed to compound EUG, CAR and CA nano emulsion. Five hundred eleven lipids' species, twenty-eight classes, were detected, and the significantly altered lipids belong to eight classes, which can be used as biomarkers for antifungal nano emulsion exploitation. Our results disclosed a novel insight of lipid homeostasis disruption of *Penicilliumdigitatum* influenced by nano emulsion.

Keywords: Nano emulsion; Penicillium digitatum; Lipidomic; Antifungal; Biomarker; Membrane

#### Integrated Transcriptomics and Metabolomics Profiling Uncovers Nano-Emulsion Induced Resistance Against Penicillium Digitatum Infection of Citrus

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Green mold caused by *Penicillium digitatum* is the most destructive pathogen in postharvest citrus fruit. Inducing natural resistance to fungal pathogen in postharvest citrus by exogenous elicitor is a promising alternative to reduce postharvest losses. In this paper, potential induced resistance effect of nano-emulsion elicitation to Citrus reticulata Osbeck. cv. Newhall. Against P. digitatum infection was evaluated through combined transcriptomics and metabolomics analysis. The results showed that the activity of peroxidase (POD), catalase (CAT), superoxide dismutase (SOD), ascorbate peroxidase (APX),  $\beta$ -1,3-glucanase, chitinase, phenylalanineammonia lyase (PAL), cinnamic acid-4-hydroxylase (C4H), 4-coumaric acid: coenzyme A ligase (4CL) and cinnamyl alcohol dehydrogenase (CAD), antifungal metabolites including flavonoids, total phenolic, hydrogen peroxide (H2O2) and lignin contents were increased, firmness was enhanced by nano-emulsion treatment. RNA-seq results showed that after P. digitatum inoculation, 653 differentially expressed genes (DEGs) were identified between control (48 hpi) and nano-emulsion treatment (48 hpi) of *Citrus reticulata Osbeck. cv. Newhall* transcriptome, including 444 up regulated and 209 downregulated genes. Regarding metabolomic profiling, 503 metabolites were identified, including 175 differential accumulated metabolites between the control (48 hpi) and the nano-emulsion treatment (48 hpi), which 77 metabolites were downregulated, and 98 metabolites were upregulated. The integrated transcriptomics and metabolomics profiling indicated certain metabolic pathway involved in induced resistance. Firstly, several differentially expressed genes (DEGs), which encoding caffeoylshikimate O-hydroxycinnamoyltransferase (HCT), caffeoyl-CoA O- methyltransferase (CCoAOMT), caffeic acid 3-O-methyltransferase / acetylserotonin O- methyltransferase (COMT), cinnamyl-alcohol dehydrogenase (CAD) and peroxidase (POD), geranylgeranyl pyrophosphate synthase (GGPS) involved in nano-emulsion induced resistance. Secondly, it was found that different accumulated primary metabolites included L-norleucine, L-methionine, L-phenylalanine, aspartic acid, glycine, L-tyrosine, lysine, L- tryptophan, L-glutamic acid, L-Valine,  $\gamma$ -aminobutyric acid, D-malic acid,  $\alpha$ -ketoglutarate, abscisic acid, D-ribose, D-arabinose, L- Xylose, D-galacturonic acid, D-glucuronic acid, elaidic acid, octadecenoic acid, 9,16-Dihydroxypalmitic acid were correlated with induced resistance. Thirdly, differentially expressed genes (DEGs) and differential accumulated metabolites (DAMs) were found belonged to the pentose and glucuronate interconversions, tryptophan metabolism, phenylpropanoid biosynthesis, flavonoid biosynthesis, stilbenoid,diarylheptanoid and gingerol biosynthesis pathway, which indicated the pivotal role of these metabolic pathways by nano-emulsion induced resistance of *Citrus reticulata Osbeck. cv. Newhall.* against *P. digitatum* infection. All these results indicated that the nanoemulsion wasa promising elicitor to induce resistance against *P. digitatum* infection of citrus.

Keywords: Citrus; induced resistance; Nano-emulsion; Penicillium digitatum; RNA-seq; Metabolome.

#### Technological Advancements in Food Quality and Food Safety: A Review

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Food is intricate, and food quality and safety are critical components. In the last few decades, a variety of new, interdisciplinary, and multidimensional concepts have evolved in response to increased consumer demand for safe and nutritious food items. In a food supply chain, food quality and safety are of paramount importance as there is a drastic change in consumers' foodhabits, behaviour, and markets. The key driving elements behind this transformation are consumer expectations for food quality and safety during the present pandemic situation. Furthermore, foodborne pathogen contamination in horticulture crops has become a major public health concern. To manage and predict these diseases, several approaches for identifying foodborne pathogens in horticulture crops were used. Conventional methods for detecting foodborne pathogens have several drawbacks, including the fact that they are time- consuming, have low sensitivity, and are labor-intensive. Recent improvement techniques haveremarkable features such as being quick, sensitive, effective, and timesaving. Non-thermal food technologies have been developed in response to the desire for fresh, healthful, convenient, and safe foods. In comparison to traditional procedures, several studies in high- hydrostatic pressures, pulsed electric fields, ultrasound, ultraviolet light, pulsed light, and coldplasma have proved their usefulness in obtaining safe, high-quality products. Understanding their processes of action has led to the identification of crucial parameters that must be satisfied to obtain good results and meet the needs of today's consumers. Due to its high-speedanalysis and reduced sample needs, optical biosensors have recently been used in food qualityanalysis. Various optical biosensing technologies for food quality analysis, as well as related equipment like as detectors, optical fibre sensors, and immobilization components, are discussed. Clearly, various green technological alternatives also have evolved that can be adopted to ensure food quality and safety throughout the entire food supply chain.

Keywords: food quality, cold plasma, biosensors, green technology, consumer demand, technologies

#### **NFC Applications in Food Industries**

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This review focuses on the application of NFC (Near Field Communication) technology and the use of AR (Augmented Reality) in smart packaging. Packaging is smart when it includes an interactive element to allow consumers to learn more about the product (price, freshness, transportation, storage, etc.), interact with a brand, and more. The interactivity can come fromNFC, AR, or with traditional technologies like a barcode, QR code, etc. NFC is a short-range wireless communication technology that transmits data wirelessly between devices without requiring an internet connection. AR is an image recognition technology that allows you to adddigital content and an interactive experience on top of a physical touch point on packaging. The combination of more modern technologies gives the opportunity to have information about the product, its quality, properties and information about transport and storage at any time. There are several technologies on the market that enable packaging to meet these modern requirements. Smart Packaging creates a fast and efficient way to get all the necessary information about the products contained in the database. In recent years, AR has tended to conquer the field of application of NFC technology in the packaging sector. Not only can theystore information, but they can also view it in real-time and spatially through the cameras of smart mobile devices. The aim of the article is to present the likely and current application of NFC, its implementation in the smart packaging technology and the expectations for further development with a special focus on the food industry. A comparative overview of the main features of these technologies associated with their use in smart packaging. How these technologies are implemented is shown using a variety of business examples. The article presents two application concepts of one and the other technology, through which all expectations for further development are presented.

Keywords: NFC, augmented reality, packaging, applications, Quality, technology

# Rapid Determination of Peroxide Value of Oil Based on Au@Ag Core Shell Nanoparticles As Substrate For SERS And Chemometric Method

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Deep frying of food is a common practice that leads to the formation of lipid oxidation products. Titration is a widely used technique for determining the peroxide value (POV) of oil. However, this method uses a lot of reagents, many of which are poisonous and smelly, pollutingthe environment. Oil quality control requires the development of novel, rapid, and accurate detection techniques. In this study, the potential of surface enhanced Raman spectroscopy (SERS) in conjunction with chemometrics has been explored for determining the POV of oil. Au@Ag core-shell nanoparticles with surface plasmon resonance at 532 cm - 1 have been synthesized as a substrate for SERS. Principal component analysis was used to distinguish the oil belonging to different frying cycles. Rapid spectrum characterization for estimating POV inoil oxidation was achieved using the artificial neural network-Levenberg-Marquardt fitting model along with principal component analysis. The mean square error and correlationcoefficient for the training and test sets of oil samples were 0.92, 0.91, and 3.46, 3.80 respectively. The developed algorithm-assisted SERS system enabled the sleek and rapid analysis of POV in oil oxidation.

Keywords: peroxide value, oil, oxidation, nanoparticles

# AI Image Feature-Based Extraction on Vegetables and Fruits Image Using Python Sujith and Aniruddh

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This paper presents an automatic fruits and vegetable recognition and feature extraction system for classifying and identifying fruit and vegetable types. The work exploits the fruit shape, colour, and various features to identify and examine each image. The proposed system includes three phases namely: preprocessing, feature extraction, and classification phases. In the pre- processing phase, fruit images are resized to reduce their colour index. In the feature extractionphase, the proposed system uses scale invariant feature transform (SIFT) and shape and colorfeatures to generate a feature vector for each image in the dataset and AI based image feature extraction tools for all other minute details of deformity for examination. For the classification phase, the proposed model applies K-Nearest Neighborhood (K-NN) algorithm classification, and support vector machine (SVM) algorithm of different kinds of fruits and vegetables. A series of experiments were carried out using the proposed model on a dataset of orange fruit images of 5 consecutive days. The results of carrying out these experiments demonstrate that the proposed approach is capable of automatically recognizing the fruit name with the time of healthiness and nutrition value that fruit or vegetable can contain in itself on the scale of nutrition value in a high degree of accuracy. Artificial intelligence, machine learning and deep learning give organizations a way to extract value out of the troves of data they collect, delivering business insights, automating tasks, and advancing system capabilities. AI could significantly improve packaging, increasing shelf life, a combination of the menu by using AI algorithms, and food safety by making a more transparent supply chain management system.

Keywords: artificial intelligence, machine learning, vector machine, chain management system

#### A Comparative Analysis Between Two Row and Six Row Malted Beer

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Beer is a widely consumed beverage around the world, made from water, malt, hops and yeastas basic ingredients. Global leading countries in beer production are China, the United States and Brazil. In 2020, the global beer production amounted to about 1.82 billion hectolitres. It is an alcoholic beverage obtained from the fermentation of sugars, mainly those obtained from barley malt. Methodology- Current beer elaboration technique includes the addition of starch from rice and corn to increase the number of fermentable sugars in the wort. Water generally constitutes more than 90% of the finished product. The final alcohol content may vary from 0.5% to 15% and the pH is typically 4.5 or less. There are two types of malt used in production beer that is 2 row and 6 row malt. Production of beer from both of this malt was carried out at lab level and final observations are depicted in this research. The analysis showed that alcohol percent of 2 row malt was found to be more than 6 row malt, differences in protein content, extract content, color, husk percentage and haze was also found.

Keywords: beer, alcoholic beverage, sugars, alcohol, malt.

#### Effect Of Different Decortication Processes on Neem Kernel Recovery

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Neem oils have immense potential and have various uses in pharmaceutical, food as well as inthe cosmetic industries. In this study the decortication process of neem dried seeds for obtainingneem kernel (which is the oil-bearing part) by different methods was investigated. Four methods were undertaken, in which, first method was conditioning, second method was alternate heaping and drying, third method was scratching method and fourth method was sodium bicarbonate mixing with seeds. After giving pre-treatment to a batch of 2 kg per methods, seeds were subjected to the decortication process. The results revealed that first method found 65 % recovery of neem kernels, and number of broken kernels were high in thismethod. In the second method 68% recovery was obtained with a smaller number of broken kernels. The third treatment found largest number of brokens due scratching process which included biting of neem seeds and the recovery was 54% whereas the fourth method sodium bicarbonate mixing found good results compared to other methods with 73% of kernel recoveryand less broken kernels. Some selected engineering properties of obtained kernels were studied which also found good results by second and fourth method, respectively. The cost estimationfor pre-treatment was analysed to study the economic viability for the above processes to findout best suited method for the decortication process.

Keywords: Neem kernel, decortication, recovery, broken

# <u>TS - 03</u> <u>Responsible Consumption</u> <u>and Sustainable Diets</u>

#### The Message is Think Global- Eat Local.

Florence Egal

Food Security and Nutrition Expert, France

Food Systems are failing to deliver healthy diets. The recent UN Food Systems Summit (UN FSS) has concluded on the need to transform them to address hunger and malnutrition withoutcompromising the health of our planet. Sustainable healthy diets support health and wellbeing,have limited impact on the environment, are accessible, affordable, safe, and equitable and are culturally acceptable. Consumers therefore have a key role to ensure a demand driven transformation. But food science and technology are also a major dimension of this transformation and paradoxically have been relatively absent from the UN FSS process. A series of opportunities should be explored to ensure that food scientists and technologists are acknowledged as key actors of multi-disciplinary teams at territorial and global levels in both development and humanitarian contexts.

Keywords: healthy diets, local food, safe and affordable food

#### Sorghum Grain: Application in Food System and Nutrition Security

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Sorghum is one the staple crops which is least utilised even when it is nutritious and have lotsof health benefits. Sorghum is a grown in semi-arid regions and is drought tolerant, heat tolerant, and can grow in harsh environmental conditions like high altitudes and saline–alkalineand barren soil. Millets specially sorghum compared to wheat and rice require less water for production and utilized for food, fodder, nutrition and health as well as environmentally safe. Application of this millet is manifold. Sorghum grain contains very good nutritional profile and contribute to various phenolic compounds. Traditionally used for production of steamed, deep fried, boiled products, baking products and fermented beverages. Today's scenario it is utilised for extraction of various functional ingredients like phenolic compounds used for the development of new, functional, and healthy foods and beverages. Along with various functional properties like anti-inflammatory, antidiabetic sorghum is very much utilised for thedevelopment of gluten free for the patients suffering from celiac diseases. This study aimed atexploring sorghum grain application in food system and understanding of nutritional and bioactive compounds that can be utilised for nutritional security and health functions.

Keywords: Sorghum grain nutritional profile, bioactive compounds, functional food

#### Combinatorial Benefits of Probiotics and Nutraceutical Enriched Mushroom forImproving Health

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Since Prehistoric times fermenting different foods has been practiced for enhancing the nutritional, nutraceutical, and sensory properties of the food. This method has evolved with time by conjugating different processing technologies. In the past few years, probiotics and their associated products have been well acknowledged due to their positive impact on consumer health. Similarly, different mushroom species can be variably used in manufacturing functional foods owing to their high nutritional value, enriched bioactive compounds, and immunomodulatory properties. The amalgamation of probiotics and mushrooms is one of the research areas which is yet not explored. Bacterial species that are regarded as healthy and favorable to human health use prebiotics as nourishment for cell proliferation. The study aimed to investigate the role of nutraceuticals ( $\beta$ -glucans, vitamin-D2, ergothioneine, pro and pre-vitamn-D2, etc.) enriched mushroom powder in the growth proliferation of probiotic bacteria along withmeasuring the quality attributes augmented by probiotic bacteria in the fermented samples. FTIR, GCMS, HPLC, and FE-SEM were used to decipher the production of bioactives via probiotic-mediated fermentation of mushroom powder. The findings revealed that the fermentation of nutraceutical enriched mushrooms using probiotics have resulted in the production of bioactive, i.e., short-chain fatty acids (SCFAs), organic acids, etc. Improved level of total phenols content (TPC), total flavonoids content (TFC), along with enhanced antioxidant activity (DPPH, FRAP) in the fermented samples, was also noticed. The current study offers a sustainable strategy for increasing the nutraceutical potential of dried edible mushroom powder in terms of SCFAs bioactive constituents, radical scavenging effects, which holds a substantial position in the nutritional regime especially during the COVID-19 pandemic.

Keywords: Mushrooms, Probiotics, Nutraceuticals, Short-chain fatty acids (SCFAs)

#### Fucus Spiralis Linnaeus as A Source of Nutraceuticals

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Brown macroalgae have been traditionally used as sea vegetables but in the last years these marine resources have been gaining attention worldwide as they have shown to be an important source of functional ingredients with potential to be included during the development of novelfunctional foods, nutraceutical and pharmaceutical formulations. Among macroalgae, Fucus spiralis is a perennial brown edible macroalga, that grows in temperate latitudes on intertidal semi-exposed and sheltered rocky shores. This alga is also recognized as a rich source of bioactive molecules such as phlorotannins, fucoxanthin, polyunsaturated fatty acids, minerals, dietary fiber, among others. In this context, the objective of this study was to determine the *invitro* antioxidant activity of F. spiralis extracted using a green and sustainable processmicrowave assisted extraction (P=9 bar; t=25min solvent 37% ethanol). To this aim, scavenging activity against reactive oxygen species and nitric oxide radical, as well asenzymatic assays to evaluate the inhibition ability of such alga extract against brain disorder- related enzymes (such as acetylcholinesterase, butyrylcholinesterase, and monoamine oxidaseA and B) were assessed. The obtained results suggested that F. spiralis extract was capable of positively scavenging the radical species nitric oxide and superoxide radicals, obtaining an effective concentration (IC50) of 74 µg/mL in nitric oxide assay and an average (IC50) 655 µg/mL for reactive oxygen species under scope. In addition, F. spiralis extract showed a significant inhibitory effect against the Alzheimer's disease-associated enzymes, but it was especially active in the retardation of the monoamine oxidase B activity as1 mg/mL extract leD to 70% activity inhibition. Based on these results F.spiralis has shown disclosing potential and can be used as a novel therapeutical approach of Parkinson's disease.

Keywords: Brown algae, functional foods, antioxidant activity, enzyme inhibition potential

# Proximate Composition and Body Weight of The Albino Rat Profile Fed with Gurasa Bread as Affected by The Addition of Soybean

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Malnutrition is still a serious health problem affecting infants and young children in most developing countries, resulting in approximately 53% of estimated children being based. It hasbeen challenging to attain the nutritional adequacy of infant- and child-based feeding largely on cereal as the main staple food in Nigeria. Gurasa is a locally made bread. It is leavened bread but flat in shape, typically produced in northern Nigeria, and is also a popular bread among Arabians. Gurasa consumption cut across all ages; thus, it could serve as a vehicle for improving the nutritional well-being of the people through the incorporation of low-cost legume flour with a better nutrient profile leading to higher protein content with high lysine level, an essential amino acid deficient in cereal. The low nutritional composition of wheat has promoted the need for fortification to increase its micronutrient content. The need to improve the nutritional content of gurasa cannot be overemphasized due to the high malnutrition problem and high cost of importation of wheat in the country. The body weight of Wister Albino rats fed gurasa is used to predict the safe status, nutrient quality, nutritive value of foods, tissue maintenance, and cell growth. The present study seeks to determine the effect of soybeanflour addition on the quality of gurasa. The study established that soybean addition into the gurasa bread improves the nutritional profile, making it a potentially good source nutrient for malnutrition prevention without negatively affecting clinical nutritional indicators.

Keywords: Guaras, Albino Rats, Soyabean, Food Fortification.

# Assessment Of Nutritional Status and Relation of Energy Expenditure with Dietary Intake of Working Women: A Pilot Study

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The study was undertaken to assess the nutritional status, energy expenditure and dietary intakeof working women of age group 25-45 years from Ghaziabad district. Women who were pregnant, lactating, hypertensive, diabetic or diagnosed for any hormonal imbalance were not included in the study. A total of 100 subjects participated in the study. Data was collected by using questionnaire cum interview method includes personal profile, health profile, anthropometric measurements, dietary pattern, and daily physical activity pattern. Mean, standard deviation, comparison & correlation were computed for data analysis. The dietary status was determined by the food and nutrient intake using diet history and the energy expenditure was computed by a factorial method using activity level and time record of one working day. The result of the study shows that the mean BMI of the women was found to be  $22.01(\pm 3.26)$  with 13% of them being underweight and 20% were being overweight or obeseand remaining were normal. The mean value of energy, protein, carbohydrate, and fat intake by the subjects was  $1292.4(\pm 69.4)$ ,  $44.5(\pm 4.3)$ ,  $183.3(\pm 11.32)$ and  $(41.9 \pm 4.2)$ . The mean value of energy, protein, carbohydrate and fat expenditure by the subjects was 2113.6(±110.4), 54.9 (±7.8), 322.4 (±31.1) and 42.4 (±4.2). The coefficient of correlation between total energy expenditure and dietary intake -0.12. Energy and carbohydrate intake was found to be less than energy and carbohydrate expenditure of the subjects. Hence, negative energy balance was observed. Protein and fat intake was positively correlated with protein and fat expenditure by the subjects. BMI of the subjects were come under normal range.

Keywords: nutritional status, energy expenditure, dietary intake, working women

#### Influence Of Nutrition Education Intervention on Nutritional Status of Cancer Patients

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Cancer is one of the most leading causes of death worldwide. Diet, alcohol, physical activity, infections, hormonal factors, radiations etc. are few important determinants of cancer risk. It isestimated that about 30-40 percent of cancers can be prevented by appropriate diets, physical activities and by maintaining appropriate body weight. It's been found that few of the components of the food may affect the cancer cells positively or negatively. Even though dietand nutrition play such an important role in cancer prevention and management of cancer manyare unaware of this fact. Hence, there is much more need for conducting more research and study in relation to cancer and nutrition. Objectives of this study include studying the sociodemography, disease profile and nutritional status of cancer patients visiting Sharda Hospital and to impart nutritional counselling to select subjects by administering specific extension aidsand study its influence on knowledge, practice, attitude (KAP) and health status of cancer patients. Collection of data is done through self-prepared questionnaire and nutritional assessment by using MNA (mini nutritional assessment) form and by using KAP questionnaire form from similar study. The patients with liver cancer have higher rate of undernutrition than other patients. The nutritional risk rate was 22.4% and 34.2% at baseline and reassessment, respectively. For patients with nutritional risk, the relative risk (RR) of adverse events (AEs) significantly increased with and without nutritional treatment. The present study concluded that undernutrition and nutritional risk are general problems that impact the outcomes of hospitalized cancer patients. Nutrition education is a key factor for improving health status of the patients

Keywords: Diet, nutrition, cancer, influence, awareness, KAP, relative risk, adverse events

#### Infant feeding practices in a slum in Delhi

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The study was designed to study the infant feeding practices followed by mothers belonging tolow socioeconomic group, residing in a slum of Delhi. The information was collected with thehelp of a semistructured interview schedule from the mothers of ninety-five children in the age group of one to three years. Although universal breast feeding was the norm, there was delay in initiation of breast feeding. About 69% mothers delayed it even up to second/third daypostpartum. Regression analysis indicated significant positive association between comparatively higher education status of mothers and early initiation of breast feeding. About23% mothers reported the practice of not feeding colostrum to infant since they considered it unsuitable for infant. However, mothers who had institutional deliveries had higher odds of giving colostrum, indicating the role of health professionals in changing the negative practice of discarding colostrum. Most of the mothers gave pre-lacteal feeds to infants. Exclusive breastfeeding was absent as almost all the mothers were giving water and/or 'ghutti' along with breastmilk to the infant. About 38% mothers reported 'almost exclusive' breast feeding for up to four months to infant. It was negatively associated with 'mothers working outside home' and low education status of father. About 65% mothers' breast fed beyond one year of age, indicating a positive trend of long duration of breast feeding. Timely introduction of complementary feeding (6-8 months) was reported by 38% mothers, while it was delayed in 40% cases. The study brought out the need for creating awareness about correct infant feeding practices in lowsocio-economic groups.

Keywords: Infant feeding practices, breast feeding,

#### **Impact Of Education on Colostrum Feeding Practices Among Nursing Mothers**

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Breast feeding has several advantages for both the babies and moms. In any case, regardless of solid confirmations on the side of breast-feeding care of its pervasiveness has stayed low around the world. Not only this, immediately after the birth of the baby, colostrum is needed ardently as it provides high amount of nutrients along with promotion of immune system. It is a yellowish thick milky fluid which is highly concentrated form of breast milk that contains immune boosting properties for the newly born. When compared with regular breast milk, colostrum is higher in protein but lower in sugar, fat and calories. The present research was conducted to see the impact of education on colostrum feeding practices among nursing mothers. The sample contained 200 urban and 200 rural lactating mothers of Delhi. Apurposive random sampling methodology was used to accumulate the information. The data was accumulated clearly from mothers by using coordinated overview to assess the impact of mother's education, occupation and financial status for taking care of colostrum feeding. After the data collection, data will be coded effectively and organized under different heads. After this, content and quantifiable investigation was done using percentages and correlation. Results indicate that no matter what your settings are whether its urban or rural, what your qualificationlevel is, mothers are well versed with the fact that Colostrum is very important as it is nutritiousand healthy for both the mother and child.

Keywords: breast feeding, colostrum, nutrients, immune system
## Eating Pattern and Body Shape Concern Comparable to Socio-Economic and Psychological Factors Among College Students

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Eating behavior has been considered as an important factor for determining the nutritional health and status of an individual by many studies and researchers. Unhealthy eating behaviorare set of actions that is acquired during the adolescent stage due to various factors like unhealthy snacking, excessive snacking, skipping meals, eating away from home, constant consumption of fast food, carbonated beverages, psychological factors and have a negative impact on health among youths according to studies. However, the relationship between socio-economic status with eating behavior such as uncontrolled eating, emotional eating and cognitive eating among college students is little known and how this may affect the weight status. The primary objective of this study aimed to study the prevalence of disordered eating behaviors among college students. The secondary objective of this research is to analyze the relationship between eating habits, body perception and weight status and whether eating behaviors is associated with physical health of students. The study was conducted using a cross-sectional study among the students of age 18-25 years. The participants were selected randomly from the campus and questionnaire on eating behavior and attitude were given out physically and through online. Half of the studied population had regular meals and breakfast (52.4% and 54% respectively). While the consumption of fruit is very less by the studied population only 24.5% students have fruits three times a week. Scoring for eating habits was found to be significantly low among younger population (18-20 years), smokers, alcohol drinkers and thosewho did not exercise (p < 0.005). Psychological factors were significantly associated with eating habits (p < 0.005). Multivariate analysis, significantly indicate eating is associated with feelinghappy(p<0.005). Students had healthy eating pattern but there was having social and psychological impact on eating behavior of the students.

Keywords: Unhealthy eating behavior, body perception, questionnaire, Multivariate analysis

### Effect Vacuum Impregnation and Vacuum Frying with Calcium Chloride on Texture Characteristics and Fat Percentage of Fortified Fries

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This study was conducted to develop calcium-fortified fries through vacuum impregnation technique and to evaluate the effect of vacuum frying and calcium chloride addition on texture characteristics and fat percentage of developed fries. Under VI experimentation using vacuum frier, potato fries' calcium impregnation was done at 15 mm Hg vacuum pressure with GRAS fortification of calcium (calcium chloride), as per Box Behken design of response surface methodology, The developed fries were in turn evaluated for their textural properties, sensory properties and difference in fat absorption percentage. Results indicated that improved textural changes were recorded for crispiness (0.39 kg/sec) Vs control (0.38 Kg/sec), hardness (0.39 kg/sec) Vs control (0.40Kg/sec), color ( $\Delta E = 67.77 \pm 1.93$ ) Vs Control ( $\Delta E = 66.22$ ). Sensory score (9 on 9-point scale) also found to be more as compared to control (8.5) because of the improved appearance due to calcium addition. Additionally, VI treated calcium fortified potatofires had low fat absorption percentage (7%) compared to control because of the use of the vacuum frier. Thus, developed fortified fries with improved textural properties and low-fat absorption can be a healthy option for fulfilling the demand of health-conscious consumer fornutritious ready to serve foods.

Keywords: fortification, fortified fries, calcium chloride, potato

# Assessment Of Impact of Nutritional Quality of Diet in Managing Type 2 Diabetes Mellitus (T2DM)

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Worldwide more than approximately 400 million individuals are affected by diabetes. It is estimated by International Diabetes Federation (2015) that by the year 2040 more than approximately 640 million people worldwide will be impacted with diabetes. We have assessed the totality of evidence by reviewing total 16 primary research articles to justify that there arecertain diet components e.g., functional foods, dietary fibers, biofortified foods/crops which can influence markers for prediabetes, diabetes, hyperglycemia etc. viz., blood or serum glucose, insulin, HbA1C level, weight etc. There was a positive impact on lowering glycemicand hepatic parameters in the patients with T2DM when curcuminoid is fed along with piperine. Galactomannan plays beneficial role in the management of initial stages of diagnosis in T2DMpatients by lowering blood glucose. Psyllium husk ethanolic extract (PHEE) could impact lowering hyperglycemia. Wholegrains that are minimally processed can positively influence the improvement in the measurements of postprandial glycemia. Lectin free common bean flour improved nutritional properties of products. Products made with lectin free common beanflour showed – increased alpha amylase activity and reduced pGIs. Vitamin A biofortified cassava flour reduced the glycemic index for gari. Flaxseed polyphenol extract has noticeableantihyperglycemic effects that can support diabetes management. Intake of high fiber also impacts the reduction of post- prandial glucose at breakfast. Post careful evaluation of all 16 selected primary research articles in the area where diet intervention has shown some or the other effect in either of the markers of diabetes or prediabetes, it can be concluded that nutritional quality of diet helps in supporting diabetes management in the long run.

Keywords: Diabetes, Galactomannan, Curcuminoid, Flaxseeds, Fiber, Psyllium, Bean Flour, Cassava

#### Celiac Disease and Telehealth – Experience from A Tertiary Care Centre In Delhi

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Celiac disease (CD) is an immune-mediated disease of the small intestine, with a steadily increasing global prevalence of close to 1%. It is characterized by histological changes including lymphocytic infiltration and villous architectural changes in genetically susceptible individuals and is triggered by the consumption of gluten. Due to current pandemic resulting from Covid - 19 viruses, the sole method of staying in contact with the registered patients wasthrough phone calls. This is also an approved method that falls under the umbrella of "Telemedicine". Ministry of Health and Family Welfare has elaborated Telemedicine as 'The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities. Appropriate gluten free diet is the most important line of treatment for celiac disease; in fact, it is the cornerstone for the treatment of celiac disease. The diet must be adequate both in terms of quality and quantity than only it will be able to fully contribute to patient's optimum growth and development. GFD has been the only effective therapy so far, also beneficial in decreasing the risk for complications. To maintain the continuum of care, since the option of telemedicine was explored, which is a novoconcept in the context of counseling and patient care, utmost care was taken to keep the needs of patients on priority. Effect of lockdown on GFD (from procurement to consumption), Understanding of GFD, Biagi's Glutenfree diet compliance score was also incorporated. Thereare 115 registered celiac cases, while contact could be initiated with 98 cases. Due to sudden lockdown supplies of GFD were impacted in 40% of households. Despite not having any physical contact with the celiac clinic 80% were compliant with GFD. Diet was adequate in almost all the cases. At the time of third scheduled call noncompliance was reduced to 10 %. While 100% of respondents were happy with tele- counselling as their queries were solved.

Keywords: Celiac disease, gluten free diet, tele-health

#### **3Development Of Immune Boosting Organic Jaggery Using Ginger and Carrot**

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Jaggery is a traditional natural sweetener made by concentration of sugarcane juice and it is the best among all sugarcane products which is enriched with mineral and phytochemicals. In general, jaggery which are commercially available is not safe because a huge quantity of harmful chemicals used during its production processes. In India, jaggery manufacturing is done by farmers or local processors using unskilled manpower's and most of the units are running under very low profits margins. Therefore, a research work was formulated to develop a suitable protocol for production of immune boosting organic jaggery during the month of December 2021 to January 2022. Ginger and carrot known to rich in phytochemical and antioxidant which were considered for these studies such as dried ginger (G, 0.0-0.4%) and Carrot (C, 0.0-4.0%) with various treatment combinations such as T1(G, 0.0%+C,0.0%), T2 (G, 0.2%+C,0.0%), T3 (G, 0.4%+C,0.0%), T4 (G, 0.0%+C,2.0%), T5 (G,0.2%+C,2.0%), T6 (G, 0.4%+C,4.0%), T7 (G, 0.2%+C,4.0%) and T8(G, 0.4%+C,2.0%). The final products were evaluated for different qualities viz. colour, texture, flavor, taste and overall, acceptably along with physical and chemical properties. Among different treatments, the maximum overall organoleptic score (7.8±0.2) was recorded for sugarcane juice treated with T7 (G, 0.2%+C,4.0%) followed by (7.5±0.3) in T5 (G, 0.2%+C,2.0%). Farmers reported that such value addition in jaggery; they could be able to sell their produce @ Rs. 80/kg and more, instead of regular selling price of Rs.35-40/kg in the local markets

Keywords: jaggery, sugarcane, value addition, organic, ginger, carrot

#### Potential Of Oat as A Gluten-Free Alternative

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Oat is a gluten-free, fiber rich cereal which belongs to the Poaceace family. It has a rich nutritional profile imparting health benefit. As it is gluten free, it is beneficial for the people suffering from cealic diseases or gluten allergy. Approximately 70-80% of the world population are having gluten allergy so consumption and utilization of oat in formulation of new product could be effective in that case. There is an emerging trend of vegan diet, replacing the dairy-based diet with similar nutritional profile. Development of milk from oat could be a better aletrantive of dairy-based milk. As of now major focus in non-dairy section are held by soymilk, cococnut-milk, almond-milk that is quite expensive. Oat milk could be the better option for the economy of poor and developing countries. The nutritional profile of oat-based product can be improved by different processing methods and by fortification of essential component. Keeping these in view the present study aims to determine the physicochemical properties of oat grain and compare it with the finding of the existing cereals like wheat and rice. Proximate composition was determined by standard procedure of AOAC (1990 and 1995). Water solubility index, water absorption index and swelling power of oat grain was determined by the method describe by Nargis et al., (2017). Total phenolic content was estimated by Folin-Ciocalteau reagent method described by Hodzic et al., (2009). The result showed that ash content of oat grain was about 2.6 % that is higher than the ash content of wheat and rice 0.6% And 0.3 % respectively. Protein content of oat was about 14% which was higher than the protein content of wheat and rice 11% and 8% respectively. Quite good amount of crude fiberwas determined in oat grain (4%) which is far better than the total crude fiber of wheat and ricethat is less than 1% in both the grains. Total phenolic content of oat was about 1367 mg GAE/Lagainst the total phenolic content of wheat (926) and rice (295). Water absorption index and water solubility index of oat was 4% and 12.2% respectively whereas water solubility index and water absorption index of wheat is 7.2% and 2.32 %, and for rice it is 8% and 1.36% respectively.

Keywords: oat, gluten free, wheat, total phenolic

## Supplementation Of Milk Protein Hydrolysates in Protein Energy Malnutrition Induced Rats Deciphers a Complex Crosstalk in Alleviating Gut Dysbiosis and State Of Immunity: Their Incorporation And Development Of A Protein Beverage Mix

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Dairy proteins in the diet are beneficial for the growth of probiotics; however, what is unknownis the gutmediated immune responses of protein energy malnutrition (PEM) and if dairy protein hydrolysates can be effective as dietary interventions. This study compared the composition of the gut microbiota of rats induced with protein deficiency at 1% (S.PEM) and 5% (M.PEM), followed by their replenishment with buffalo and whey protein hydrolysates. Fecal samples were collected, and the composition of the gut bacteria was analyzed by whole genome sequencing using long-read sequencing. Gene expression of immunomodulatorycytokines involved and quantification of sIgA was carried out. IL-6 and IFN- $\sqrt{}$  was downregulated by about  $0.17 \pm 0.06$  and  $0.12 \pm 0.10$  folds by whey protein hydrolysate in SP-RWC rats and by about  $0.02 \pm 0.06$  and  $0.35 \pm 0.12$  in buffalo milk hydrolysate. The percentage of Firmicutes decreased in M.PEM and S.PEM rats (33.57%, 28.83 versus 47.73% of control at 3 weeks) but increased on protein replenishment of all three protein sources at the end of 8 weeks. The percentage of Bacteroidetes increased to 31.03% in S.PEM induced rats as against 28.17% in control rats. Relative abundance of Lactobacillus sp. decreased in M.PEM and S.PEM while it had the opposite effect on protein replenishment. Gut microbiota modulated pathogenesis of PEM differentially based on protein intervention along with a significant increase in the relative abundance of keystone Lactobacillus genus. A ready to reconstitute beverage containing whey protein and buffalo milk hydrolysates (10-20%) basedon sensory analysis was developed. The beverage mix finds potential applications in alleviatingPEM and as immune boosting food among children.

Keywords: milk protein hydrolysate, whey protein, beverages

# The Obesity Epidemic – Challenges, Health Initiatives and Implications faced by Today's population

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Obesity is a disorder that leads to excessive weight gain of a person due to the accumulation of extreme amount of fats in his/her body. Earlier it was taken a 'not so serious' or a 'for granted disease' but now it has taken a form of epidemic. It has become so common that in 1997 the World Health Organization (WHO) has declared obesity as a global epidemic and estimated that the worldwide prevalence of obesity has nearly tripled since 1975. Globally, there are nowmore people who are obese than who are underweight, a trend observed in every region over the world. In India, obesity has reached epidemic proportions in the 21st century, with morbidobesity affecting 5% of the country's population. Consumption of fast food, trans fatty acids (TFAs), and fructose-combined with increasing portion sizes and decreased physical activity-has been implicated as a potential contributing factor in the obesity crisis. One of themajor indicators of obesity is Body Mass Index (BMI). BMI more than 30kg/m2 is referred asobese whereas BMI more than 40kg/m2 is termed as extremely obese. However, only BMI alone will not be accurate measure of obesity, so it should be collaborated with waistcircumference, waist to hip ratio, skinfold thicknesses and bioelectrical impedance. Several studies have shown that obesity is a major contributor of some chronic medical conditions such as diabetes mellitus, hypertension, hyperlipidemia, and obesity-related cancers. Epidemiologicstudies have also shown an association between adult obesity and premature death from allcause mortality. One study found that obesity was associated with a 7-year decrease in life expectancy for women and a 6-year decrease for men. These clinically significant outcomes are not restricted to medical fields, but also complicate surgical outcomes. Postoperative complications occur more frequently in obese patients than lean controls, with an increased incidence of MI, peripheral nerve injury, wound infection, and cardiac arrest. In addition to the potential impact on mortality, the overall morbidity seen in this growing patient population remains a key issue contributing to decreased quality of life in overweight and obese individuals. Impairment in activities of daily living-such as eating, dressing, and transferringto and from a bed or wheelchair—occur at a younger age in obese patients compared to nonobese controls.

Keywords: Obesity, Body Mass Index, Health Implications, Health Initiatives.

#### Influence Of Supermarkets on Consumer Behavior and Psychology

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When on any given day we decide to visit a supermarket, we mostly have something in our mind that we would like to purchase. Sometimes we might just want to purchase one or two things such as bread and milk. But have we ever wondered how often do we end up buying only what we thought we needed? Supermarkets are not as simple as they might seem to be. They have much more planning and execution of product placement, floorplan, shop layout, etc. to entice the customers to shop more than what they require to buy. Products that we require are usually placed at the back of the store. There is a simple reason as to why- to make the customer go through the aisles of the heavily processed food products such as chips, sodas, etc. This does not simply end here, even within the processed food aisles, the most heavily processed food is usually placed at the eye level and will be easier for us to reach. For example, in baking sections the ready-to-make cake mixes are kept at eye level which areheavily processed and more expensive. It is also quite evident to notice that fruits and vegetables section is almost always opposite to the dairy section. It is again a good way of letting the customers ponder in the aisles full of products that they don't usually need. Foods whose target groups are young children are generally placed at two levels i.e. down at the average typical height of a threeyear-old and the other at exactly the level of a child who is sitting in a shopping cart which makes it easy for them to notice and ask for. A lot of research is also gone into the music that is played in the supermarket throughout the day which is slowtempo that aims to slow down the flow of traffic in the store increasing the sales volume. An easy way to escape the psychological play of the grocery stores is to stick to the periphery of the store, where fresh and perishable products are displayed. Try and make a shopping list andstick to it and try not to go shopping when you are hungry as it leads to making unhealthy and convenient choices.

Keywords: Supermarkets, Consumer Behavior, Food Choices, Processed Foods, Store Layout

#### **Responsible Consumption and Sustainable Diets**

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We live in a world where food wastage is at the peak despite numerous efforts. To combat foodwastage and shortage, we as a consumer should choose foods that are less polluting to the environment and help the planet to sustain its original roots. We should create an ecological balance by opting for sustainable diets. Sustainable diets are the diets with low environmentalimpacts that contribute to food and nutrition security and to healthy life for present and futuregenerations. The concept of sustainable diets presents an opportunity to successfully advance commitments to sustainable development and elimination of poverty, food and nutrition insecurity and poor health outcomes. A sustainable diet considers the impact it will have on the environment, the individual and the food chain. For example, choose foods that are free from any pesticides and insecticides. Such foods will help individuals live a life free from any diseases being near natural foods. Food preferences, choices and eating habits notoriously hard to change as they are a central aspect of people's lifestyles and their socio-cultural environment. Many people already hold positive attitudes toward sustainable food, but the notable gap between favorable attitudes and actual purchase and consumption of more sustainable food products remains to be bridged. So, this gap can only be changed when peopleset their minds on the right food choices as well as right production methods.

Keywords: Food wastage, sustainable diets, food security, nutrition security

## **Consumption Of Plant-Based Diet for Improving Iron Status of Adolescent Girls**

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Adolescent girls are at high risk for iron deficiency anemia (IDA) due to the higher demand of iron for fast growth that happens throughout adolescence, the loss of blood during menstruation and the consumption of predominantly plant-based diets with low bioavailable iron, all contribute to the depletion of iron stores that substantially increase the susceptibility of adolescents to IDA and related adverse outcomes in future pregnancies. National Family HealthSurvey (NFHS-5), conducted during 2019-21, reported the alarming prevalence of anemia among women aged 15-19 years as 59.1 percent in India. The high prevalence of anemia demands due emphasis on the consumption of iron rich food along with the inclusion of iron absorption enhancing food items in single meal to bring down the total prevalence of anemia among adolescent girls. The objective of this study was to investigate the cross-sectional relationship between the consumption of different iron rich food items in combination with vitamin C rich food in a single meal, to improve the absorption and bioavailability of non-heme iron in adolescent girls to combat iron deficiency anemia. The findings indicated that adolescent girls who did not maintain WHO recommended level of fruits and vegetable consumption bear a significantly higher likelihood of being moderate to severely anemic. Combining poorly absorbed plant-based non-heme iron with vitamin C-rich foods, improves non-heme iron bioavailability. Even in the presence of inhibitors such as phytates and oxalates, ascorbic acid has been recognized the most potent facilitator of non-heme iron absorption in human bodies. It transforms ferric iron from meals to ferrous iron, increasing absorption by 75to 98 percent. Iron absorption is doubled when 50 mg of Vitamin C is added to the same meal. Along with iron rich common fruits and vegetables, some underutilized leafy greens, such as cauliflower leaves (40.0 mg), turnip leaves (28.4 mg) etc. are good source of iron. So, incorporating these leaves into iron-rich product formulations can help to boost mineral content, which can help to prevent iron deficiency anemia among adolescent girls.

Keywords: Anemia, cauliflower, turnip, bioavailability, consumption

# <u>TS-04</u> <u>Conservation and</u> <u>Promotion of Traditional</u> <u>Food Culture</u>

#### **Sattva and Mindful Eating**

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The Indian perspective of personality as represented by the exemplary Triguna theory classifies the gunas-Sattva, Rajas, and Tamas, as elements of personality. Tri means three and Gunas means qualities, thus Trigunas determines the three qualities, a state of mind and attitudes which determines people's nature, belief, and perception. This article emphasizes the effect of Sattva on mindful eating behaviors. Each of the gunas has varied characteristics including the patterns of food consumption but the focus is more on how such behavior impacts the overall well-being of individuals. The effect of gunas on mindful eating and perceived stress has not been fully explored, although observed that individual's higher vslower in mindfulness may report a weaker relationship between stressors and stress-related eating. As for perceived stress, an association between disordered eating or uncontrollableeating such as overeating, binge eating, hunger, and disinhibition, and comfort eating has been found in several studies. Additionally, mindfulness- based eating interventions have brought about significant changes in weight, eating behaviour, and psychological distress in obese individuals, indicating that mindful eating and stress do share an effective relation. Evidence suggests an attempt has been made to study the effect of gunas and gender on perceived stress and mindful eating among young adults. A data was collected from 158 subjects, accounting 79 females & 79 males & evaluated using factorial ANOVA. The results show that overall subjects with sattvic traits experience less perceived stress as compared to other gunas. Furthermore, the individuals of Sattva & Rajasic gunas were found to engage in mindful eating practices more than the individuals with tamasic gunas.

Keywords: Gunas, Sattva, Rajas, Tamas, Mindful Eating, Health, Triguna

#### **Conservation and Promotion of Traditional Foods**

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Food is not just Nutrition, but represents emotions, pleasure, and culture. Every culture in the world has a tradition to respect food and mentions good and bad foods. Local food culture is generally harmonious with local agro- climatic conditions, and represents knowledge accumulated through prolonged observation. It tries to optimise nutritional benefits of local resources and support local economy. Technological and social revolution after second worldwar witnessed huge transformation in food preparation and consumption pattern. However, nostalgia for traditional food has always been there and will always continue. Traditional foodmarket is characterised as regional, seasonal, skill based and segmented. It is typically suited for small entrepreneurs, especially women. Combining appropriate technology, creating quality awareness, and proper financial and marketing support is needed to promote traditionalfoods in contemporary market. This offers three-way benefit as Value addition to agriculture produce, women empowerment, and better Nutrition to society.

Keywords: food conservation, traditional food, value added products

# Value Addition in Jaggery: A Process Protocol for Immune Boosting Organic Jaggery using Cinnamon and Beetroot

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During last two years, due to COVI 19 pandemic situation, the health practitioner all over the world as well as AYUSH, India suggested that peoples should consume different herbs and spices regularly for improving immune systems which may help in faster recovery. Traditionally, jaggery is used for improving digestion, preventing bronchial or lung infections, blood purification, regular functioning of liver and kidney. Jaggery is a traditional natural sweetener, and it is the best among all sugarcane products which is enriched with mineral and phytochemicals. The most of the jaggery available in the local markets are not safe due to presence of harmful chemicals added during production processes. Therefore, there is an urgent need to standardized chemical free value added organic jaggery which has high demand in both national and international markets. Therefore, the present investigation was formulated to develop a suitable protocol for production of immune boosting organic jaggery during the year 2021-22. Cinnamon and beetroot known to rich in phytochemical and antioxidant were considered for these studies with treatment combinations viz., T1(C, 0.0%+B,0.0%), T2 (C, 0.2%+B,0.0%), T3 (C, 0.4%+B,0.0%), T4 (C, 0.0%+B,2.0%), T5 (C, 0.2%+B,2.0%), T6 (C, 0.4%+B,4.0%), T7 (C, 0.2%+B,4.0%) and T8(C, 0.4%+B,2.0%). The sensory and physical qualities of final value added jaggery products were evaluated. Among different treatments, the maximum overall organoleptic score (7.9±0.3) was recorded for sugarcane juice treated with T6 (C, 0.4%+B,4.0%) followed by (7.6±0.2) in T7 (C, 0.2%+B,4.0%). Farmers reported that such value addition in jaggery; they could be able to sell their produce @ Rs. 85/kg and more, instead of regular selling price of Rs.35-40/kg in the localmarkets.

Keywords: jaggery, sugarcane, value addition, organic, cinnamon, beetroot

# Extraction Of Betalains from Celosia Cristata L. Flowers Through Novel Extraction Methods for Application as Natural Food Colourant

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This study was conducted to investigate the effect of conventional solvent (CSE), microwave assisted (MAE) and ultrasound assisted extraction (UAE) techniques on the Total Betalain Content of biocolourant extracted from inflorescence of Celosia cristata. The effect of processparameters viz: Time, Microwave Power/Ultrasound Power/Temperature and solid liquid ratiowas also assessed by single factor experiments. The best extraction method was achieved with UAE at t = 20 minutes that gave maximum values for betalain content (245 mg/L) at 33.34 g/Lsolid liquid ratio. The highest betalain was 218 mg/L and 168 mg/L in Microwave Assisted Extraction and Conventional extraction respectively. Conventional extraction gave the minimum yield of total betalain content as compared to the other two methods. In case of microwave assisted extraction betalain yield increased with increase in treatment time from 15 seconds to 45 seconds but decreased with further increase in treatment time. Similar trend wasobserved in Microwave power and highest yield was obtained at 480 W. Betalain yield increased with increase in solid-liquid ratio from 1:10 to 1:30 g/ml and on further increase. Incase of ultrasound assisted extraction betalain yield increased with increase in treatment time from 10 minutes to 20 minutes but decreased with further increase in treatment time. Similar trend was observed in ultrasound power and highest yield was obtained at 200 W. Betalain yield increased with increase in solid-liquid ratio from 1:10 to 1:30 g/ml and on further increase. The study suggests, Ultrasound Assisted Extraction a promising alternative for extraction of coloured pigment from C. cristata flowers as it reduces extraction time and increases extraction yields of betalain.

Keywords: Extraction, betalains Celosia cristata, food colourant

#### Dietary Usage of Some Wild Edible Plants and Wetland Plants of Manipur

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Manipur state is located (23°27' to 25°41' N latitude and between 93°61' to 94°48' E longitude) in the north-eastern part of India and along with the other seven states viz., Arunachal Pradesh, Assam, Nagaland, Meghalaya, Mizoram, Tripura, and Sikkim form an integral part of the Indo-Burma centre of biodiversity hotspot of global significance. Wild edible plants (WEPs) and wetland plants are widely consumed in the local people's daily diet.WEPs such as *Centella asiatica* (L.) Urb. are eaten boil or 'kangsu', *Apinia nigra* (Gaertn.) Burtt, *Hedychium coronarium* are used in preparation of local dish 'eromba' and wetland plantslike *Neptunia oleracea* Lour., *Oenanthe javanica* (Blume) are used in preparation of 'sinju', *Euryale ferox* Salisb. are used in 'eromba' or it's leaf petiole is eaten as salad. WEPs and wetland plants are important for the sustenance of the ethnic communities in Manipur anda source of income. Moreover, WEPs and wetland plants received a little attention in terms of research activities, biodiversity conservation, economic development, sustainable management, and many are largely unnoticed or remained unexplored. Reducing the gap between ethnic knowledge and tapping into the hidden potential resources for proper utilization and sustainablemanagement of wild edible plants and wetland plants are now crucial.

Keywords: Wild edible plants, Wetland plants, Traditional knowledge, Manipur.

#### The Forbidden Black Rice (Zizania Aqatica): A Review

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A review has been made on black rice, popular among the scientific society as a superfood because of exceptionally good nutritional profile. The purpose of this systematic review is to focus on the historical aspects, nutritional composition, functional properties, phytochemicals, and bioactive compounds of black rice such as flavonoids, phenolic compounds and their healthbenefits. Black rice (Zizania aqatica) also known as forbidden rice, emperor's rice and royal'srice mainly originated from Asian countries. The richest country in cultivation of black rice isChina (62%) followed by Sri Lanka (8.6%), Indonesia (6.2%) and India holds the 4th placed with (5.1%) follows by different countries. It is a good reservoir of essential amino acids suchas lysine, tryptophan, minerals including iron, calcium, phosphorus, zinc and selenium;vitamins such as vitamin B1, vitamin B2 and folic acid. There have been several studies of black rice which alleged beneficial health effects when consumed regularly in diet as it retainsantioxidant activity, anti-inflammatory activity, anticancer activity, antihyperlipidemic and antihyperglycemic and anti-allergic activity which may help in preventing many non- communicable diseases. This most nutritious variety of rice has the potential to be used in theproduction of healthy foods and beverages, such as functional products and gluten-free cereals, thereby providing extra health benefits to consumers.

Keywords: superfood, antioxidant, bioactive, non-communicable diseases, anti-inflammatory

#### Formulation And Sensory Evaluation of Flavoured Fermented Rice Water

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With the rise in urbanization and increasing health awareness, demand for fermented foods and beverages are also growing. Besides, the COVID -19 pandemic also played a significant role in popularizing the market of traditional fermented food worldwide, owing to the health benefits. Traditional fermented products are those that are indigenous to the local area. Fermentation is mainly done by certain microbes that impart characteristic organolepticproperties, enhances shelflife and provide bio-enrichment to the food. However, the characteristic aroma from certain fermented products is a major concern, which many consumers do not prefer. Therefore, the addition of flavour and other active ingredients are preferred to mask the fermented taste and aroma. This study aimed to determine the formulation to increase the overall acceptability of traditionally fermented rice water as a beverage among consumers. The fermented rice water was prepared using exotic rice varieties, viz., black, brown, and red rice. Different artificial flavors such as pineapple and orange, along with sugar, were taken in an optimum ratio. Acceptance was evaluated through a 9-point hedonic scale toassess the overall liking for sensory attributes, where 9 denoted liked very much and 1 referred as very much disliked. Sensory evaluation of three fermented rice water, i.e., Black, brown, andred, revealed that pineapple flavour was most favored in black and brown rice water, whereas orange flavour was preferred in red rice water. The optimum sugar content was 5 % in black and red rice water and 3% in brown rice water. This indicates that adding flavors and other ingredients may help increase sensory acceptance and other attributes in certain fermented products, which can help provide a desirable consumer market for traditionally fermented ricewater.

Keywords: traditional, fermented food, rice water, consumer acceptance

#### Cordia dichotoma G. Forst-An underutilized traditional plant

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In the last few decades, the attention towards the ethnomedicinal plants has been significantly increased, these plants are underutilized and considered as the mines of various bioactive components. They are generally utilized by local communities for various purposes including culinary, medicinal, wood, animal fodder etc. They are highly nutritious in nature despite havethe potential to grow under adverse climatic and soil conditions, these plants also help in achieving the food security by controlling the over-exploitation of the staple food crops. One among these underutilized plants include Cordia dichotoma G. Forst, belongs to Boraginaceae family, commonly known as Lasora in many parts of India. It mainly grows in tropical and sub-tropical regions including northern parts of India. Cordia has been traditionally utilized aspickle, vegetable, natural gum, decoctions etc. Cordia species has been identified with various bioactive components including Lignans, Terpenoids, Saponins, Carotenoids, Quinones, Phenolics, Alkaloids, Coumarins, Steroids, Flavonoids, Fatty acids, Porphyrins, and many Essential oils. Various pharmacological activities including analgesic, anti-helmentic, anti- inflammatory, diuretic, aphrodisiac, anti-microbial etc were reported in cordia. Despite all the functional attributes, it is still underutilized but has the potential to be considered as future food. Therefore, systematic research is required to manifest cordia as a nutritional alternativein both food and non-food sector in order to promote food security and sustainability. From thepast few decades, people are drifting towards the plant-based products for their therapeutic anddietary purpose. The ethnomedicinal plants are the mines of phytochemicals and bioactive agents, they are generally utilized by local communities for various purposes including culinary, medicinal, wood, animal fodder etc. but still categorized as underutilized. These underutilized plants not only provide nutrition but also assist in achieving the food security and sustainability by controlling the overexploitation of the staple food crops. One among them is Cordia dichotoma G. Forst (Lasura) belongs to Boraginaceae family has been reported with various pharmacological properties including antioxidant, anti-microbial, antidiabetic, antiulcer, anti-inflammatory, immune-modulator, analgesic, diuretic, and laxative. Cordia dichotoma G. forst has been identified with various bioactive components like lignans, terpenoids, saponins, carotenoids, quinones, phenolics, alkaloids,

coumarins, steroids, flavonoids, fatty acids, porphyrins, and essential oils. The ripe cordia fruits consist of sticky polysaccharide gum which acts as a potential tablet binder in many pharma industries. Traditionally, people utilize cordia fruits as pickle and vegetable and in treatment of dyspepsia, headaches, snakebite, fever, diarrhea, leprosy, gonorrhoea and burning sensation, menstrual pains, cough, cold, ulcers etc. This study aimed to gather the traditional knowledge on cordia dichotoma G. Forst and to evaluate cordia fruits for their antioxidant potential through various assays like ABTS, DPPH, LPA, TPC, TFC, TAC. The data collected proved cordia dichotoma G. forst as traditional medicinal plant with great antioxidant potential helps in protecting our body from free radicals which causes heart diseases, skin diseases, cardiovascular diseases, and cancers. Therefore, we can consider cordia as future food and a systematic study on this traditional plant may provide new dimensions to the health care and food system and assist in promoting economic security to the local farmers.

**Keywords:** *Cordia Dichotoma G. Forst,* underutilized, traditional medicine, bioactive components, antioxidant activity, future food

# Food Heritage Makes a Difference: The Importance of Cultural Knowledge and Importance of Traditional Food System

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Anna, or food, is a factor of Brahman, in accordance with Indian philosophy. It was once given to result, it needs to be treated with big care. us by Paramatta. As a Because the bodily physique is nourished and grows through absorbing the energies from food, it is termed Annamaya Kosha, or meals body. Food be consumed for the body's survival and strength, no longer for pleasure. Another phase of the regular meals machine is fasting. Its cause is to cleanse each the thought of our cutting- edge lifestyle, common culinary ideas have been and the body. Because radically altered in our society. The many features of regular meals device have been documented in historical scriptures, literature and folktales. In Karnataka, we might also discover unique foods and a vast range of dietary options. There are a wide variety of lesser-known veggies in these kinds that are notion to provide health benefits. Traditional staple ingredients and other meals corporations used in diet, such as nuts, seeds, wild fruits, and vegetables are location specific. Indigenous people's wellbeing and health are largely established on their ordinary meals system. Nonetheless, proof abounds that indigenous people's regular food groundwork and expertise are being lost. As a result of family food insecurity, fewer species have been used, dietary range has reduced, and fitness has suffered as a result. The grasp of the normal food system has the achievable to alternate this situation. Creating attention to usual food structures can help to promote a healthysociety and a sturdy nation. Traditional meals knowledge is the greatest for agiven geographical location. Changing ones consuming habits would possibly be hazardous tosociety health. As a result, its integral to understand the value of wholesome eating habits rooted in our way of life and a well-balanced diet.

Keywords: Annamaya Kosha, Indian Philosophy, Nutrients and Traditional Meals etc.

#### Mahua: The Unswept Treasure

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Mahua is a native plant of India, belonging to the family Sapotaceae the major species of genus Madhuca found are Madhuca indica and Madhuca longifolia. Jharkhand (the land of trees), rich in its forest resource, is blessed with a large population of Mahua trees. It is used for manyculinary preparations and medicines. Young generations engaged in their wonderland bother less about their traditional treasure. If not motivated towards preserving the cultural and food heritage, they will lose many values and real transfer of the knowledge would not be passed to the next generation. This paper aims to make this treasure accessible to this generation in a form they are aware of and ready to accept and appreciate. This will be executed by introducing "MAHUA FOOD PRODUCTS" in the form of" MAHUA FLAKES" and "MAHUA HONEY". Mahua flowers have been used as a cooling agent, tonic for many treatments. The high amount of sugar (sucrose, glucose, fructose, arabinose, a few amounts of maltose and rhamnose) and phytochemicals in the mahua flowers makes them a sweetener and edible flowers, with therapeutic applications, where along with flavour comes good health for everyone. With the easy acquisition of flowers (Annual production of mahua flowers: 45000 million tonnes), least spoilage, low pollution in the production process, providing high employment opportunity forunskilled as well as skilled labour, easy handling, and transportation, with reasonable investment and affordable sale price, mahua products become appealing and affordable to thepublic. Earlier, dried mahua flowers with milk have been used to treat weakness of the nervesand diseases of the neuromuscular system, regular uptake of mahua flakes and mahua honey with milk will build a strong muscular, neural system and strengthen the immune system of an individual respectively.

*Keywords:* Mahua, Medicines, Mahua Flakes, Mahua Honey, Phytochemicals, Strengthen Immune System.

#### **Development Of Indigenous Nutritious Nutribar for Children**

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Nutrimix is an instant food type that can be a good supplement of essential nutrients both macronutrients and vitamins and minerals that contribute to recommended daily intake. Various local available ingredients put in a form of a bar can be an easy way to get children tomeet the recommended requirements of protein and energy and it is best because it is not only for the nutritional gain but also for their satisfaction. This study aimed to formulate a nutrimix and then conversion of it to RTE nutribar that is rich in protein, calcium and iron for school going children. The locally available ingredients used were maize flour, sorghum flour (Jowarflour), millet powder (Ragi flour), pumpkin seed, soya flour, peanuts, sesame seeds, amaranthseeds and jaggery. The foods mentioned are both locally available in India and Malawi. The product must go through some test to estimate the nutritional quality, to evaluate its self-life and we also must perform a sensory evaluation of the product. Nutritional analysis revealed that the product contained good amount of iron (2.5 mg) and calcium (160 mg) per serving (20g) of the bar. Nutribar was found to be safe for consumption for 14 days both at room and refrigeration temperature. The sale price of the bar came as low as 10 Rs. Therefore, the formulation of this product will help school going children to meet the increasing nutritional requirements.

Keywords: Nutrimix, nutribar, ready to eat, child nutrition

#### Study On Knowledge Attitude Practices of Lactating Mother on Complementary Feeding

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Complementary feeding (CF) is a systematic process in which suitable food is introduced at the right time in addition to mother's milk to provide needed nutrients to the baby. The World Health Organization stresses that complementary feeding must be timely, adequate, appropriate, and safe. Appropriate complementary feeding and optimal childhood nutrition goes hand in hand. As such, inappropriate complementary feeding practices have remained as a significant cause of malnutrition in children which is a primary cause of health problems among childrenunder 2 years of age in many developing countries and other developed countries including India. Apart from being a crucial process needed for the child's growth, complementary feedingalso sets a good foundation for the child's health throughout the course of life. Untimely introduction of complementary food may lead to growth faltering in infants. The main objective of this study is to assess the knowledge, attitude, and practice of mothers regarding complementary feeding and their impacts on the nutritional status of the children. This is a hospital based quantitative descriptive study in which assessment of the knowledge, attitude and practice of mothers and nutritional status of children was done. Study was conducted on 100 mothers and 100 children selected based on convenience and inclusion criteria. Data on knowledge and practice of mothers was collected using structured questionnaire questions while data on the attitude of mothers was collected using the Likert scale. The overallknowledge score of mothers was average (34.56%) and the overall practice scores of mothers were graded as average (35.21 %) but the overall attitudes score of mothers towards complementary feeding was poor (1.75%). Nutritional status of children was found out to be only 38.58% of children have normal weight for age while 44 % of children had mild degree of malnutrition and 17.32 % had moderate degree of malnutrition.

Keywords: Complementary feeding practice, lactating mothers, nutritional status

#### **Conservation Of Culinary Heritage**

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Food is not only a central activity of mankind but one of the most significant trademarks of culture and heritage. India has a rich culinary heritage which is evolved over centuries. We grew up eating the food of our cultures, cuisines passed down from one generation to next as an expression of cultural identity. Immigrants who move to new places, carry their traditional food practices wherever they go, and it is one of the perfect ways of preserving their culture. Inone of the aspects dietary qualities is an important factor to enhance the bioavailability of manynutrients in plant-based diets. In several traditional households' food-processing and preparation methods are used which include thermal processing, mechanical processing, soaking, fermentation, and germination/malting. It aims to increase the physiochemical accessibility of nutrients, decrease the content of antinutrients, such as phytate, or increase the content of compounds that improves the bioavailability of food. A balanced approach to preparing, eating, and digesting food is a key to wellbeing and sound health. But as the eating habits of Indians are changing, we run the very real danger of losing our local food heritage as people are running towards more convenient and ready-to-eat foods because they lack time for preparation and cooking. A study in 43 Arctic communities found that on days when people ate traditional foods their diets were better than people who eat processed and ready to eat foods. This is because traditional foods benefits in number of ways such as less calories for weight control, less saturated fat for the heart, more lean meats and fish for quality proteins, more iron for muscles and blood, more zinc for wound healing and fighting infection, more Vitamin A for vision and fighting diseases, more calcium for strong bones and teeth and finally to strengthen cultural capacity and wellbeing. Food is a social and cultural marker which is tied to much symbolic meaning in our society and the diversity of recipes, ingredients, and processes which we have access to-is unique in its breadth and diversity. We should embrace our culinary heritage and remember that each dish has a special place in the culture towhich it belongs. Food is a portal into culture, and it should be treated as such.

Keywords: food heritage, bioavailability of nutrients, eating habits, benefits of traditional fod

#### Kefir: As a Functional Beverage to Improve Gut Health

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During COVID-19, there has been an increase in the rising global trend for consuming foods with health-promoting attributes. Furthermore, fermented dairy products are a significant functional food subcategory with positive health benefits. Likewise, milk kefir and water kefirare one of the most consumed traditional fermented dairy products and have a complex probiotic and nutritional composition. It constitutes a unique symbiotic association, comprisingmainly of lactic acid bacteria, yeasts, and occasionally acetic acid bacteria, which are naturally present in the kefir. This review paper gathers information regarding the microbial, chemical, nutritional, and therapeutic aspects of kefir and kefir like products to justify their consumption.Kefir grains consist of casein and other milk solids that can cause fermentation with the help of yeasts and lactobacilli. Kefir and kefir like products have a rich microbiota, and their composition can vary based on its origin and method of production (artisanal or industrial). Lactic acid bacteria (LAB) are an integral constituent in the kefir's microbial composition and the health-promoting effects. During the Covid-19 pandemic, it was suggested to consume natural probiotic-containing foods as it will be beneficial for improving gut health and overallhealth and immunity. Moreover, milk kefir provides a significant amount of protein, probiotics, and prebiotics. Water kefir can be a significant source of probiotics and prebiotics for vegans and people allergic to dairy products. This review gives reasons that kefir and kefir like products are essential for humans for their potential health benefits.

Keywords: Kefir, nutritional, therapeutic potential, microbial composition

#### **Conservation and Promotion of Traditional Food Culture**

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This study focuses on the potential benefits of traditional foods and their functional role insustainable food consumption. Traditional foods are the foods and dishes which have been consumed for many generations. Being diverse in variety, these foods not only add to the dietary diversity, but also are nutrient dense. A traditional food is also local, that is, it is locally available in the geographical area of the community that prepares it in their traditional ways and consumes it. The growth in the consumption of locally produced foodhas resulted in significant increases in the number of sales of food produced by local farmers, thereby supporting the economy at the ground level instead of benefiting huge supermarkets. In addition to the benefits that local foods cater to the local consumers, theseare beneficial for the growth of small farmers, who need support, now that large agribusinesses dominate food production. In the context of sustainable agriculture, this study analyses the contribution of production of traditional foods to it as compared to that of modern agriculture practices in the following ways- the implications of the distance travelled in the transportation of food to the consumer's table, farming practices that reducecarbon emissions, local trading of food produced by rural farmers. It highlights the example of how meals prepared using ARF (Amylase Rich Flour) provide adequate nutrition to infants and hence, is a traditional way to combat malnutrition. Infants fed porridge with ARF consumed more per sitting (213Kcal in 131ml) than those fed porridge without ARF (107Kcal in 62ml). In concussion, this study highlights some of the most importanttraditional foods- millets and legumes which are nutrient-dense and need to be promoted.

Keywords: Amylase Rich Flour, Traditional foods, functional potential

# <u>TS - 05</u> <u>Sustainable Green Food</u> <u>Processing Technologies</u>

#### Beetroot Betalains: Stability, Challenges and Opportunities

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Beetroot is one of the most important industrial crops from *Caryophyllales* order known for itsnatural colourant, betalains and exceptionally high antioxidant activity. Beetroot betalains, extracted by physical means, are permitted by the European Union for use as a natural colourantin foods (E162). Like other natural colourants, betalains have limitations due to the lack of standardized extraction protocols and reduced stability. Aqueous and enzyme assisted extraction of betalains pigment has been standardized through response surface methodology. Effectiveness of various additives for betalains and antioxidants stability when added as per the prescribed limits given by FSSAI for food uses will be an integral part of the talk. In nutshell, additives, namely, 1% ascorbic acid, 10% glucose/ fructose, sucrose >45%, EDTA 40ppm and sodium benzoate 350 ppm are the best additives for imparting maximum betalains stability. Study showed maximum loss of native betalains was occurred by light exposure (2400lux), temperature beyond 60 °C and salt (NaCl) concentration level  $\geq 10\%$  (w/v). Stability underidentified deteriorative conditions can be enhanced (confirmed by higher half-life time and lower degradation rate constant) through pigmentation, complex formation, and encapsulation for wider and secure use of betalains in food applications.

Keywords: beetroot, betalains, natural colourants, enzyme extraction

#### May Small Fruits Be Seriously Considered as A Source of Plant-Origin Proteins?

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Some small fruits are highly prized for their content of bioactive phytochemicals. Many species possess distinct flavour and are consumed as fresh fruits. However, due to a short shelf-life large amounts of harvested berries are processed into various more stable for storage products such as juice, jams, purees, etc. Processing generates large quantities of by-products such as juice pressing pomace, which may constitute 30% of the total fruit dry matter. We have developed effective biorefining schemes for valorising berry pomace and obtaining various high nutritional value functional ingredients: lipophilic fractions with highly unsaturated oil, tocopherols, phytosterols; antioxidant fibre; polyphenolic antioxidant extracts. The content ofproteins in fresh berries is rather low; however, it remarkably increases in berry pomace fractions recovered after certain biorefining steps. For instance, the following content of proteins in defatted by supercritical CO2 pomace was determined for different berries: sea buckthorn - 20.1%, blueberry - 13.2%, bilberry - 12.5%, blackberry - 9.5%, lingonberry - 8.46%, raspberry - 7.51%, cranberry - 11.79%. Defatted pomace may be further fractionated for recovery polyphenolic fractions with polar solvents causing further increase of the contentof proteins in the extraction residue. Considering that the whole pomace contains seeds, skins and residual pulp, while berry lipids and proteins are mainly located in the seeds, other approach may be applied for fractionation. Firstly, mechanical pre-separation of pomace into seeds and other parts is performed and afterwards the products are fractionated by using supercritical CO2 extraction for the recovery of high nutritional value lipids and insoluble residue with the increased content of proteins. For example, the content of proteins in defattedsea-buckthorn seeds may reach 40%. This study discusses the technologies for obtaining protein-rich fractions from various berry pomace and mechanically separated seeds, their nutritional value, physical properties, and the prospects of application in various foods.

Keywords: berries, proteins, fractionation, application

# Comparative Study on Quality Attributes of Vacuum and Atmospheric Fried Bitter Gourd Chips

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The correlation between increased vegetable consumption and protection against chronic diseases as well as a shift towards sustainable and personalized food choices has motivated interest in production of value-added products from vegetables. In this study bitter gourd sliceswere vacuum fried at three different temperatures 90°C, 100°C and 115°C at vacuum pressure9 kPa. The prepared chips were analyzed for quality attributes such as oil content, total phenoliccontent, crude fibre, colour, texture, browning index. The sensory evaluation of vacuum fried bitter gourd chips fried at 115°C and 9 kPa scored highest points 8.02 among all other sampleson nine-point hedonic scales. The composition of vacuum fried bitter gourd chips showed 21.67% oil, 11.52% crude fibre and 3828 mg/100gm total phenolic content. The colour was measured using Lovibond RT 300 portable reflectance spectrophotometer, and the colour values L\*, a\* and b\* were 57.67, 10.76 and 34.09 respectively. The scanning electronmicrograph of vacuum fried bitter gourd chips reveals the presence of more porous structure compared to atmospherically fried chips. The moisture sorption isotherm for vacuum fried bitter gourd chips at 38°C showed typical type II sigmoid shape. Sorption isotherm model equations such as Brumauer-Emmet-Teller (BET), Smith, Halsey, Oswin, Henderson, Kuhn, Iglesias and Chirife, and Freundlich applied for the fitting of experimental moisture sorption data yielded high coefficient of determination R<sup>2</sup> ranging from 0.96 to 0.99 confirming the applicability of the equations employed for modeling the process. The study indicates the feasibility of developing vacuum fried bitter gourd chips with high nutritional values and desired quality attributes.

*Keywords:* Vacuum frying, bitter gourd chips, total phenolic content, crude fibre, browning index, moisture sorption isotherm

# Phyto-Constituents of Fruit Processing Agri-Waste and Their Antioxidant Potential for Use in Nutraceuticals

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The Fruit processing industries generate large volumes of pomace wastes that resulting in severe pollution difficulties. Such wastes might have a potential for promising source of bioactive phytochemicals that may be useful products of high value for use as nutraceuticals and functional foods. Similarly large amounts of fruit and vegetable processing wastes are generated which may be good sources of bioactive phytochemicals. Industrial residues from citrus fruit juice industry are good source of essential oils and phenols, key group having antioxidant phytochemicals, and profound importance due to their biological and free radical scavenger. Reactive radicals induce oxidative stress leading to several diseases like cancer, inflammation, and aging processes. Antioxidants offer protection from such damage of free radicals in lipid peroxidation, protein damage and DNA strand breakage and associated disorders. Therefore, the prime focus of present studies was to manage agri-waste generated from fruit juice processing industries to identify useful phytochemicals and combat pollution. The wastes like fruits and vegetable peels, and pomace residues of citrus, pomegranate waste were studied for essential oils, composition, total phenolic content (TPC) and antioxidant activity (AOA) to explore their potential for use in nutraceuticals or functional foods. The TPCdetermined as mg/g Gallic acid equivalent (GAE) varied from 127.2 mg/g GAE in Citrus to 364.1 mg/g GAE and AOA in residues was 78.8 to 98.8%. The essential oils from citrus were extracted by hydro-distillation and composition through GC-MS. Antioxidants protect lipid peroxidation, protein, enzymes, and DNA damage from reactive oxygen species. These results on antioxidant phytochemicals that can be used in nutraceuticals and functional foods will bepresented.

*Keywords:* Nutraceuticals, Agri-horticultural wastes; Antioxidant activity; Total Phenoliccontents (TPC); Functional foods

# Recent Advances in the Development of Hybrid Greenhouse Drying Technologies for Fruits and Vegetables.

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The use of solar energy as a preservation method for agricultural produce is a long-established phenomenon. Recent studies have shown various limitations of sun drying and numerous solardrying techniques have been proposed. These technologies are used for low temperature drying of fruits, cereals, spices, and vegetables etc. Recent development in the solar greenhouse dryingtechnologies such as hybrid drying technologies using Heat pump, infra-red dryer, flat plate collector, Phase Change materials, mixed mode tunnel drying, biomass assisted drying have been discussed in this paper. A systematic approach for classification of greenhouse solar drying has been evolved. Fruits and vegetables dried under greenhouse have been found qualitatively superior to traditional sun drying methods. Energy and Exergy analysis has beendiscussed which is of great interest across the world. Exergy analysis is the mechanism to assess the effectiveness and efficiency of solar energy usage. In this paper a comprehensive approach to study energy and exergy analysis has been made.

*Keywords:* solar energy, hybrid drying technologies, energy, exergy

# Extraction And Characterization of Sulphated Polysaccharide from Brown Macroalgae Using Green Technologies

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Macroalgae, also known as seaweeds, are grown commercially and considered a potential feedstock for various applications in the nutraceutical, cosmeceutical, and pharmaceutical industries. The global production of marine macroalgae was approximately 33 million tons in2017, out of which 32 million tons were harvested from the culture sector. Macroalgae are an abundant source of a wide range of biologically active compounds such as proteins, phenolics, pigments, carbohydrates, polyunsaturated fatty acids (PUFAs), dietary fibers, and various otherbioactive compounds. They are the significant source of sulfated polysaccharides or hydrocolloids like fucoidan and alginate in brown macroalgae, carrageenan in red macroalgae, and ulvans in green macroalgae. These sulfated polysaccharides are reported to exhibit variousbiological properties such as antimicrobial, antifungal, anti-inflammatory, antitumor, and antiviral properties, which are associated with cosmeceutical and pharmaceutical preparations. We have employed different technologies to extract fucoidan from brown macroalgae, including ultrasonic-assisted extraction, enzyme-assisted extraction, subcritical water extraction, and the conventional method. We investigated the effect of these extraction methodson fucoidan yield, chemical characterization, monosaccharide composition, structure, and antioxidant activity of extracted fucoidan.

*Keywords:* macroalgae, sulfated polysaccharide, green extraction techniques, structural classification, antioxidant

# Sonication And Microwave Processing of Elephant Apple (Dillenia Indica) Juice: A Synergistic Approach

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Food that is safe, healthy, and nutritious is what today's consumers desire. Ultrasound processing is a relatively recent technique for extending the shelf life of fruit juices without harming their quality. Microwave treatment, on the other hand, is rapid, preserving sensory qualities, nutrients and vitamin content, and taste content. This study looked at the combined effects of sonication and microwave processing on improving the quality of elephant apple (*Dillenia indica*) juice. The juice was placed into plastic bottles, sealed, and stored for 30 days after being processed using sonication and microwave. The purpose of this study was to see how pH, titratable acidity (TA), total soluble solids (TSS), total phenolic content (TPC), total flavonoid content (TFC), antioxidant activity (AA), ascorbic acid levels, microbiological qualities, and sensory properties were influenced by sonication and microwave. Between sonicated and microwaved juice samples, there were no significant (p.05) differences in pH, TA, or TSS. According to the experimental data, sonication and microwave boosted the quality of elephant apple juice by significantly improving the amounts of TPC, TFC, and AA (p.05) and ensuring the microbiological safety of juices. Furthermore, the findings of this study revealed that sonication can be utilized to process elephant apple juice as a low-cost alternativeto thermal processing while keeping high quality.

Keywords: Dillenia indica, sonication, microwave, antioxidant properties
#### Nutritional Assessment and Formulation of Lotus Stem Products for Adolescent's Health.

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Adolescence is defined by WHO as a distinct age group between 10-19yrs of age with specificneeds because of physical and psychological development throughout puberty. Iron deficiencyoccurrence and severity indicate a major public health problem among adolescent girls. Due toseveral causes the inability to consume an iron-rich diet and compensate for the losses induced by menstruation, adolescent girls are the ones who are most affected. They may become anaemic, increasing the risk of difficulties during pregnancy and childbirth. Thus, there is a need to develop iron-rich nutritional products using lotus stem. Nelumbo nucifera is a scientificname for Indian lotus. It's an aquatic herb with a thick yellowish-white rhizome that creeps along the ground. The health benefits of lotus stem are that it is rich in proteins, iron, vitamin-C, calcium, potassium, omega-3 and 6 and low in sugars. It has also been utilised in India as an indigenous medication. Lotus stem alkaloids have been proven to have nutraceutical advantages. It is nutrient-dense and anti-inflammatory, aiding in the prevention of anaemia, PEM, osteoporosis, gastrointestinal diseases, fungal and viral infections, and numerous degenerative diseases. The objectives of the study are to assess the prevalence of iron deficiency in adolescent girls, as well as their nutritional knowledge with reference to iron, andto develop iron-rich products incorporating lotus stem, as well as a self-help disc for intervening the population with information related to iron-rich food. Therefore, the present study is to undertake an attempt to assess nutritional status and overcome anaemia related problems by improving the dietary practices and quality of life.

Keywords: anemia, iron deficiency, adolescent girls, lotus stem, iron-rich foods, dietarypractices.

#### **Artificial Aging of Wine**

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Due to wine's newly discovered benefits like "good for heart" and skin rejuvenation properties the demand for it has increased drastically in India in last few years. To fulfil this demand the implementation of new techniques has become essential. Aging of wine is a crucial part in winemaking. Traditionally Romans used to age wine in oak barrels, and it is done similarly tilldate. Research have shown that the small amount of oxidation that takes place in these barrelsgives the wine it's unique aroma and flavour. But this process requires a lot of time, workspace, and maintenance. Due to these disadvantages, many new technologies are introduced to speedup the aging process of wine. This includes - use of ultrasonic waves, application of high hydrostatic pressure, electric field, gamma irradiation and micro-oxygenation. One year of standard aged wine has same taste as that of a young wine when treated with 20kHz of ultrasonic waves for one week. Applying electricity converts the alcohols and aldehydes into esters and free amino acids and thus transforms the harsh wines into a dainty one (E.g., Cabernetsauvignon wines). This process is equivalent to a 6 month of traditional aging in oak barrels. Gamma irradiation is used to accelerate the physical maturation of wine after it's malolactic fermentation. Considering the importance of oxidation, in microoxygenation very small doses f oxygen is introduced in young wines (usually 2 ml /L month) after alcoholic fermentation and before malolactic fermentation to stabilize the color and improve the astringency and aromatic components of wine. This technique is used for many purposes like improving the organoleptic properties of wine, stability of its color, reduction of sulfur-derived smells and most importantly to stimulate the aging process of wine. Although the traditional method creates quality wines, but this modern, innovative, and inexpensive techniques shorten the aging time without much change in the taste and aroma of the wines and thus making it available for all the consumers efficiently.

*Keywords:* Artificial aging, Traditional methods, Micro-oxygenation, Modern techniques, Wines, Enology.

#### Green Synthesis of Silver Nanoparticles by Murray Koenigii L. Spreng

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*Murraya koenigii*, generally known as karipatta or as curry leaf in India. It is a health promoting herb, which is not only used for flavor and aroma, but also has many potential health benefit. We report here the synthesis of silver nanoparticles (AgNPs) using curry leaves. Green synthesized nanoparticles have been characterized by color change, UV-V is spectroscopy andSEM. The color of leave extract prepared turned from green to brown after treatment with AgNO3 (1mM). The UV-V isible spectroscopic analysis showed absorbance peak at 434 nm. Scanning electron microscopy showed the presence of spherical silver nanoparticles. Curry leafextract as a reducing agent converts silver ions to AgNPs in a rapid and ecofriendly manner. Green synthesis has advantage over chemical and physical method as it is cost effective, environment friendly, easily scaled up for large scale synthesis and also in this method there isno need to use high pressure, energy, temperature and toxic chemicals.

Keywords: curry leave, silver nanoparticles, green synthesis

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#### Role Of Nanotechnology in The Development of Biodegradable Packaging Films

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Packaging fulfils the diverse role from protecting products, preventing spoilage, contamination, extending shelf life, ensuring safe storage thereby helping to make them readily available to consumers. Every year, 40% of all plastics manufactured are wasted in landfills and more than 500 billion plastic bags are distributed, with just around 3% of those bags recycled. They are commonly composed of polyethylene and can take up to 1,000 years to disintegrate in landfills, which produce dangerous greenhouse gases. Biodegradable polymersmight be the answer to the problem. Unfortunately, the application of biodegradable films for food packaging has been severely limited due to natural polymers' low barrier properties and weak mechanical strength. Example Edible films based on whey protein were reported to be flavorless, tasteless, flexible and has desirable film forming and barrier properties, however, have low tensile strength and high-water vapor permeability. With the application of nanotechnology, we can overcome this problem. Nanotechnology is broadly described as the design and use of structures with at least one dimension on the nanoscale length scale  $(10^{-9}m)$ . These structures are known as nanocomposites, and they may change the characteristics of materials or add new properties and phenomena to them. These nanocomposites are produced by interaction between polymer matrix and the nanofiller for example when bioplastics are blended with nanoclay particles, the resulting nanocomposites have better barrier qualities thanpure bioplastics and may be composted and returned to the soil after their useful life. These nanoclay particles gets arranged in parallel platelets due to which gases flow in a torturous paththrough the film thus creating higher barrier properties. Solution cast whey protein isolate films containing  $TiO_2$  and  $SiO_2$  nanoparticles for better mechanical characteristics. Tensile stress study revealed that the use of nanoparticles enhanced the whey protein isolate film; such filmsmight possibly become effective packaging materials to improve food quality and safety.

Keywords: biodegradable, nanotechnology, packaging material, nanocomposites

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#### **Protein Based Edible Films-Recent Trends**

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Edible protein films are used to enhance shelf life of food by preventing loss of important components and providing surface sterility, being sustainable is its salient feature. Recent advances in this field have encompassed several alternative protein sources for fabrication of edible protein films. Some of the novel sources discussed are Feather keratin; collagen was cross linked with keratin; collagen used in formulations, namely with chitosan and with soy protein isolate; surimi, isolated from muscle; brewers' spent grains proteins; Sesame protein isolates; gum ghatti (GG); agricultural wastes (Perilla seeds, canola), Mung bean proteins. Some additives are also added to make the efficiency of the films better. This innovative food packaging technique is of interest as it counteracts the problem of inappropriate waste disposal.Chemical, mechanical, sensory, physiological properties of the material, suitability for environment has significant impact on the utility of the material. More growth and advances inthis promising technology can further be seen as an alternative for synthetic packaging.

*Keywords:* Sustainable Packaging, Feather keratin, Collagen, chitosan, surimi, soy protein isolates, sesame protein isolates, mung bean proteins, agricultural waste, gum ghatti

#### **Edible Films & Coating in Fruits and Vegetables**

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Fruits and vegetables are perishable commodities i.e., they are more liable to deteriorate therefore there are more post-harvest losses, especially in developing countries. Edible film &coatings is an environmental friendly way of increasing shelf life, improving appearance, providing safety, and good gas and moisture barrier properties. Components used for preparation are hydrocolloids, lipids, and composites. This was studied by coupling silk fibroin(SF) with poly(vinyl) alcohol PVOH, their water suspensions were mixed at different ratios forming a multi-layered membrane and their effect such as transparency, mechanical properties, water vapour, oxygen permeability was noted. The edible coating contains bio preservatives or functional ingredients such as antioxidants, antimicrobials, nutrients, and flavours to enhance food stability and Quality.

*Keywords:* Edible coating, post-harvest losses, silk fibroin (SF), polyvinyl alcohol (PVOH), hydrocolloids

#### A Study on Manufacturing of Edible Cutlery Using Carrot Pomace

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Now-a-days innovation along with sustainability is necessary. Plastic cutlery is easy to use and convenient choice, but it has a lot of adverse effect on the environment. Edible Cutlery from carrot pomace in combination with oats flour and wheat flour is a delicious way to replace plastic cutlery towards sustainable development. Carrot pomace is a by-product obtained during carrot juice extraction. This edible cutlery can be developed by blending of two or morestaple food items, keeping in mind the nutritional importance of these staples, by assessing the consumer's acceptance. "Ready To Eat" cutlery market can be segmented into spoon, knife, fork, etc. Carrot Fibres improves strength, enhance finishing, and increase nutritional benefits. Consequently, these fibres are subjected to dehydration without outrunning it's functional and nutritional properties. Hydrocolloids such as xanthan gum and protein such as soy protein provides core structure. Posteriorly, anti-fungal agents and naturally occurring preservatives are incorporated followed by dough making. Casting process of dough and settling it into a mold according to derived demand is formulated. Once acceptable formulations and process conditions are established, the process is scaled up in commercial manufacturing unit.

Keywords: carrot pomace, edible cutlery, soy protein, xanthan gum

## <u>TS-06</u> <u>Food Diversity and Food</u> <u>Security</u>

#### Diversity Of Wild Edibles in The Indian Himalayan Region: A Potential Source to Address Nutritional and Food Insecurity

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The traditional system of food has strong bondage to combine cultures and play an importantrole in biodiversity conservation. This relationship between food, biodiversity and cultural diversity significantly contributes to ensuring sustainable human development. However, over the time the rapidly changing socio-economic and environmental scenario has greatly affected the traditional systems of food, leading to disruption of these linkages and existing knowledge systems. This has consequently narrowed the food base. Implication of this deterioration in food base is wide ranging and needs revival. In this context, wild edibles, which have historically remained a part of dietary system in traditional societies in the mountains region deserve attention. Among others, wild edibles across the world are one of the viable options of sustainable livelihood and nutritional security. Besides having high nutritional potential, wild edible plants are innately resistant and adaptive to environmental changes such as climatic regimes and other perturbances in comparison to introduced or exotic crop species. The presentation thus highlights the potential of Himalayan wild ediblesin terms of diversity, nutritional status, health benefits, and their role in ecology and economy. Presence of large number of wild edibles in small geographic regions of the Himalaya and the dependency of the people on these resources suggested their potential in addressing nutritional and food security. Moreover, their nutritional potential along with medicinal and therapeutic value can meet the sustainable development goals of zero hunger. This review also attempts to highlight the gaps in the wild edibles research.

Keywords: wild edibles, Himalaya, food security, nutrition; Sustainable Development Goal

#### Food Diversity: An Important Strategy for Achieving Food Security and Sustainability

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Food is a fundamental human right. Current estimates show that nearly 690 million people suffer from hunger i.e., 8.9 percent of the world population. As per the recent trends, the number of people affected by hunger would surpass 840 million by 2030. According to the World FoodProgramme, about 135 million people suffer from acute hunger mainly due to man-made conflicts, climate change, and economic downturns. The COVID-19 pandemic could now double that number, putting an additional 130 million people at risk of suffering from acute hunger. With more than a quarter of a billion people potentially at the brink of starvation, swiftaction needs to be taken to provide food and humanitarian relief to the most at-risk regions. At he same time, a profound change of the global food and agriculture system is needed if we areto nourish more than 690 million people who are hungry today and the additional 2 billion people the world will have by 2050. Increasing agricultural productivity and sustainable food production is crucial to help alleviate the perils of hunger. Food security would only be possible with the adaptation strategies and policy responses to global change, including options for handling water allocation, land use patterns, food trade, post-harvest food processing, and food prices and safety. Intensive industrial agriculture does not appear to be sustainable and does not contribute to a healthy human diet. Reduced consumption of livestock products and increased use of plant products are important to reduce food carbon footprints and promote healthy eating. Hence, food diversity is a key factor for the achievement of food security and improved nutrition. All food systems depend on biodiversity and a broad range of ecosystem services that support agricultural productivity, soil fertility, and water quality and supply. Low-input and ecosystem-based approaches to agriculture are particularly adapted to support the conservation and sustainable use of biodiversity. Genetic diversity in agriculture is one key element of food security. It helps to ensure the evolution of species that can adapt to changing environmental conditions, as well as resistance to diseases, pests and parasites. This diversity has been managed or influenced by farmers, livestock keepers and pastoralists, forestdwellers and fisherfolk for hundreds of generations and reflects the diversity of both human activities and natural processes. It can also reduce farmers' vulnerability to climate change. Further, it can provide a diversity of foods with a variety of nutritional benefits.

Keywords: Food diversity, food security and sustainability

#### Food Diversity and Food Security: Need of the Hour

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Diversifying our food basket helps in improving the nutritional quality and quantity of crops. Our current food practices mainly focused on consumption of only few crops due to different agricultural policies that showed biasedness towards a limited amount of high yielding crops (HYCs). Although, it has helped in attaining food security in our country, yet there is limitation of nutritional security and almost one third of Indian populations suffering from malnutrition because these HYCs are not nutrient-rich/dense. In this context Government of India has identified various high yielding crop varieties that are adding to the food basket to tackle the problem of malnutrition. The Sustainable Development 2030 Agenda having 17 Sustainable Development Goals (SDGs), that have a second goal a Zero Hunger will help in ending hunger and poverty that lead from climate change and sustaining agriculture and food by 2030. For achieving Zero Hunger by the year 2030, the world is not on the way to achieve this and if thistrend continues, the number of individuals affected from hunger would reach up to 840 million by 2030. Therefore, there is a need of diversification of global agricultural and food system tonourish hunger people. Moreover, increasing nutritional quality of food crops will help in alleviating the effect of hunger and sustainability of nutrition. These crops should have high nutrient like iron, zinc, calcium, high dietary fibre content, vitamins, and minerals as well as climate resilient, adapted to changing environment and are economically viable. To remove hunger nutritional diversification of different crops in food system is a need of hour. Further, there is a need to develop and screen the trait-specific germplam with the crop as well and hereis what we need is Plant Genetic Resources (PGR).

*Keywords:* Diversification, Food quality, Food security, Sustainable Development Goals, Plant Genetic Resources (PGR)

#### Phytosterols as Nutraceuticals in Cardiovascular Ageing

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Nutraceuticals are non-nutritive plant chemicals, bioactive constituents that sustain or promotehealth and occurs at the junction of food and pharmaceutical industries. They have either defensive or disease protective properties. They are nonessential nutrients and mainly produced by plants to provide them protection. Phytosterol is one such example of a phytochemical of nutraceutical importance. Phytosterols and phytostanols are a large group of compounds that are found exclusively in plants. Phytosterols are natural components of human diets, largely derived from vegetable oils, cereals, fruits and vegetables. Phytostanols are much less abundantin nature than phytosterols and common dietary sources of phytostanols are corn, wheat, rye, and rice. They are structurally and functionally related to cholesterol but differ from cholesterolin the structure of the side chain. Phytosterols lower total and low-density lipoprotein (LDL) blood cholesterol by preventing cholesterol absorption from the intestine, so they have been known as blood cholesterol-lowering agents. Phytosterols are naturally found in fruits, vegetables, nuts and mainly oils. Dietary phytosterol intakes normally range from 160-400 mg/day with variations depending on food culture and major food sources. Studies have shownthat maximum cholesterol lowering benefits are achieved at doses of 2-3g per day. The prospect of lowering cholesterol levels by consuming functional foods fortified with natural phytonutrients would seem more attractive to many than use of drugs or dietary restrictions. Dairy foods remain a food of choice for use as delivery vehicle for many functional ingredients including phytosterols and there are many dairy products available in the global markets which are enriched with phytosterols. The use of phytosterols in commonly consumed dairy productsmay soon provide an effective tool against cardiovascular diseases (CVD) and its introduction our food products is worth anticipating soon as nutraceuticals for healthy ageing.

Keywords: phytosterol, nutraceuticals, phytochemical, cholesterol, cardiovascular diseases

#### Comparison Of Extraction Efficiency of Different Gelatin Extraction Methods from Pink Perch Skin and Bones

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Globally fish processing industry produce more than 100mMT of by-products in the form of head & viscera, skin, bones, roe, fins, scale etc. The objective of this study was to evaluate thepotential of pink Perch skin and bones produced from surimi industry as a raw material for gelatin production and further compare extraction efficiency of different gelatin extraction methods. Skin and bones were profiled for its proximate composition, mineral composition, and microbiological growth. Further gelatin extraction was conducted using two green extraction methods (i) two-step extraction with NaCl pre-treatment (ii) single-step extraction with aceticacid and water. The gelatin extracts were analyzed based on yield and L-hydroxyprolinecontent. Extracted gelatin was also characterized for its physical and chemical properties. Theproximate analysis suggested skin and bones are rich in protein and contains very low amount of fat. Microbiological analysis depicted absence of pathogenic bacteria in skin and bones. Mineral profiling of skin and bones indicated presence of calcium in highest concentration followed by phosphorus. Results from EDX also suggested absence of any heavy metals. Regarding yield and L-hydroxyproline content acetic acid treatment was more effective methodof gelatin extraction than NaCl pretreatment method. Gelatin extracted using acetic acid had higher protein content (79.56%) than gelatin extracted using NaCl pretreatment (48.10%). SDS-PAGE analysis of gelatin revealed higher degradation of protein components in salt pre-treatment extraction method than the acid extraction. Results suggested skin and bonesobtained from Pink Perch can be successfully utilized for gelatin extraction.

Keywords: Gelatin, Fish by-products, Skin and bones, SDS-PAGE, Waste valorization, SEM-EDX

### Processing and Functional Properties of Edible Insects: Risk and Benefits Associate with its Consumption

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Gradually, the world has become more technologically advanced, and industrialization has been practiced everywhere. However, along with this, the world's population is steadily increasing, and environmental pollution is also increasing. Due to increasing population and pollution, a global challenge of food insecurity is emerging, Therefore, nutritious food sources are needed, and edible insects are in the limelight. Insects as food have the rich composition of proteins, vitamins, and amino acids. These plays very important role in human life. They exhibit variousfunctional and chemical properties after applying numerous processing techniques. In this review, we will discuss the farming techniques of edible insects and various functional properties of edible insects, and processing techniques that cause a change in functional properties. Generally, insect shows solubility, emulsifying, gelling, foaming, water holding, and oil absorption properties. Edible insects are nutritious, but some people are reluctant to eatinsects because of their disgust, so we will introduce various processing techniques to eliminatethem. It also discusses the environmental impacts of eating edible insects and their benefits tohumans, as well as related risk factors.

Keywords: farming; functional properties; food safety; environmental effect; benefit

#### Nutri-Cereals Incorporated Probiotic Dairy Spread: Development and Characterization

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Changing lifestyle and growing consciousness regarding health and proper diet increasing thedemand for convenience and functional foods. Among the functional foods, probiotics are receiving more commercial interest and upsurge in research due to its highly effective, multiplehealth benefits. Nutricereals, apart from ensuring nutritional security and sustainability, they also found to exhibit prebiotic potential and provide excellent nutritional complementation with dairy foods. This study was aimed for the development of nutri-cereals incorporated probiotic composite dairy spread. Finger millet malt and sorghum malt (SM) were studied for its prebiotic potential, and it was found that incorporation of sorghum malt significantly (p<0.5) increased the viable probiotic L. plantarum count (11.22 log10) CFU/ml) in the milk – millet composite medium compared to finger millet malt (10.15 log10 CFU/ml) and control sample (9.18 log10 CFU/ml). In the study, it was also observed that, mixed strain culture (L. plantarumand L. casei) showed significantly higher viable probiotic count (11.44 log10 CFU/ml) compared to individual strains (L. plantarum - 10.15 log10 CFU/ml, L. casei - 9.23 log10 CFU/ml) indicating symbiosis between the strains. The composite probiotic curd (PC) was prepared by admixture of sorghum malt (SM), milk protein concentrate (MPC) and skimmed milk powder and inoculated with mixed strain culture containing probiotic L. plantarum and L. casei (1:1) and used as an ingredient in preparation of dairy spread. The levels of otheringredients viz. Butter, MPC, SM, PC and stabilizer were optimized using I-optimal mixturedesign technique (Design expert® software version 10.0.4.1). The ingredients were mixed, heat processed to 85°C for 2 min and homogenized using high shear mixer. The probiotic curd wasadded during homogenization. The developed product recorded viable probiotic L. plantarumand L. casei count of 10.36 Log10 CFU/g, 29% protein and 42% fat on dry matter basis.

Keywords: probiotic dairy spread, Sorghum, finger millet, L. plantarum, L.casei

#### Food Fermentation: An Approach to Enrich Water Soluble Vitamins' Content

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Nutrients especially water-soluble vitamins are vital for health and the requirements can be only met by oral or intramuscular route. Diet plays an essential role in fulfilling daily vitamin dose; however, lack of awareness, poor bioavailability, and indigestibility leads to deficiency of water-soluble vitamins. Furthermore, due to diverse dietary habits, and advancement in foodtechnology approaches, consumers are exploring a wide range of options to fulfil their nutritional needs. The microbial production of vitamins provides a naturally and economically interesting approach to improve the vitamin content of fermented foods. The benefit of fermented foods for consumer is not only limited to water soluble vitamins but also a good source of antioxidants, and improved antimicrobial, probiotic, and organoleptic qualities. It enhances the nutritional quality, bioavailability of nutrients, and involves various physical andbiochemical changes based on food substrate used and fermenting microorganism. Moreover, food treatment and the length of fermentation during processing also affect food fermentation. For all the fermented foods and beverages that have been identified, lactic acid bacteria (L.A.B.) is the dominant microbiota, which has been considered the most critical part contributing to beneficial effects in fermented foods/beverages. In this review, will briefly discuss the role of microbial fermentation on production of water-soluble vitamin on different substrate and the impact of various environmental factors on the stability of soluble vitamin.

*Keywords:* bioavailability, bacterial fermentation, food substrate, nutritional quality, lactic acid bacteria.

#### Tackling Hidden Hunger: A Call of Holistic Approach

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It is estimated that more than two billion people suffer from 'hidden hunger' (micronutrient malnutrition) globally, with nearly half living in India. Hidden hunger is a kind of undernutrition where the food intake doesn't provide enough vitamins & minerals affecting the normal growth & development of an individual. Micronutrient deficiencies have a huge impact on health especially of vulnerable group especially children &women. Factors like wrong dietary habits, increased nutrient requirements, poor absorption, diseased conditions like infections & parasitic infestation are some of the contributory factors with poor dietary intake being most common of all. This may be the result of wrong selection of foods & poor lifestyle. In most cases the symptoms remain unnoticed. More than 2 billionpeople are suffering from micronutrient deficiency all over the world out of which 15.3% is the Indian population in the year 2018-20. Despite of the fact that these nutrients are required in minute quantities to carry out various biochemical processes still they show adverse impacton the health of an individual. Therefore, there is an urgent requirement to devise certain foodprocessing methods to combat the problem of hidden hunger. This review will focus on various powerful interventions like food fortification, biofortification, supplementation, dietary diversification & biotechnology and their application in prevention and combating hidden hunger. The scaling of food and nutrition system approaches that combine sustainable agriculture aimed at improved diet diversity and livelihoods have been limited in their development and implementation. However, an integrated system approach to reduce hidden hunger could potentially serve as a sustainable opportunity.

Keywords: hidden hunger, food processing, food and nutrition systems, food-based strategies

#### Technological And Socioeconomic Aspects of Lab Grown Meat

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Lab grown meat, also known as cultured meat or in-vitro meat is a healthier alternative to conventional meat. Lab grown or cultured meat is part of the growing area of cellularagriculture and its a possibly way to produce meat that was previously only available from animals. This scientific innovation aims to reduce the harmful effects of current meat production and consumption on humans, cattle, and the environment. Adult muscle stem cells from a live animal, cultured in skeletal muscle strips in the laboratory must be added to a collagen matrix (obtained either from living or dead animals) to create lab generated meat. A circulatory system is also necessary for the delivery of oxygen and nutrients, as well as the removal of metabolic waste. But so far, no significant large-scale production is obtained by anyresearch team. One more barrier of the lab meat is the conventional shape or meat muscles. Toprevents animal components carrying agents for communicable illnesses, cultured meat requires acceptable cells and proper growth medium, ideally non-animal in origin, as well as edible ingredients for the matrices for cell development to generate thicker and continuous pieces of meat such as steaks. Lab grown beef might also be a fantastic functional meal for persons suffering from a variety of diseases. This is owing to the technology's capacity to change the composition of vital ammino acids and lipids, as well as and vitamins, minerals, and bioactive chemicals. However, there are several unsolved concerns particularly in ethical and socioeconomic aspects.

Keywords: Lab-grown meat, in-vitro cell-culture, ethics, animal welfare

#### Dietary Polyphenols As "Culinary Medicine" Against Alzheimer's Disease

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Alzheimer's disease (AD), the most common cause of dementia worldwide, pose significant socioeconomical burdens. AD is type of age-related neurodegenerative disorder which is characterized by extracellular amyloid beta deposition and intracellular tau hyperphosphorylation in cortex and hippocampus region of brain. These molecular events result in progressive loss of neurons which ultimately leads to the cognitive impairment. Theavailable treatment therapeutics like memantine, donepezil only delay the process of disease progression. Hence, an immediate and urgent focus is required to shift on other approaches to treat this disease. Recently, dietary polyphenols is reported to slowdown the progression of the disease by interfering with the beta amyloid cascade. Polyphenols are a group of phytochemicals that are abundantly present in natural foods like berry, grapes, fruits, vegetables and shows promising results against Alzheimer's disease pathologies. Many studieshave been carried out to unravel the exact molecular mechanisms and the specific targets of polyphenols in Alzheimer's disease and extrapolate dietary polyphenols as "culinary medicine" against Alzheimer's disease and related disorders.

Keywords: Alzheimer's disease, culinary medicine, dietary polyphenols

## Extraction And Characterization of Flaxseed Mucilage and Its Application in Preparation of Muffins

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In this study, mucilage is extracted from Indian flax seeds (Linum usitatissimum L.) by using hot water in a 1: 10 (w/v) ratio. The effects of different drying methods (oven drying, vacuumdrying, spray drying, and drying with ethanol precipitated) on functional properties of flaxseedmucilage were evaluated. The chemical composition, yield percentage, physicochemical properties, functional properties, gel strength of mucilage were studied and compared with those of untreated samples. This study shows that the various drying method has significant effects on the properties of dry mucilage. It is found that spray-dried mucilage powder shows a better yield as compared to the mucilage powder obtained by other drying methods. The Flaxseed mucilage can be used in place of eggs for vegan and eggless baking. It is found that, flaxseed mucilage shows similar properties as an egg whisk, so flaxseed mucilage is utilized asan egg replacer in baking industry. It can act as a good egg replacer for vegan/ vegetarian people and mucilage is used in preparation of muffins.

Keywords: extraction, flaxseed mucilage, muffins

#### Review On Parabens Uses in Food Products and Their Alternatives for Prevention of Associated Adverse Effects

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Preservatives are chemical compounds which are added to food products to prevent spoilage caused by microorganism like bacteria, molds, fungus, and yeast. Preservatives keep food fresher for longer duration and used to prevent changes in color, flavour, texture and extend shelf life of food. Some categories of Chemical food preservatives are benzoates, nitrites, sulphones, sorbates, and parabens. Parabens have been widely used as preservatives in cosmetics, food products (bear, sauce, frozen food products etc.), and pharmaceutical industries. The present study focuses on numerous uses of parabens in food products, their detection techniques, and uses of alternatives for prevention of associated adverse effects. Parabens alsooccur naturally at low level in certain food. Research shows that parabens can disrupt hormones in the body and harm fertility and reproductive organs, therefore effects birth outcomes and increase the risk of cancer. Techniques like photocatalysis, adsorbent techniques are used for removal of parabens and high-performance liquid chromatography (HPLC) is used to determine the concentration of parabens before and after removal. Methylparaben acts by interfering with cellular processes as well as by inhibition of the synthesis of DNA, RNA, and enzymes in bacterial cells. Other preservatives like Sodium benzoate combination with potassium sorbate, is an acceptable alternative to avoid parabens and other natural alternative like grapefruit seed extract, honey, jojoba, vitamin A, C and E can be used which helps in prevention from bacterial growth.

Keywords: parabens, photocatalysis, HPLC, Adsorbent technique, Natural alternatives

#### Women At the Forefront of Food Security. How Gender Equality and Women Empowerment Can Serve as An Efficient Tool Against Hunger?

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Women continue to be the largest disenfranchised group on earth, they are responsible for halfof the world's food production, and in most developing countries they produce between 60 to 80 per cent of the food. If women had the same access to resources as men, there would be up to 150 million fewer hungry people in the world. Yet relative to men they lack access to adequate resources i.e.: land, energy, technology, credit, pesticides, and fertilizers, they additionally have reduced access to training information, social protection, and public service markets due to a myriad of cultural, traditional and sociological factors. The major caveats that exist currently in ensuring equity have land rights and credit as their center. Archaic land reforms and the further disintegration of their distinguished communal holding have led to the concentration of power and the exclusive rights to the males of the household. The current pandemic has undoubtedly exacerbated food insecurity with the ICDS, Mid-day meal, PDS systems not being able to reach the vulnerable sections. Further, the loss of jobs, domestic inflation, Increase in International commodity prices, inefficient government policies have highlighted the inadequacy of the system placing increased importance on integrating gender-inclusive reforms. It is through furnishing women with ever so important tools like education, credit, anti-discriminatory measures, and adequate technological aid that we can ensure that they progress as independent farmers and economic agents on their own merit. This paper includes a brief analysis of the relationship between food security and gender equality derived through studies and data collected from national thinks tanks and central statistical organizations, factors affecting this inequality gap i.e., gender roles and division of labor, equitable allocation of resources and suggestive gender-transformative strategies for implementing existing food and nutrition policies and programs in India.

Keywords: food insecurity, gender inequality, land rights, gender transformative strategies

#### **Chocolate – A Functional Food**

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The Latin name for chocolate, Theobroma Cacao means "Food of the Gods" for a reason., chocolate affects our brain by causing the release of the "happiness neurotransmitters" serotonin, dopamine, and endorphins. Cocoa can be termed as a functional food due to its highcontent of monomeric and oligomeric flavanols. Evidence supports that dietary intake of flavonoids and the specific flavanols from cocoa consumption may have many diverse health benefits, including effects on endothelial function, blood pressure, ,blood lipids, insulin sensitivity, cognitive function, inflammation, and oxidative stress. Some other studies have suggested chocolate could lower cholesterol levels as the polyphenols in cacao increase HDLcholesterol, which in turns leads to decreased oxidized LDL cholesterol. Cocoa and its derivatives are sources of epicatechin, polyphenols, anthocyanins, and volatile compounds which are responsible for the astringent and bitterness in cocoa beans. Dark chocolate improves he lipoprotein profile and platelets profile in humans and thus has a protective effect on the cardiovascular system. Research suggests that chocolate is prebiotic, microflora in the colon work to break down high molecular weight polyphenols, so that the smaller secondary metabolites may circulate throughout the body. Gut bacteria by feeding on larger cocoa polyphenols can change the intestinal microbiome composition. In a study, beneficial prebiotic effect of high flavanol chocolate consumption was discovered after 4 weeks in take of a high flavanol cocoa powder, subjects had a significant increase in bifidobacterial and lactobacilli populations, decrease in clostridia levels. Cocoa polyphenols abundant food is correlated to a reduced risk of several noncommunicable diseases, including obesity, diabetes, and neurodegenerative diseases. Since many years, chocolate has been treated as delicious, sweet and nothing more. Now, a relatively new field of research dedicated to exploring the health benefits of chocolate shows that this traditional sweet may hold many keys to solving health problems.

Keywords: cocoa, flavanols, prebiotic, health benefits, functional food

#### Dietary Diversity and Its Role in Food Security in the Country

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India has one of the most diverse cuisines to offer in the world. The culinary diversity of this country is one of its greatest assets. Researchers at the Indian Institute of Technology studied over 2,500 Indian dishes comprising almost 200 distinct components in 2015 to discover whatmakes our cuisine so rich and distinct. Despite its vast food diversity, India is one of the countries with a major hunger problem, along with severe malnutrition and starvation in vulnerable communities. According to a report of FAO, published in 2021, around 200 millionpeople in the country are undernourished. Households find it hard to provide for their family both quantity and quality wise. Being the world's largest food producer of milk, wheat, rice, and several varieties of pulses, it does not have to secure food piles but needs a more organized and strategic distribution of it among the population. Dietary diversity should be a factor that aids food security in the country and helps households in different geographical and social regions thrive. Because of such a wide spread of communities in different regions and part of the state, food security is hard to provide. Factors such as poverty, difference in social, political, and geographic backgrounds pose a huge difficulty in providing food security. The constraint is not food supply but it's availability and knowledge of what is best and nutritious. The presentregulations and policies in place that aim at food security needs to be implemented effectively by the government. Raising awareness with relation to the provincial dietary habits will aid the households in providing enough nutritional value to their family's access to enough food for anactive, healthy life within the cost limit that is affordable. A thorough examination and analyticstudy into the area of food security is necessary. An increase in dietary diversity has shown anincrease in the socioeconomic status of the households and in turn increasing food security in he community.

Keywords: food security, dietary diversity, malnutrition, food availability

#### **Mushroom As a Dietary Source of Vitamin D**

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When regularly eaten, mushroom species are exposed to UV radiation, such as sunshine or a UV lamp, they can produce nutritionally significant levels of vitamin D. In mushrooms, the most prevalent form of vitamin D is D2, with minor levels of vitamins D3 and D4, whereas inanimal diets, vitamin D3 is the most common form. Although vitamin D2 levels in UV-exposed mushrooms may decrease with storage and cooking, if consumed before the 'best-before' date, vitamin D2 levels are likely to remain above 10 micrograms/100 g fresh weight, which is higher than the level in most vitamin D-containing foods and like the international daily vitaminD requirement. Mushroom consumption has risen dramatically over the world in recent years. Mushrooms have the potential to be the only non-animal, unfortified food source of vitamin Dthat can provide a substantial amount of vitamin D2 in a single serve. Our motive is to examines the current information on the role of UV radiation in enhancing the concentration of vitamin D2 in mushrooms, the effects of storage and cooking on vitamin D2 content, and the bioavailability of vitamin D2 from mushrooms. Vitamin D increases calcium absorption by stimulating the creation of calcium, transport proteins in the small intestine. Vitamin D deficiency is also critical for muscular function and may help protect against some malignancies, children's respiratory disease, cardiovascular disease, neurological diseases, andtype 1 and type 2 diabetes. Although vitamin D is classed as a vitamin, when the skin is exposed to ultraviolet (UV) radiation from the sun, it can be generated in sufficient amounts by the body. If sunshine is scarce, dietary sources of vitamin D are needed to keep the circulating 25-hydroxy vitamin D concentration at a healthy level. Around 1 billion individuals worldwide are estimated to be vitamin D deficient.

Keywords: mushroom, vitamin D, calcium absorption, bioavailability

# <u>TS-07</u> <u>Advances in Food</u> <u>Formulations and</u> <u>Packaging</u> <u>– Introducing Sustainable</u> <u>Food Products and</u> <u>Technologies</u>

#### **Computer Vision Applications to Monitor and Calibrate Extrusion-Based 3D Food Printing**

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3D food printing is an emerging technology that can customize food designs and produce personalized foods. Extrusion-based 3D food printing dispenses food filaments onto a platform, and the object is built layer by layer based on a digital design. However, printing food still suffers from low accuracy and high failure rates due to the diversity of food materials in terms of material properties. Computer vision (CV) offers automated and standardized methods to measure object distance, velocity, and temperature (IR thermography). Here, we introduce a few applications of CV to monitor and calibrate 3D food printing to improve printing accuracy and avoid excessive material wastes. Specially, extruded filament geometries are monitored and measured for quality assurance purposes. The collected filament geometry data can also be linked to printing parameters and food rheological properties to develop predictive algorithms and assist printing controls. Furthermore, CV was used to measure the extrusion flow and calibrate extrusion latency per printing material. The extrusion latency calibration can inform printer controls to improve the printing accuracy. With IR thermography, we can also monitor the heat transfer of the printed layers and improve temperature controls during 3D food printing. The CV tools that we developed are based on modular designs and open-source software's, which can be integrated to existing 3D printers. The simplicity and automation offered by CV can improve the adaptivity of 3D food printers to achieve timely and accurate printings of various food materials.

Keywords: 3D food printing, food rheology, adaptive control, predictive analytics

#### Food Packaging: A New Era to Achieve Bigger Goals

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Food packaging is responsible for a multitude of functions, including to contain, protect, preserve, transport, and identify food. Conventional packaging is ideally inert, i.e., does not interact with packaged foods. However, a new era of packaging has emerged to achieve biggergoals and different concepts such as intelligent packaging, active packaging, sustainable packaging, nano-based packaging was developed. Active packaging intentionally interacts with food with the aim of increasing the shelf life of food. There are two main groups of active packaging: absorbers and emitters. Emitters aim to release active compounds at the surface of packaged food or into the headspace of the packaging. Nowadays the tendency is to incorporate in polymers, natural active compounds obtained by plants, essential oils, or food by-products inorder to avoid adverse health effects associated to synthetic additives. Moreover, petrol-basedand/or non-biodegradable polymers are being substituted by eco-friendly food packaging (i.e., biodegradable packaging and/or packaging obtained from renewable resources). In this oral communication, the evolution of food packaging and the advancement of 'active packaging' concept will be addressed. Examples of active packaging developed using plants extracts, essential oils and industrial fruits' by-products will be presented. Factors affecting themigration from these specific materials and their effectiveness in contact with model foods will be addressed. Finally, future tendencies will be explored, such as the development of materials with different functions whose main objective is to simultaneously increase foods shelf-life, tomonitor their quality (intelligent packaging) and to have lower environment impact, using lower number of materials.

Keywords: sustainability, active packaging, edible packaging, natural extracts, antioxidant capacity.

#### Ag Biomass: A Versatile and Sustainable Biomaterial to Develop Biodegradable Plastics and Clean Up the Plastic Mess

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Plastic is everywhere – it's in our hands, in our clothing and in almost every imaginable cornerof our lives. Plastics nonbiodegradability, however, pollutes waterways, oceans, and air, and impacts marine life, wildlife, and the soil ecosystem. Consumption by wildlife leads to chokingand entanglement hazards and potentially to their extinction. Plastic contaminates the food chain too affecting human health. A concerted approach for alternatives to plastic is warranted, and our own agriculture is the source of this solution. Agriculture feeds the world, but a significant portion of crop exists as biomass or the parts that can't be used as food by humans. Ag biomass such as corn stalk, wheat straw and soy stalk offer a sustainable source of cellulose that has excellent potential to replace plastics. Cellulose is a low-density biomaterial with a strong and stiff structure and certainly has the desirable qualities to mimic plastics. Results suggest that strength of cellulose products such packaging films is comparable to plastics. More importantly cellulose-based materials biodegrade within a span of 4 to 5 weeks whereas plastic demands more than 700 years. Thus, cellulose's intrinsic ability to biodegrade aids to create human friendly, environmentally viable and durable lightweight products. Overall, Ag biomass, as a sustainable source of cellulose, serves as benefactor to humans to design and develop biodegradable and functional materials to replace plastics. The use of Ag biomass further offers a unique value-added proposition to the Ag industry and farmers to capitalize on heir byproducts to increase the profitability of their operations. The Earth, and its current and future generations, will indeed benefit immensely with this cost-effective and environmentally feasible solution to curb the ills associated with plastics.

Keywords: plastics, ag biomass, cellulose, biodegradable, packaging films

#### What I wish I knew during my food science studies

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By the time I defended my PhD in June 2020, it occurred to me that I had just spent 25 consecutive years of my life in school. I had never stopped to take a break or gap year like many students. I was always pushing forward to the next step or the next degree. So, when I finally took a breath after defending my PhD, I began to reflect on my education which had finally come to an end. And it was during this time, amid a global pandemic, that I realized how many skills and how much knowledge I had unconsciously picked up over time. Things no teacher ever took the time to teach me such as the best way to study, how to deal with yourmistakes, or adopting the right mindset to succeed. In this special session, we will discuss howto transform yourself from a passive learner to taking a more active role. We will cover practical tips to study smarter like the Pomodoro Method, active recall, and spaced repetition. And lastly, we will discuss how to overcome procrastination, so you stop putting off those difficult tasks. If you would like to become a better learner, or teacher, this special session willsurely pique your interest.

Keywords: learning, studying, student, university, advice, tips

#### Technology For Production of Grape, Guava and Noni Juice Blended Wine

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The present investigation entitled "Technology for production of grape, guava and noni juice blended wine" was undertaken in the Department of Food Microbiology and safety, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) India. In this investigation efforts were made to study the physicochemical properties of raw and clarified juices of grape, guava, and noni fruit respectively. The effect of adding 80 percentgrape juice, 5 to 15 percent guava and noni juice on chemical characteristics blended juice wasalso studied. The changes in chemical properties of blended juice were studied for 15 days fermentation process. Antioxidant activity of raw, clarified, blended juices and prepared winewas studied. Further microbial quality of blended wine was checked. Thus, in the light of the scientific data of the present investigation, it was concluded that blended juice wine containinggrape, guava, and noni juice at the concentration of 80, 10 and 10 per cent respectively was found to be more acceptable with 59.24 percent antioxidant activity.

Keywords: Blended wine, noni, antioxidant activity, grape, clarified, guava.

#### **Development of Chocolate Coated Pumpkin Balls**

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The objective of this study was to standardize the recipe of pumpkin balls, method to coat pumpkin ball with chocolate and conducting its proximate analysis by AOAC method. Functional foods and nutraceuticals provide a better and healthier option. Insight of making functional food we came up with chocolate coated pumpkin balls. Pumpkin flesh is rich in protein, antioxidant vitamins and minerals but are low in fat and calories. Pumball is made from Pumpkin squash (64%), milk powder (8%), white chocolate (14%), pectin (1%), sweetener (13%) and cardamom. To develop this product, varying composition of ingredientswere taken, and the best was selected based on sensory evaluation. Ingredients were cooked tilla desired consistency was achieved and was left to cool down and later formed into balls. These balls were coated with milk chocolate using chocolate mold. Proximate Analysis of pumpkinsquash, pumpkin chocolate and Pumpkin balls was conducted by different techniques using standard AOAC methods such as Kjeldahl to determine protein, Soxhlet method to determine fat, Oven drying method to determine moisture, dry ashing (muffle furnace) to determine ash and carbohydrate. Resultant product contains 3.13% Protein, 21.56% crude fat, 8.496% moisture, 1.906% ash, 64.908% carbohydrate and provides energy of 18.673kcal. Minerals such as Iron and Phosphorus were also analyzed. Iron content in product is 0.0055mg and phosphorus is 0.1458mg per chocolate. This chocolate having vegetable-based filling is a contribution towards the rising popularity of vegetable-based food products and health consciousness among customers.

*Keywords:* Functional food, Pumpkin, chocolate, composition, sensory evaluation, proximate analysis.

#### **Calcium Fortified Bread**

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The objective of the present work was to develop an innovative food product with nutritional properties as well as appealing organoleptic qualities. We thought of bread, Bread could be a suitable vehicle for fortification because it is a common part of diet worldwide. Therefore, we came up with the idea of calcium fortified bread, which is made from cereals, fortified with eggshell to increase the calcium content in the normal bread that we eat which could help us meet our daily calcium requirement. For the preparation of Eggshell powder (ESP), Eggshellswere separated from boiled eggs (white) and the membranes were removed manually from theobtained shells. Four bread samples along with a control sample were produced with variationin amount of eggshell powder. All the samples were then submitted for sensory analysis using a five-point hedonic scale that revealed the panelist's preference of sample D with 0.5% of eggshell powder is successful because it is consumable and palatable. The results obtained revealed that less than 0.5% eggshell powder is appropriate for incorporating it in bread enhancing the potential health benefits associated with its consumption and further studies canbe done by taking less than 0.5% amount of eggshell powder. Moreover, all the storable products were kept at room temperature for analysis of their shelf life.

Keywords: Bread, eggshell, calcium fortification, sensory analysis, shelf life.

#### Protein Extraction from Underutilized De-Oiled Groundnut Cake and Its Characterization

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Protein malnutrition deficiency has become a global problem. Plant based proteins are a sustainable and alternate source for animal-based nutrition. Potential of protein rich edible de-oiled cakes are not fully explored and are used majorly as animal feed. Keeping in mind growing human population, the need for utilization of under-utilized oil seeds was realized foredible protein extraction. As India is an important producer of groundnut, so de-oiled ground nut cake was selected for this study. Protein content of cold pressed de-oiled groundnut cake was 45%. Protein was extracted from cake, by commercially accepted wet milling process, i.e., alkali washing (pH 8.5 by NaOH) and acid precipitation (pH 4.5 by glacial acetic acid). The obtained protein extract was dried by two different drying methods, i.e., freeze drying (FD) and hot air drying (HOD). After drying, the extract was grinded to fine powder and protein content for both FD and HOD ground nut protein extract (PE) was 89.6-90.0%. The obtained PE was also analyzed for its various functional properties. The water absorption capacity (WAC) of FD-PE and HOD-PE was 2.65 and 2.40 g/ml respectively, and oil absorption capacity (OAC) was 1.85 and 1.00 g/ml respectively. The bulk density of the FD-PE and HOD-PE samples were 2.85 and 3.83 g/ml respectively. Overall, it was found, the properties of FD-PE and HOD-PE samples, i.e., swelling capacity, emulsifying activity and emulsion stability (ES), to be quite similar to soy protein isolate. The SDS-PAGE electrophoresis of the FD-PE and HOD-PE samples showed similar protein bands for both samples, indicating no many changes in proteins because of drying operation after extraction. In conclusion, groundnut protein extract was found quite like soy protein isolate and may be used for development protein rich food products and for suitable other applications.

Keyword: Ground nut, oil cake, protein extraction, properties, SDS-PAGE

#### **Freezing Food and Factors Affecting Its Stability**

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One of the best methods to maintain the quality of food is to put it in the freezer. Due to the delayed biochemical and enzyme activity generated by freezing, dangerous and degrading microorganisms cannot survive in frozen food. This research is primarily concerned with determining the drip loss and its effects on the quality attributes of frozen food (Meat). The lamb loin chops were taken as sample and cut into: Cube; Cuboid; Cylindrical. Nine pieces of meat are cut, and three pieces of each shape cut was stored inside the cold storage (2°C) as the control samples. Then, three pieces of every sample cut were then frozen using a standard deepfreezer at -15°C and an air-blast freezer at -35°C (1.4m/s). After the 24 hours, the frozen samples were removed and thawed at 25°C (6 hours) in an incubator. The drip loss inside the samples was determined. In another experiment, the effects of different freezing rates on weightlosses were also examined. The research concludes that the drip loss of the thawed samples was found to be higher than the control samples. However, it was found out that no significant difference was noticed in mean values of drip loss using different freezing temperatures. Furthermore, it was found that slowly frozen meat lost more weight during freezing and thawing than the fast frozen meat. In addition, apart from the freezing situations, the quality of frozen meats also depends upon the post-mortem treatments (pH reduction). Freezing, like anyother method of food preservation, has an impact on the food quality and nutrition. Although, advances in freezing technology can mitigate this effect. Higher-quality frozen foods with longer shelf lives are possible due to new processing techniques and edible coatings. If high- pressure and high-power UAF (Ultrasound assisted freezing) is to be commercialized in the future, it will be easy-to-operate and economically viable in the food industry.

Keywords: thawing, enzymes, degradation, drip loss, shelf life, microbiological safety.

#### **Starch Modification: Methods and Its Application**

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Starch is naturally occurring polysaccharide present in sufficient amount in many food products. It is biodegradable, cost effective and abundantly present in plants. Starch is present in seeds, roots, rhizomes, tubers in form of semi crystalline granule carrying its own unique attributes. Starches are composed of linear chains of amylose and highly branched chains of amylopectin. As starches are fundamentally unsuitable for most purposes, they must be physically and/or chemically changed to improve their favorable features and/or reduce their flaws. Thus, various modifications methods including physical, chemical methods and enzymatic methods even some of the environmentally friendly methods are also used toprevent the environment by harmful impacts of chemical effluents. Due to the lack of chemical gents, starch modification is usually done through physical procedures that are simple and inexpensive. Chemical modification, on the other hand, makes use of the hydroxyl group found in starches to get the required effects for the use of starches in certain applications. These modifications alter the physic-chemical properties of the starches and make it worthy. The modified starches are used as self-healing agents, in drug delivery systems, as biofilms in packaging industries. However still there is basic structure function question that if resolved can open up to new possibilities for its use. This review enlightens different methods of starch modification and application of modified starches.

Keywords: polysaccharide, biodegradable, amylopectin, chemical modification, modified starches
# Optimization and development of muffin from Hibiscus sabdariffa calyx extract using RSM

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Hibiscus sabdariffa commonly known as Roselle are rich in bioactive compounds and are used in various traditional system of medicine. Aqueous extract of H. sabdariffa calyces contain richred pigment due to the presence of anthocyanins, and the color properties have been the subjectof intense scientific investigations. Confectionery products are consumed all over the world invarious forms. However, the quality of the product depends on many factors and acceptance depend upon the level of consumer. Any attempt to formulate unusual ingredients in the product should be characterized by a comprehensive approach to determine the composition and by using statistical tools. For this reason, Response Surface Methodology (RSM) was used. The study aimed at optimizing and development of muffin and to check its acceptability and nutrition of the optimized muffin with its constituent ingredients. Muffin was developed using different formulations in different proportions resulting from Response Surface Methodology (RSM). Using sensory parameters, the determination of optimum formula was carried out involving 30 semi-trained panelists. The result showed a successful optimization with the optimized range of selected variables (components) against categorized responses for the development of muffin using RSM with desirability of 0.84. In this condition, it produces a sensory value of 8.31 for Texture and 8.30 for Overall Acceptability with an acceptable response from the panelists. Nutritive value of the optimized muffin was determined and showed a high nutrition value than that of control muffin. It is concluded that the development of muffin using H. sabdariffa calyx extract showed to have high nutrition value, rich antioxidant, anthocyanin, phenolic content, and ascorbic acid. Hence the result of the present research can be used as a valuable information for developing food product with additional nutritious characteristics that may provide health benefits to people.

*Keywords:* hibiscus sabdariffa, roselle calyx, aqueous extract, roselle muffin, response surface methodology, product development

#### **Biodegradable 3d Pulp Containers/Trays from Banana Peels**

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Banana fruit grows in the tropical countries of the world. Around 114.08 million metric tons of banana waste is produced across the globe. India is the largest producer of banana, an average of 2.7 million metric tons of waste is generated by Tamil Nadu state, which is the largest producer of banana in India. The post-harvest losses accounts to 60% waste leading to excessive emission of greenhouse gases, which is a big environmental issue. According to Environmental Protection Agency (EPA) data the discarded peels are a major contributor to global warming, accounting for 20% of methane emissions. Thus, a novel approach is needed to utilize the horticulture waste into some value-added form to promote sustainability. The present research work aims to utilize this wastage from banana peel into biodegradable packaging material. In the present work the formulation of 3d molded cartons/trays from banana peel was standardized and thus synthesized trays were analyzed for their physical and mechanical properties. The trays were evaluated on various parameters including thickness, Grammage (gsm), Cobb test etc. Biodegradation studies for tray/cartons was conducted. The study was carried out in triplicates and compared with paper pulp trays commercially used in the market trays. These trays/cartons are economical also. From the observations it can be concluded that the trays/cartons synthesize from banana peel waste has a potential to be utilized in the commercial market.

*Keywords:* waste utilization, value added product, renewable, recycled, biodegradable packaging, economical.

#### Development of Carambola Candy by Osmotic Dehydration

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Carambola is a minor fruit crop in India, even though it is one of the largest producers. Most of the trees in the country are decorative. In warm, moist conditions, star fruits flourish in steep places up to 1,200 meters. Carambolas grow largely in the southern states and along the west coast, spanning from Kerala to West Bengal, according to the book "Minor FruitCrops of India." The star fruit season in India lasts all year, but carambolas bloom in Septemberand October, and January and February, respectively. Because of their great perishability and absence of organized market coordination, carambolas are rarely seen in other markets. Another constraint is transportation requirements: the fruits must be precisely packed and keptat a constant temperature to withstand long distances. India's farming efforts are likewise dispersed and decentralized, resulting in inconsistent fruit quality and wide variance among cultivars. Carambola candy is a new flavored candy made from the carambola fruit, which is high in Vitamin C. It's a wonderful candy with a pleasing shape and a pleasant taste. It is madeby an osmotic dehydration method, and it has a shelf life of 6 months if packaged in LDPE pouches. The goal is to improve usage, consumption, and utilization by making the product shelf stable. Carambola candy is a novel product made from the fruit Carambola, which is in highenergy, carbs, vitamin C, has very little fat, and has antioxidant properties. It can be used as a cooler and works as an acidulant. Carambola candy is a new flavor that has recently been launched to the shelves.

Keywords: Carambola, LDPE, Osmotic Dehydration, Antioxidants

# Starch Based Nanomaterials and Delivery Systems for Encapsulation of Bioactive Compounds

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Starch has a wider application in the food and pharmaceutical sector. The emerging applications evolve in the preparation of nanoparticles with better physicochemical andbiological properties. Nanoparticles of starch) allows the formation of fibers and capsules withgood loading efficiency and delivery of compounds. They are utilized as delivery systems for the protection of bioactive compounds like vitamins, polyphenols, and probiotics from harsh environmental, thermal, and gastrointestinal processes. The bioactive compounds are poorly absorbed by the human body and very less amount reaches to colon in biologically active form, because of degradation during its passage from plant matrix to human digestive system. The bioactive compounds are therefore encapsulated in biopolymer matrix and the maximum amount gets released in the intestinal section. The nano sized starch materials are nowadays synthesized and utilized as a carrier for delivery of bioactive compounds. The nano delivery vehicles improve the solubility and cell permeability of bioactive compounds and thereby increases their bioavailability and bioactivity after digestion.

Keywords: Starch; Nano particles; Delivery system; Encapsulation

# Process Standardization, Consumer Acceptability and Nutritional Valuation of Value-Added Bread with Mushroom Powder.

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Pleurotus sajor caju popularly known as oyster mushroom is extremely. perishable one. This ends up affecting the commercial production on large scale. To alleviate the problem, fresh oyster mushrooms were processed to powder which were used to formulate the bread. The different concentrations of 0% (standard); 5%, 10% mushroom powder (MP) were incorporated into the wheat flour. Their value-added products have an organoleptic acceptability for the appearance, color, taste, texture, and flavour. It was observed that the 5% MP bread had a better outcome in terms of texture and acceptability for the consumers as wellas nutrients content. 5% MP bread has protein (10.07%), ash (1.82%), carbohydrate (62.87%)moisture (16.04%) as well as fat (9.20%) as compared to (0 %) MP sample (blank) having Protein (9.46%), Carbohydrate (62.50%), Moisture (17.31%), Fat (9.10%) and Ash (1.63%). Based on acceptability of the consumer and the nutritional composition, the study concluded that out of the three formulated bread samples; 5% MP received the highest acceptability from consumers. When there is more than 10% MP added to the product, it affects value and quality of the baking product and its general acceptability. Mushroom's anti- inflammatory properties were also screened, and the powdered sample has 62.29% inhibition, which showed that the sample also has anti-inflammatory properties.

Keywords: Mushroom powder, Pleurotus sajor caju, anti-inflammatory, nutritive value

# Bioactive Components and Antioxidants Levels in Idli Batter as a Function of Storage Condition

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In numerous dietary products, the bioavailability of bioactive chemicals and antioxidant efficacy have been examined. However, extraction, processing, and storage can cause bioactive compounds to degrade and oxidants to lose their effectiveness. Bioactive components and antioxidant levels in fermented Idli batter were examined for 30 days under different storage conditions. Idli batter was fermented for 12 h at 30°C (3 rice: 1 black gram). The fermented batter was stored at 30°C and 5°C for 30 days. Bioactive compounds and antioxidants were evaluated in Idli batter samples every two days. The folin-ciocalteu and aluminum chloride methods were used to determine the total phenolic content (TPC) and total flavonoid content (TFC) in the samples. The DPPH method was used to determine antioxidant activity. There was a significant difference (p<0.05) in total phenolic and total flavonoid content in batters stored at both 5°C and 30°C. The phenolic and flavonoid compounds were evaluated in the 30°C samples after fermentation till the 30th day and their content increased from 94.22 to 490.55µg/ml and 54.69 to 86.91 µg/ml, respectively. The phenolic and flavonoid compounds increased from 102.55 to 151.99 µg/ml and 51.15 to 79.05 µg/ml respectively in batters kept at 5°C. In the batter samples stored at 30°C, radical scavenging activity increased significantly from 28.02 % after fermentation to 74.62 % on the 30th day. The radical scavenging activity increased from 30.11 to 37.45 % on 8th day of storage, and it was decreased to 26.87 % on 30<sup>th</sup> day. Thus, the concentration of bioactive components and antioxidant activity varied during Idli batter fermentation.

Keywords: Idli, bioactive components, antioxidant, storage studies.

# Utilization of Waste Generated During Cocoa Industries, by Means of Food Tech and its Best Possible Solutions

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The cocoa and chocolate industries have huge problems with the utilization of waste generatedduring the production process. Waste material generated during production include cocoa podhusk, pulp, and cocoa bean shell. Cocoa shell is a by-product that has great potential because of its composition. It consists of dietary fibers, proteins, polyphenols, methylxanthines, etc. However, despite its favorable composition, cocoa shell often cannot be used directly in food production because it may contain components that are harmful for human health. Cocoa shellcan carry mycotoxins, different microorganisms, polycyclic aromatic hydrocarbons, and heavy metals. High voltage electrical discharge presents a novel non-thermal method that has great potential for the decontamination of waste materials and can also be used for extraction of valuable compounds from cocoa shell.

*Keywords:* cocoa shell; HVED; waste material; sustainable production

#### Spent Coffee Grounds as A Viable Source of Plastic Replacing Biodegradable Films

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Plastics are strong, flexible, and inexpensive and are desirable for packaging. However, plasticsare non-biodegradable, and their waste is a global burden and warrants developing alternatives. Towards this end, cellulose fraction from biowaste such as spent coffee grounds (SCGs) standout as a viable option to create biodegradable packaging materials. Herein, cellulosic fraction from SCG was extracted and various amounts (0.6, 0.8, 1.0 and 1.2 g) were solubilized using 68% ZnCl2 and crosslinked with CaCl2 amounts of 0.1, 0.2, 0.3 and 0.4 g to prepare biodegradable films. The films were evaluated for the color, thickness, moisture content, water absorption, transparency, tensile strength, elongation at break, water vapor permeability, biodegradability, and UV transmittance. The results reveal that crosslinking calcium ions is critical as their absence did not yield films. Cellulose content increases the whiteness index and yellowness index and decreases the total color difference. There were no significant changes in films thickness, and the moisture content did not show any specific pattern. The water absorption declines with growing cellulose amount that further boosts with the calcium ions. Films transparency upturns with calcium ions but recedes with cellulose increment. The films biodegrade and lose more than 50% of their weight within 60 days. The elongation at break and water vapor permeability drops with increasing calcium amount. The tensile strength of films is 2 to 12 orders more than the commercial plastic films and escalates with cellulose andcalcium ions. Interestingly, films block 100% of UV radiation. Overall, cellulose fraction from the spent coffee ground shows potential to replace plastic material.

*Keywords:* plastic replacement, spent coffee grounds, cellulose fraction, biodegradable films, UV blocking.

# Rheological Properties, Texture, And In Vitro Digestion of a Plant-Based Fish ball Analogue Based on Soy Protein-Konjac Glucomannan

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A plant-based fish ball analogue was developed based on soy protein and konjac glucomannan (KGM). The impact of KGM on the texture and rheology of this plant-based fish ball (PFB) analogue and the metabolic release after in vitro digestion was investigated. Results showed no significant difference in hardness, chewiness, and elastic moduli between PFB6.5 (6.5% KGM)and fish ball (FB). The rheological properties met with Burger's model. Increasing KGM decreased instantaneous compliance J0, where PFB6.5 had a similar J0 (77.25 × 10-6 Pa-1) toPFB (74.79 × 10-6 Pa-1). PFB6.5 had a matched compact microstructure to SFB, while PFB8.0had excessively dense gel networks. KGM decreased metabolic release by influencing amino acid and carbohydrate metabolic pathways. PFB6.5 digesta exhibited a significantly higher consistency coefficient K (46.25 Pa·Sn), yield stress  $\tau 0$  (28.0 Pa), and viscoelasticity G0\* (749Pa) than PFB3.5. PFB6.5 also had a more continuous microstructure after digestion, demonstrating that KGM decreased protein breakdown. In conclusion, PFB with 6.5% KGM imitated fishball texture and extended digestion, which may help control postprandial blood glucose level and appetite.

Keywords: fishball, soy protein, analogue, texture

#### **Biodegradable Antioxidant Films from Opuntia Ficus-Indica Mucilage**

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Environmental damage due to plastic materials for packaging food systems and several other purposes internationally is a serious matter of concern. The natural biopolymeric materials of plant origin stands out as a feasible and safe solution for biodegradable food protection. The objective of this work was to obtain biopolymeric films with antioxidant properties. For this purpose, cactus mucilage obtained from the Opuntia ficus-indica cladode was combined with Ilex paraguariensis (IP) extract. These ingredients were used to formulate a functional biopolymer with potential application as protective films for packing food. The operating conditions (temperature, pH) were optimized to obtain the mucilage using the ethanol precipitation methodology, using as starting material young cladodes. The cladodes were processed to obtain the mucilage. From dried plant material of IP, a hydroalcoholic extract wasobtained, using a modified microwave-assisted extraction methodology. The film preparation was carried out by mixing for 90 min the IP extract with an 0.7% w/w aqueous solution of mucilage, containing 3% w/w glycerol. The films were obtained from the casting method at 25 °C and storage stability was evaluated for 9 days at 4 and 60°C by monitoring the total phenolic content (TPC) mg /g GA gallic acid equivalent, antiradical activity (ARA) by ABTS radical bleaching. TPC reached 4.8 in the films containing IP extract, although, it was 0.80 mg/g GA without addition any other antioxidant. After 9 days of film storage stability TPC decreased by 40% at 60°C compared to 4°C and no changes in ARA. The antioxidant biopolymeric materialindicate that the proposed methodology is suitable for the preparation of antioxidant films stable at typical cold storage temperatures of foods.

Keywords: Ilex paraguariensis, phenols, antioxidant, antiradical activity

## Evaluation Of the Development of Value-Added Chikki with Quinoa and Ragi

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Chikki, the famous Indian traditional sweet, is usually made from groundnuts and jaggery which is known as Peanut chikki. Peanut chikki is the winter's, special Indian sweet. They are ready to eat Indian brittle square bars filled with the goodness of peanuts enriched with protein, minerals, and vitamins by incorporating jaggery (Gud) enriched in minerals, vitamins and contains a good amount of iron and copper percentage. This study was therefored signed to make some modifications in the chikki and to add some superfood which can provide more nutrients to the people and especially the pre-schooler in the form of ready-to-eat energy bars. The modifications were to develop the CHIKKI WITH QUINOA AND RAGI, which can be more nutritious and can fulfil at least some nutritional requirements of the consumer. Quinoa is a great source of protein, fibre, vitamins, and minerals. Besides this, quinoa is also gluten- free as it can be easily consumed by people having celiac disease. Ragiis a whole grain staple food that is also gluten-free, and it is rich in fibre which aids with weightloss and diabetes. And it's packed with calcium, good carbohydrates, amino acids, and Vitamin D. Incorporating these two superfoods can give a good amount of nutrition to the consumers. The quinoa and ragi incorporated with peanut chikki were evaluated based on proximate analysis tests, nutrition analysis, and sensory evaluation. Microbial analysis was also done to check the presence of harmful microorganisms which can contaminant food andleads to unfit consumption for humans. The tests were done under the guidance of the industry guide and conducted as per the standardization.

Keywords: Chikki, popped, value-added, millets, gluten-free, ragi, sensory evaluation

### **Utilization Of Waste Cooking Oil to Prepare Value Added Products**

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The waste cooking oil production per year is estimated to be around 100-200 million metric tons globally with India's contribution estimated to be at 3 million metric tons per annum. Large scale production of this waste cooking oil has posed serious threats of waste managementand disposal by the food and hospitality industries. The food and hospitality sectors are shiftingtowards sustainable and innovative ways to reduce disposal of waste and produce value addedproducts to protect environment from degradation. This study highlights the possible applications of waste cooking oil apart from biodiesel production. The waste cooking oil can be processed to form toilet soaps; Methyl Ester Sulfonates which are further used in detergentmanufacturing. It can also be processed chemically to obtain biodegradable polyurethane sheets, greases, bio lubricants and alkyd resins. The oil can also be used in energy saving by biodiesel or electricity generation, hydrogen gas production and pyrolytic oil production. Purified and sterilized waste cooking oil can be used as a source of carbon in fermentation process to produce rhamnolipid biosurfactants and polyhydroxy butyrate. Further waste cooking oils are used in the oleochemical industry for development of skincare products, cosmetics, paints, detergents etc. Utilization of waste cooking oil to prepare value added products has a potential not only in creating more jobs and revenue for companies but, also in the protection of environment and waste management.

Keywords: Waste cooking oil, waste management, value added products.

# Effect Of Physical and Chemical Modifications on Protein Isolates from Different Plant Sources

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The use of plant-based protein isolates for food formulations from different plant sources has recently become of great interest due to greater sustainability and lower costs. There is also growing interest in replacing animal proteins with plant proteins in food products because of their better sustainability, lower environmental impact, and improved ethical profile. Proteins are also an essential component of diet performing various functions in the human body. The use of plant protein isolates in foods as functional ingredients is used to improve the nutritional quality of the product or for economic reasons. However, plant protein isolates have limited application due to their poor solubility, complex structure, and sensitivity to stress such as pH, and temperature. The modification of plant proteins by altering their physicochemical properties provides the possibility to improve and diversify their functionality and biological activities as well as address their limitations. Protein modification method should be done carefully from the final application view especially in food products since it can influence theprotein functionality, nutritional value and organoleptic properties. Therefore, it has been found that physical treatments such as conventional heating, gamma radiation, ultraviolet radiation, high-pressure treatment, extrusion technology improves the stability, emulsifying properties, gel-forming characteristics, improved digestibility and eliminated various anti-nutrients from plant protein isolates. Whereas chemical modifications such as glycation increases bioactivity, solubility, and thermal stability of various plant protein isolates. However, heating at higher temperatures can also lead to denaturation of certain proteins. This review highlights the various effects of physical and chemical modifications on various protein isolates from different plant sources.

Keywords: Pea protein isolate, physical modifications, chemical modifications

#### **Traditional And Developed Drying Processes on The Quality of Dried Herbs**

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In recent decades, a considerable number of herb-drying studies have been done, and a variety of herbdrying systems have been introduced. Commercial dried herbs, on the other hand, are of inferior quality than fresh herbs. Because scent compounds are heat-sensitive molecules that can quickly evaporate from plant tissues during drying, high-temperature drying procedures would dramatically reduce the amount of aroma compounds. The content of essential oils in some species of herbs, on the other hand, has been reported to be unaffected by the drying method used. Many studies have focused on the development of alternative drying processes, which could provide advantages over conventional methods, due to the negative impact of highdrying temperatures on the quality of dried materials. Some of these methods are already in usein the industry, such as solar-assisted drying, microwave drying, microwave-vacuum drying, infrared-assisted drying, heat-pump drying, and contact drying. The impact of both traditionaland newly developed drying processes on the quality of dried herbs is discussed in this researchwork.

Keywords: drying process, herbs, essential oils

# **Development Of Edible Coating from Lima Bean Peels**

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Food preservation is one of the important requisites to meet the demand and bring down food wastage. The packaging of food plays an important role in increasing the food products' shelf-life over shortand long-term transportation and storage. The conventional packaging is usually made from petroleum-based derivatives which are unsustainable and pollute the environment as well. The awareness of the consumers regarding the downside of these packaging materials has led to an increased inclination towards more sustainable and environmentally friendly packaging. This has led to a rise in numerous research on edible films and coatings obtained from biopolymers for the past two decades. The field of edible films and coatings have opened up new ideas and innovations on the implementation of underutilized food products that goes to wastage such as seeds, peels, leaves etc. This study utilizes the peels of mature lima bean that usually go as waste for the preparation of edible coatings for fruits. The coated fruits had better values for physiochemical parameters as compared to the uncoated or control fruits.

Keywords: Food preservation, edible, films, coatings, lima bean

# <u>TS-08</u> <u>Valorisation of Food by-</u> products and Food Waste

#### **Fish Waste Management**

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When fish are processed, the amount of waste or by-product generated can range from very low (when only the viscera is removed), to as much as 70% when boneless fillets are produced for the highly developed countries. The major by-products that may be produced are the head, viscera, frame (backbone), skin, scales, and trim. In trying to optimize their use, the amount of each of these fractions for each species of fish processed needs to be determined. Also, whether these fractions can easily be collected separately or do they need to be dealt with together needs to be determined. Ideally each collectable fraction's use can be optimized. Some of the possibilities include for the head: capturing cheek meat and mincing for pet food; viscera: enzyme preparations, chitterlings, stomachs (for Korea) and casings; frames: mince from between the bones (>50% by weight), blood, and bones for calcium; skin: gelatin and fried skin; scales: pearl essence and gelatin (especially desirable for the strictest kosher trade); and trim: mince and restructured fillets. If the different fractions cannot be separated, then productslike silage and fertilizer may be appropriate. The goal being to maximize the value of each product, but as a fall back, composting may also be a viable alternative. To optimize the systems will require a market analysis of the opportunities, and an analysis of the companies' capabilities to deal with products that are very different from normal fish processing. One aspect of the market that may require special attention is the kosher and halal markets which are more highly developed in some of the potential countries where products might be marketed.

Keywords: by-products, skin, scale, viscera, heads, frame

#### Adopting Circular Horticulture to Increase Supply Chain Resilience

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Soilless farming is often touted as being one of the methods to solve agriculture issues around the world. Soilless farms use 15x less water to grow a head of lettuce, compared to their soil- based counterparts. However, as water droughts and erratic weather patterns increase, the needfor indoor farms to improve their resource efficiency is becoming increasingly important. Once the agriculture industry chooses to empower itself with closed-loop systems related to inputs and energy, we are certain that farming operations will reduce their greenhouse gas emissions and dependence on imported agricultural inputs. Actionable steps towards sustainable agriculture practices as a way to deal with the current global environmental crisis can be easilyadopted using distributed, regional sourcing approach. This presentation will discuss multipletypes of waste to value and how using a circular approach can identifies opportunities to reduce operational costs and increase self-sufficiency specific to inputs and water. Feasible strategies to move the needle for closed-loop agriculture will be provided while demonstrating opportunities to expand to long-term strategies. Using insights gained from the launch of GlensFalls Urban Agriculture Pilot, a public-private partnered vertical farm in Glens Fal, NY, Re- Nuble, strategies used to transition indoor farms to a more cost-effective vertical farming modelwill be shared. This model was designed to promote new production systems but contribute toadapting agricultural practices and consumer behavior during the current climate crisis (FAO,2022). Through a production standpoint, the pilot will promote crop diversification, increase revenue streams and work towards a more sustainable future. Re-nuble uses organic cycling science technology to transform unrecoverable vegetative food products into a platform of sustainable technologies for soilless farming.

Keywords: circular horticulture, closed loop agriculture, organic hydroponic nutrients, indentation

#### Valorisation of Food By-Products and Food Waste

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This presentation briefs viable valorization food by-products and food waste in China. Six typical food by-products from livestock products processing, milk processing, wine processing, sugar processing, condiment processing, and grain processing are discussed. About 1.2 milliontons COD of wastewater and 9 million tons of solid waste are generated from livestock productsprocessing. About 0.26 million tons COD of wastewater, 0.85 million tons COD of wastewater, and 2.75 million tons of solid waste are produced from milk processing, condiment processing, and grain processing, respectively. Whereas the wastewater from sugar processing fluctuates, declining from ~1 million t COD of wastewater in 2013 to ~0.7 million t COD of wastewater in 2017 and bouncing back to the previous high level in 2019. The wastes from wine processing demonstrate a declining trend, decreasing from 2.3 million tons COD of wastewater and 0.37 million tons of solid waste in 2013 to 1.4 million tons COD of wastewater and 0.21 million tons of solid waste, respectively in 2021. Combination of anaerobic (anaerobic digester, upflow bio-trickling filter) with aerobic (anoxic) technologies (i.e., contact oxidation lagoon, fenton oxidation lagoon, bardenpho unit) is commonly adopted for wastewater treatment, while versatile valorization methods are adopted for solid byproducts. Food waste production increases over time, reaching 283 million tons in 2021. The food waste is treated to produce crude oil, animal feed, and bio-fertilizer.

*Keywords:* food by-products, food waste, valorization, anaerobic digestion, aerobic oxidation, composting

#### New Approaches for The Valorisation of Agricultural Wastes

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Food processing sustainability, as well as waste minimization, are key concerns for the modernfood industry. Significant amount of waste is generated worldwide each year. In addition to theeconomic losses caused by the removal of these wastes, its impact on the environment is undeniable. The best option is to minimize food waste/by-products since it triggers many globalenvironmental problems, the economy, and society. Different waste management methods areavailable to use food wastes in different industries. Additionally, novel, and green approaches may also be used to valorize food wastes and improve their stability and applicability. In this work, novel methods for waste valorization including their applications for different purposes are covered together with the limitations and future perspectives.

Keywords: waste minimization, by-products, valorization

#### Valorisation Of Agri Food Processing

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Despite having Agri based economy, India loses valuable crops due to huge post-harvest losses. There are several reasons such as small land holding, open field Agri entirely dependenton natural rainwater, in adequate infrastructure for cold storage and transport etc. Being a tropical country, high ambient temperature also leads to these losses. One of the ways to solve this [problem is to encourage MSME food processing of fresh agri produce at locations of cultivation. However, small scale food processing units find it difficult to sustain economically, because smaller capacity means higher cost of production. The approach used in our research group to solve this problem is three-fold. (i) Develop sustainable technologies (ii) Have multipurpose processing unit to have flexibility of processing various raw materials (fruits/ vegetables) and (iii) Have complete utilization of the Agri produce by valorization. Case studies utilizing all parts of fruits and vegetables (e.g., skin, seeds, seed cake after recovering oil). Products such as seed and bran biscuits, edible wax, calcium preparation, proteins, edible filmsas packaging etc are developed to improve economic viability of these processing technologies. How to valorize seed meal of Garden cress (Haleem) and Kalounji (*Nigella sativa* and *Lepidium sativum*) is discussed. Biodegradable films are prepared with silver nano particle incorporation, and it is proposed to use as active packaging for fruits/ vegetables.

Keywords: post-harvest losses, food processing, food waste valorisation

# Ultrasonic-Assisted Green Extraction of Peach Gum Polysaccharide for Blue-Emitting Carbon Dots Synthesis

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Raw peach gum is hard crystalline-like solid with very poor solubility, which greatly restricts its application in various fields. This study optimized the parameters for ultrasonic-assisted peach gum polysaccharides (UPGP) extraction. The results showed that the maximum extraction rate was up to 80.1% under the optimized conditions of 5 h extraction time, 90 mL/gwater to raw peach gum ratio and 532 W ultrasonic intensity at 95°C. The acquired UPGP mainly consisted of Ara, Gal, and Man with a molecular weight of  $8.18 \times 10^6$  g/mol. Moreover, the UPGP was used as a green precursor for carbon dots (CDs) preparation through a simple one-step hydrothermal reaction. The synthesized CDs had the mean particle diameter of 7 nmand showed excellent fluorescence intensity and stability. This study improved the utilization of raw peach gum and further broadened the UPGP application.

Keywords: peach gum polysaccharide; ultrasonication; carbon dots; hydrothermal reaction

#### Valorization Of Ghee Residue for Development of Value-Added Food Products

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Ghee residue (GR), a nutrient dense mass, is obtained as by-product during the manufacture of ghee. The flavoring compounds, viz. FFA and carbonyls are 10 times higher while, carbonylsare 100 times higher in ghee residue than ghee. It is also a good source of phospholipids and proteins with free sulfhydryl groups, contributing to antioxidant activity. However, so far, ithas not been effectively utilized by the food industries. India produced about 170 thousand metric tons of ghee in 2020, accounting to about 17 thousand metric tons ghee residue (Dairy India, 2019). Thus, there is tremendous scope for valorization of this nutrient rich, underutilizedby-product. Ghee residue could be utilized in convenience food products such as energy bars and dairy spread. With this backdrop, present study was conducted to valorize ghee residue by using it as a techno-functional ingredient. The D-optimal mixture design was used for optimizing the level of liquid sugar (15-25%) and ghee residue (30-40%) for energy bar, while level of ghee residue (10-20%), milk solids (25-45%) and stabilizer (0.5-1.5%) for dairy spread, respectively. The samples were evaluated for sensory acceptability and textural parameters. The linear models were significant (p < 0.05) for spread ability, flavour, and firmness; while quadratic models were significant (p<0.05) for body and texture and overall acceptability of chocolate spread. Upon optimization, the desirability of 0.88 and 0.83 were obtained for energybar and chocolate spread, respectively. Optimized energy bar contained 5.49% fat, 20.82% protein, 9.80% moisture, 1.10% phospholipids, 31.1% antioxidants activity, 15.28% crude fiber and 377.70Kcal/100g total calories, respectively. Optimized chocolate spread had 23.49% fat, 6.52% protein, 14.82% sugars and 1.82% ash, respectively. Thus, it is concluded that valorization of ghee residue was successfully achieved by developing protein rich energy bar and chocolate spread, thereby providing an effective solution for maximizing the benefits from this byproduct.

Keywords: ghee residue, valorization, optimized, spread, energy bar

#### Food Processing Wastage and UNSDG

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Food loss and waste occurs at all stages of the food supply chain i.e., during harvesting, production, processing, sales, and consumption at different degrees. Food waste is one of the most common global challenges. Population growth, rapid increase in urbanization along with industrial development, changes in lifestyles and economic status have resulted in the generation of excess amounts of food waste. A report prepared for FAO in 2011, suggested that around one third of the world's food is lost or wasted every year. Also, according to a prediction for the FLI, prepared by FAO, indicates that globally - in terms of economic value- around 14 percent of food produced is lost from post-harvest and it doesn't include the retaillevel. The postharvest loss ranges from 10 to 25 percent for nonperishable, semi perishable and products like milk, meat, fish, and eggs. Further, the estimated losses in fruits andvegetables are higher and reached from 30 to 40 per cent. Food loss and waste are leading to greenhouse gas emissions and cereals and pulses contribute the most i.e., more than 70 percentfollowed by fruits and vegetables. Thereby, to manage food wastage and losses, innovative and sustainable technologies are required as a part of food waste/loss management. Sustainable development goals especially SDG 12.3 focuses on reducing the global food wastage by half at retail and consumer levels. 2 indices have been brought forward for the same namely- FoodWaste Index (FWI) and Food Loss Index (FLI). In this review article we are going to discuss few technologies and methods to reduce and manage food wastage.

*Keywords:* Food loss, greenhouse emissions, sustainable development goals (SDG), Foodwaste/loss management, postharvest loss.

# Antioxidant Bio-Constituents from Agro-Industrial Waste and Their Importance in Functional Foods

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The Food processing industries and post-harvest produces large volumes of wastes that pose severe pollution problems and loss of valuable nutrients. Such wastes might have a potential for conversion into useful products of high value as food or feed after proper treatment. Large amounts of fruit and vegetable processing wastes are produced which may be good sources ofbioactive phytochemicals. Phenols, a major group of antioxidant phytochemicals, have profound importance due to their biological and free radical scavenging activities (FRSA). Freeradicals induce of cellular and tissue pathogenesis leading to several diseases like cancer, inflammation, and aging processes. Antioxidants provide protection from such damage caused by reactive oxygen species (ROS) in lipid peroxidation, protein damage and DNA strand breakage and associated disorders. Therefore, the prime focus of present studies was to manage Agri-waste to develop useful product and combat environment pollution. The wastes like peels, leaves, twigs, flowers, pod pericarp, seed meal and seed coat and residues from kitchen wastewere studied for total phenolic content (TPC) and antioxidant activity (AOA) to explore their potential for use in nutraceuticals or functional foods. The TPC determined as mg/g Gallic acidequivalent (GAE) varied from Arachis hypogea seed coat (146.2 mg/g GAE) to peels of Allium cepa (Red) 64.1 and 57.5mg/g GAE. The AOA in residues was 27.8 to 89.8%. Antioxidants provide protection from damage caused by reactive oxygen species and lipid peroxidation, protein, enzymes, and DNA damage. The results from some Agri-wastes be cost effective source of antioxidant phytochemicals that can be used in functional foods beneficial in health will be presented.

*Keywords:* Agri-horticultural wastes; Antioxidant activity; Total Phenolic contents (TPC); Free Radical Scavenging Activity (FRSA); Functional foods

# Antioxidant Phyto-Constituents from Agri-Horticultural Waste and Their Role to Combat Oxidative Stress and Associated Disorders

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Agri- industry and post-harvest produces large volumes of wastes, both solids and liquid. Thesewastes pose severe pollution problems and represents a loss of valuable biomass and nutrients. In many cases, wastes might have a potential for conversion into useful products of higher value as by-product, or even as raw material in other industries for use as food or feed after biological treatment. Large amounts of fruit and vegetable processing wastes are produced which may be used as an animal feed. Industry continues to make progress in solving waste problem through recovery of by-products and waste materials such as peel, pulp, or molasses by fermentation process. Free radicals are known inducers of cellular and tissue pathogenesis leading to several diseases like cancer, inflammatory disorders, and aging processes. Antioxidants provide protection to living organisms from damage caused by reactive oxygen species in lipid peroxidation, protein damage and DNA strand breakage and associated disorders. Antioxidants provide protection from damage caused by reactive oxygen species and lipid peroxidation, protein, enzymes, and DNA damage. Therefore, the prime objective of present studies was to manage Agri-horticultural waste to develop useful product and prevent pollution. The Agri-wastes like peels, leaves, twigs, flowers, pod pericarp, seed meal and seedcoat were studied for their total phenolic content (TPC) and antioxidant activity (AOA) to explore their potential for use in nutraceuticals or functional foods. The AOA varied from 57 to 95%, TPC 105 to 254 mg/g GAE.

Keywords: Agri-horticultural wastes; Antioxidant activity; Total Phenolic contents

# Production Of Protein Hydrolysates from Surimi Processing By-Products Using Enzymatic Hydrolysis

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In India Pink Perch (Nemipterus japonicus) is used for production of surimi. During surimiprocessing, 35-40% of head, and viscera and 25-30% skin and bones are generated as the by-products which are either discarded or used for production of low value products such as feed. These by-products possess different industrially important value-added biomolecules of nutritional importance. Therefore, valorization of these by-products would aid in an economical and ecologically sustainable utilization. In present study, pink Perch by-products obtained from fish processing industry were analyzed for proximate composition i.e. moisture, protein, fat and ash content for its potential utilization. The Pink Perch head, and viscera and skin and bones contained  $78.2\pm0.7\%$ , and  $73.6\pm1.4\%$  moisturecontent; 2.2±0.4% and 2.2 ±0.3% lipid content; 17.4±1.3% and 23.5±2.5% protein content; 5.6±0.7% and 7.8±1.5% ash content respectively on wet weight basis. As it contains goodamount of protein, it was decided to utilize it for preparation of protein hydrolysates. For this screening of different enzymes (Alcalase, Trypsin, Bromelain and Papain) for enzymatic hydrolysis of pink Perch by-products was done on basis of yield, composition of amino acids and antioxidant activity. The protein hydrolysates from Pink Perch Head and Viscera (PHVPH) and Skin and Bones (PSBPH) obtained after Alcalase hydrolysis had higher yield percentage (26.4±5.5%; 26.1±2.3% respectively) and essential amino acids content (37.0±0.3%; 34.4±0.4% respectively) compared to Bromelain plus Papain, Trypsin and Endogenous enzymes. The Protein Efficiency Ratio (PER) value of all PHVPHand PSBPH indicated that good quality of protein hydrolysates with antioxidant activity was obtained. The present study indicated that head and viscera and skin and bones can be potential source to produce good quality of nutritional peptides which can be used in foodand pharmaceutical industry.

Keywords: Pink Perch, Surimi, Antioxidant activity, Protein efficiency ratio, Protein hydrolysates

#### **Evaluation And Green Synthesis of Bioethanol from Valorisation of Food Waste**

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Environmental concerns and a scarcity of fossil fuels have sparked interest in the use of renewable, economical, and environmentally friendly fuels like ethanol synthesized from the food waste. This research work is mainly concentrating on the efforts of using wastes and its by-products as resource (raw ingredients) for the green synthesis of biofuel called bioethanolto manage food waste and producing valuable biofuel. Household food waste is produced in large quantities and its management can be difficult and furthermore, their disposalcan result in serious environmental problems such as emanation of harmful gasses of greenhouse, etc. the food waste does comprehend considerable amounts of soluble and insoluble sugar substrates and can be used for synthesis of bioethanol as kye raw material. In the currentstudy, food waste was exploited as a raw material intended to produce biologically synthesized ethanol with high dry material consistency. The procedural steps include a discrete liquefaction/saccharification step, which drastically lowered down the viscosity of substate with higher solid content, allowing for better engrossment of microbiome performing fermentation. The phase resulted in a significant increase in bio-ethanol production, up to 38.2 %. After completing fermentation about 45-50 % w/v dry material (which also includes unhydrolyzed portions of the cellulose), the remaining solids (residue) were imperiled to a hydrothermal pre-treatment before being used as raw material for a subsequential production of bioethanol by fermentation technique and this resulted in an 8.1% rise in ethanol production. In conclusion, it has been proved that household food waste may be used to produce bioethanolwith a high dry material content. Both ethanol output and productivity can be increased by using a separate liquefaction/saccharification process. Finally, continued fermentation of the leftover solids may result in an increase in overall bio-ethanol yield.

Keywords: Biofuels, bioethanol, food waste, value-added fuel, green approach.

#### Valorisation Of Food Waste: Sources and Applications

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Every year large amount of uneaten part of food, termed as agro waste, food waste, solid waste, or food by-products are discarded, which are produced from different practices such as agricultural practices, processing, production, and it is an unavoidable phenomenon that continues till the consumption of food products and improper dumping of these wastes creates various environmental issues. These food wastes are a rich source of many natural, bioactive, and functional ingredients which may lead to the production of various valuable products. The availability of different nutrient content in food waste is also used as a potential source in different applications. These food wastes utilize in the production of biofuels, biofertilizers, valuable chemicals, functional food, pharmaceutical, biomedical, and nutraceutical products. These food wastes can also convert into valuable nutrients for microbial processes and be utilized as prebiotics. The ingredient present in food waste is attributed to the packaging and cosmetic industries also. The valorization of food waste in different application not only helpsin decreasing the environmental problems but also offer economic growth as a sustainable alternative source of numerous value-added components. The present review focused on the different source of food waste and utilization of food waste and their valuable components in various applications.

Keywords: food waste, environmental issues, biofertilizers, biomedical, nutraceutical

#### Protein Extraction from Wastes and By-Products of Food Processing

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Wastes and by-products of food processing can be used as raw materials for extraction of proteinrich ingredients. Cereal processing wastes and by-products that can be used for proteinextraction include wheat, buckwheat and rice brans while seed and nut processing wastes and by-products that carry a potential for protein extraction can be listed as press cakes of oilseedssuch as flaxseed, canola and sesame seeds, pumpkin seeds, press cakes of almond, walnut, andhazelnut. In addition, legume wastes such as pea pods, soybean hull, milling byproducts are investigated for their potential to be utilization as raw material for obtaining protein-rich ingredients. Moreover, animal-based processing wastes and by-products including fish processing wastes, meat and dairy industry by-products can be utilized for protein extraction. This study provides insights on the possible applications of innovative extraction technologies for obtaining protein ingredients from wastes and by-products of food industry. Extraction andfractionation techniques used for obtaining protein ingredients from wastes and by-products offood processing are reviewed, and several characteristics of proteins extracted in terms of composition, nutritional and functional properties are presented.

Keywords: protein, waste, by-product, valorization

#### Anthocyanins-Active Component in Smart Packaging

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Smart packaging systems have widely been used in raw and processed food products for quality analysis and quality management ensuring food safety. Active packaging and intelligent packaging technologies are two different forms of smart packaging. Active packaging appliesgas emitters, gas and moisture absorbers, scavengers, chelating agents and so on in/on the packaging for maintaining and extending the shelf life of the food products. Whereas intelligent packaging systems uses different indicators as tool for detecting and communicating the food quality to the consumers. Extensive research has been conducted to find out a sustainable and safe solution for the packaging industries, where a single component can serve he dual purpose. Anthocyanins are one of the active compounds which have been extensively explored for its application in active and intelligent packaging systems. Anthocyanins are plantconstituents which impart the bright and attractive orange, red, purple, and blue colors to mostfruits and vegetables, and flowers. The antioxidant and antimicrobial properties help inimproving the product shelf life, and the pH sensitive pigment is used as quality indictor in packages. This review article focuses on recent studies that deals with the use of anthocyanin for smart food packaging applications, giving a thorough understanding of the benefits of anthocyaninbased natural dyes for shelf-life indicator when applied to package material specific to foods. The potential of anthocyanins opens the path to technological developments for commercialization of the technology for different food commodities.

*Keywords:* Active packaging, anthocyanins, food safety, food quality, intelligent packaging, smart packaging

# Effect Of Ultrasonication on The Recovery of Essential Bioactive Compounds from Tomato Waste Industry

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The tomato processing industry causes high amount of waste mainly skin and seeds that createsthe environmental problem. Tomatoes are industrial processed to obtain juice, ketchup, paste, dried or canned tomatoes and dried tomato powder having industrial growth on global scale. Itis a protein food containing essential amino acids having emerging antioxidants properties These residues are major source of bioactive compounds and valuable pigments. Hence the purpose of this study was to extract the lycopene from tomato industrial pomace using conventional organic solvent extraction (COSE) and ultrasonication assisted extraction (UAE)methods and tomato seed oil from tomato waste seeds. The effect of operating conditions wasdetermined by varying extraction treatment time, solid liquid ratio and power variation in UAE. The maximum yield of lycopene was obtained in UAE (160 volt for ratio 50:1 for 15 minutes) as compared to COSE. Determination of total phenolic content (soluble and insoluble) and DPPH [1,1 diphenly 2 picrylhydrazyl] were also measured in extracted alcoholic lycopene to study its antioxidant properties. FTIR analysis was performed and shown the detection peak oflycopene. Beta carotene was also obtained in the lycopene enriched alcoholic extract and maximum yield was found to be in UAE at 50: 1 for 20 and 30 min at 180 volts. Tomato oil wasisolated from dried tomato seeds obtained from tomato pomace by using Soxhlet extraction method. GC analysis was performed to study fatty acid profile of isolated tomato oil. Oil contain maximum amount of polyunsaturated (54.59 %) fatty acids and high level of omega 6 fatty acids were obtained in oil 54.59 % which is essential fatty acids

Keywords: Lycopene, ultrasonication assisted extraction, total phenol content, DPPH, B- carotene.

# Effect Of Temperature on Nutritional and Functional Properties of Beer Spent Grains and Use in Functional Foods

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Beer is very popular and widely consumed beverages all over the world. The brewing process produces substantial amounts of insoluble residue, known as brewer's spent grain (BSG). The sustainable use of organic waste and by-products generated in food industry has attracted increased environmental concern. Besides, BSG may be raw material to develop functional foods products that can provide higher nutritional and functional value. BSG contains a high moisture (70-80%), which must be dried for storage to avoid rapid microbiological deterioration. The objective of present work was to evaluate effect of drying process on BSG properties. The BSG collected from breweries was dried at room temperature under natural aeration and in ovens at 45, 60, and 100°C. Subsequently, dried BSG was processed in electricgrinder to powder and extracted under assisted by ultrasound using hydroalcoholic solvents. Phenolic contents were measured by the Folin-Ciocalteu reagent, melanoidin, soluble sugars, tannins, and soluble protein were also determined. Antioxidant activities were analyzed using ABTS radical bleaching method and lipid oxidation as TBARS. Results indicate that drying BSG at high temperatures, significantly increases in phenolic contents, antioxidant activity andmelanoidin contents. Parallelly, BSG drying at 100 °C increased oxidative deterioration markers. BSG from lager beer dried at high temperatures leads to material rich in antioxidants and phenolic compounds although increased lipid oxidation with promising potential for use in functional foods. Drying by natural aeration would allow obtaining extracts rich in bioactivecompounds with lower oxidative status, and reduced energy consumption.

Keywords: BSG, ABRS, TBARS, phenols, antioxidant activity, melanoidin

#### Antimicrobial Effect of Essential Oils Extracted from Food Waste

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Antimicrobial resistance becomes a global public health issue due to overuse of antibiotics worldwide hence there is a need to develop an alternative drug to combat the resistance among microbial strains. The objective of this study is to focus on valorization of food waste (citrus peel /leftover coriander part) and recovery of these by-products to obtain natural antimicrobial agents such as essential oils. Essential oils are complex volatile compounds, synthesized naturally in different plant parts during the process of secondary metabolism. Several essentialoils exhibit synergistic effects in combination with antibiotics against various multi drug resistant human pathogens such as Methicillin resistant Staphylococcus aureus (MRSA). MRSA is known to cause severe nosocomial infections such as pneumonia, bacteremia, endocarditis etc. The possible mechanisms of synergy exhibited by essential oil- antibiotic combinations in bacteria include disruption of cell wall structure/ ergosterol biosynthesis pathway, enhanced transdermal penetration of antibiotics, alterations in membrane permeability and intracellular leakage of cellular contents. A few recent studies have demonstrated that not only the combinations of essential oils but also nanoparticles functionalized with essential oils show enhanced antimicrobial activity. Based on the available information, it can be concluded that essential oils in synergistic combination with other essential oils, antibiotics, and nano-formulations can be an alternative to develop drugs with increased efficacy, and low toxicity.

Keywords: Antimicrobial resistance, Essential oils, Food waste, Synergistic effect

#### Proximate Analysis and Phytochemical Screening of Onion Waste (Allium Cepa)

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Allium cepa, commonly called onion which belongs to the family of Alliaceae, is mostly grownin the temperate regions and is the most widely used vegetable around the world. The large quantity of onion waste produced is of great concern. Characterization of the waste is essential for the valorization of the waste. The light scaly leaves, and outer bulbs were collected, washed, dried in an air-circulating tray dryer at 60oC and ground into fine powder using a mechanical grinder. The objective of the study was to determine the proximate composition and phytochemical constituents found in these wastes using laboratory's standard methods. The qualitative phytochemicals screening was determined in ethanol, methanol, and hexane extracts, indicated the presence of anthraquinones, anthocyanins, flavonoids, glycosides, terpenoids, flavonoids, and tannins. The proximate composition of the onion waste powder contains moisture (3.672%), protein (8.56%), carbohydrate (70.47%), fat (0.64%), crude fiber (4.49%),dietary fiber (69.06%), insoluble dietary fiber (63.64%), energy in kcal/100g is 321.88.

Keywords: Agro-wastes, horticultural, quantitative, phytochemical, screening.

# Essential Oil Composition of Some Agri-Horticultural Wastes Their Larvicide and Insecticide Potential

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Plant essential oils (EOs) are natural, complex, volatile aromatic, hydrophobic, oily liquids composed of multiple related composites synthesized in aromatic plants as secondary metabolites. The present investigation is related to the analysis of EOs from agi-hortuculture waste and their role as larvicide and insecticide potential to develop cost effective, eco-friendlynatural insecticide. The prime objective was to utilize domestic waste like fruit peel from citrus, apple, pineapple, and unutilized residues of mint (Mentha arvensis), coriander (Coriandrum sativum), mustard (Brassica juncea) and fallen leaves of neem (Azadirachta indica), tulsi (Ocimum gratissimum) and eucalyptus (Eucalytptus globulus). The EOs from domestic wasteresidues (leaves, stalks, peel) were extracted by hydro-distillation method and composition was determined by GC-MS. The phytochemical constituents from plant wastes were extracted by maceration method and extractive of bio-active constituents was efficiently formulated into natural insecticides. The product effectively repels mosquitoes, house fly, cockroaches and is lethal to their larvae at high concentrations. The product has a pleasant aroma with long lastingeffect as good natural insect repellent, ecofriendly and non-toxic to non-target species. The EOs combination was synergistically more active on target insects. The study showed that EOs have promising potential to be used as natural larvicide and insecticide. They are safe, natural, and eco-friendly and do not affect the non-target species.

Keywords: Essential oils, Agri-horticultural wastes, Larvicide, Insecticide, Botanicalpesticides
# <u>TS-09</u> <u>Food and Function:</u> <u>achieving Bigger Goals</u>

#### **Overview Of Dietary Patterns and Food Components in The Management of Mental Health**

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The recent global events including the emergence of novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its spread through the human population in early 2020 have accelerated attention to the overall mental health. After being declared a pandemic, levels of anxiety, depression and overall stress have increased worldwide. Coupled with uncertainties and irregularities in food production, supply, and consumption as well as increased stress consequently reduced the well-being, work productivity, quality of lifeand management of every-day life population wide. Identifying dietary patterns that may promote reduction of mental health issues is becoming increasingly important due to several factors such as food processing and readily availability of processed food products. Coupled with the recent events (SARS-CoV-2 pandemic), consumption of these food products has increased further adding to the decline in overall mental health. Although processed and ultra-processed foods (UPF) have a role in the food supply chain, their consumption as a regular part of the dietary intake should be limited rather than being main source of nutrients (if any). Nevertheless, their consumption is widespread globally even throughout some of the most traditional dietary patterns. The most prevalent dietary patterns relating to the management ofmental health include Mediterranean diet (traditional) and its modifications (DASH, MIND), Japanese, Nordic, and variety of plant-based diets. This presentation will include the findings from current studies relating to the adherence to dietary patterns (Mediterranean diet), consumption of nutraceuticals and bioactive that are used in the management of mental health. Some of the common nutraceutical approaches include green tea components (theanine), curcuminoids and main anthocyanins found in blueberries.

Keywords: mental health, plant bioactives, nutraceuticals, dietary patterns, Mediterranean diet

#### Development Of Food with High Ability Against Advanced Glycation Products (AGES) Formation

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Advanced glycation end products (AGEs) accumulation in vivo has been implicated as a major pathogenic process in diabetic complications. Extracts of some edible plants can be used as natural inhibitors of AGEs e.g., selected fruits, mung bean, buckwheat hull and seeds, teas, spices, and herbs. Therefore, the aim of our research was to analyze the anti-glycation activity of selected products and study the relation of their anti-AGEs properties with the profile and content of phenolic compounds. The material of red beetroot (raw, fermented, and cooked), cabbage (raw and fermented), and oatbuckwheat cookies with herbs from the Labiatae familywas used in the experiment. Experiments of anti-AGEs properties were carried out in the in vitro model systems of bovine serum albuminglucose/methylglyoxal (BSA-glucose/MGO), whereas the profile of phenolics was analyzed using the LC/MS-MS method. The fermentation of beet and cabbage increased the ability to inhibit AGEs. Fermented cabbage extracts showed a higher level of AGEs inhibition by 17% (BSA-MGO) and 25% (BSA-glucose), while fermented beetroot extracts by 23% and 18%, respectively, compared to raw materials. Cooking of red beetroot reduced its anti-glycation abilities by 13% in the BSA-MGO model and by 16% in BSA-glucose. The dominant bioactive compounds in fermented cabbage are sinapic acid and epicatechin. In contrast, compounds such as syringic acid and epicatechin dominate in fermented beetroot, and isoferulic acid in cooked. Among the cookies, the additionof mint caused a significant increase in the level of AGEs, by 1.35-times (BSA-MGO) and by1.18-times (BSAglucose) compared to control (without herbs). In cookies dominated rosmarinic acid and luteolin. The tested products can be a rich source of bioactive compounds. Moreover, they can be effective inhibitors of the formation of AGEs and probably decrease AGEs accumulation in the human body, thereby be a part in the broadly understood prevention of diet-related diseases.

*Keywords:* AGEs, bakery products, glycation inhibitors, phytochemicals, technological processes, vegetables

#### **Obesity Management Potential of Plant Extracts and their Active Principles**

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Obesity has outreached the dimensions of a health problem and has established as a global epidemic (so-called Globosity) over the past decades. Excessive body weight appears among the top five risk factors in terms of attributable deaths and metabolic complications development [2, 3]. Consequently, management of obesity (*i.e.*, prevention and treatment) is subject of undergoing intense research. In this respect, plant extracts and compounds of natural origin attract profound interestas candidates for obesity management. Ziziphus jujuba Mill. (ZJL) leaf extract is reported as atraditional remedy for diverse pathological conditions, including obesity. The present study investigated whether ZJL affects adipogenic differentiation in human adipocytes. Additionally, apigenin (APG), betulinic acid (BA) and maslinic acid (MA) were selected for biological activity evaluation. The possible interactions between APG, BA, MA, and target proteins with a central role in adipogenesis were assessed through molecular docking. The potential mechanisms of ZJL, APG, BA and MA were identified using transcriptional analysis through real-time quantitative PCR and protein abundance evaluation by Western blotting. The obtained results revealed a concentration-dependent reduction of accumulated lipids after ZJL, BA and MA application. The key adipogenic transcription factors peroxisome proliferator- activated receptor gamma (PPARy) and CCAAT-enhancer-binding protein alpha (C/EBPa) were strongly decreased at a protein level by all treatments. Moreover, the phosphoinositide 3-kinase (PI3K)/protein kinase B (AKT) signaling pathway was found to be involved in the antiadipogenic effect of ZJL, APG and BA. Collectively, our findings indicate that ZJL and its active compounds hampered adipocyte differentiation through PI3K/AKT inhibition. Among the selected compounds, BA exhibits the most promising anti-adipogenic activity. Furthermore, being a complex mixture of phytochemicals, the ZJL extract could be utilized assource of yet unknown bioactive leads with potential implementation in obesity management.

Keywords: Obesity, Plant Extracts, Ziziphus Adipogenic, Phytochemicals

#### Identification And Characterization of Bioactive Peptides from Millets

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From last few decades, food-derived bioactive peptides have been continuously studied for their potential functional role as safer and novel bioactive components. Recently, millet protein has also became an area of interest for the exploration of bioactive protein and peptide ingredients. In the present study bioactive peptides from pearl millet (PM), finger millet (FM) and sorghum millet (SM) were identified and characterized. Millet's protein enzymatically hydrolyzed, and peptides were separated using different purification techniques. Results represent that the antioxidant activity was significantly improved after protein hydrolysis followed by peptide purification. One peptide (SK-15) from PM, two peptides (TR-15 and SR-16) from FM, and seven peptides (VP-8, VK-8a, GK-10, LE-10, VK-8b, TK-10, and HK-7) from SM were identified with potential antioxidant activities using MALDI-TOF-MS/MS. Further in vivo acute oral toxicity and effect of millet-derived low molecular weight peptides (LMWPs) for the management of hypertension was studied. Results showed that, LMWPs from PM and SM exhibited significantly higher angiotensin-converting enzyme inhibitory activity with an IC50 value of 244.68 µg and 372.89 µg, respectively as compared to protein isolates and hydrolysates. Further, within short and long outcomes, no acute oral toxicity was observed upon administration of a single maximum dose of LMWPs from PM and SM. Moreover, oral administration of LMWPs from PM and SM, significantly reduced systolic blood pressure and mean arterial pressure in rats. The present study indicates that millets contain potential LMWPs with antioxidant and antihypertensive activities, hence can be used as nutraceutical and functional ingredient in formulating functional foods for the management of hypertension.

Keywords: pearl millet, sorghum millet, bioactive peptides, antihypertensive, nutraceutical

#### Effects Of Brasenia Schreberi Polysaccharides on Type 2 Diabetes in a Mouse Model: A Gut Microbiota Analysis

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This study aimed to investigate the hypoglycemic activities and gut microbial regulation of polysaccharides from *Brasenia schreberi* (BS) in diabetic mice induced by high-fat diet (HFD)and streptozotocin (STZ). Our data indicated that BS polysaccharides not only improved the symptoms of hyperglycemia and relieved metabolic endotoxemia-related inflammation but also optimized the gut microbiota composition of diabetic mice with significantly decreased Firmicutes/Bacteroidetes ratios. More importantly, altered gut microbiota components may affect liver glycogen and muscle glycogen by increasing the mRNA expression of phosphatidylinositol-3-kinase (PI3K) and protein kinase B (Akt) in the liver of mice through modulated the abundance of beneficial bacteria (*Lactobacillus*). Altogether, our findings, for the first time, demonstrate that BS polysaccharides may be used as a beneficial probiotic agentthat reverses gut microbiota dysbiosis and the hypoglycemic mechanisms of BS polysaccharides may be related to enhancing the abundance of *Lactobacillus* to activate PI3K/Akt-mediated signaling pathways in T2DM mice.

Keywords: type 2 diabetes, microbiota analysis, Brasenia schreberi, polysaccharides

#### **Cell-Based Meat as a Sustainability Metric**

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Animals are produced and slaughtered on a massive scale to supply the meat demand of an everincreasing global population, posing serious environmental, ethical, and health concerns. Meat production by livestock contributes to the risk of zoonotic illnesses, emission of greenhouse gases from enteric fermentation and manure. Consumption of red meat raises ethical concerns and human health issues and pollutes the environment through animal butchering since it is unsanitary and violent. Furthermore, it creates soil erosion by grazing meat-producing animals, the proliferation of weeds, which results in the loss of crops and natural wildlife variety, and loss of genetic diversity through crossbreeding to generate solely high-yielding animals. The spread of superbugs and antibiotic resistance genes, as the drugs are left over from the animal feed is also a big concern. Considering these considerations, cell- based meat is considered as an alternative meat production technique that is highly efficient, sustainable, ecologically friendly, and long-lasting. Cell-based meat is edible muscle tissue created by culturing stem cells in a controlled culture and physiological environment in a laboratory utilizing tissue engineering and computational simulation technologies. Cell-basedmeat is envisioned as a viable replacement to traditional meat due to significant benefits such as animal-free production, up to a 50% decrease in energy use, 75-95% lower greenhouse gas emissions, 99% less land use, 80-95% less water usage, and low carbon impact. Thus, the outnumbered benefits of cell-based meat techniques compared to traditional meat production opened the field of scope for this innovative technique for sustainability. In this paper I wouldlike to shed some light on the techniques, challenges, and prospects of the cell-based meat as a possible alternative for sustainable food systems by solving the research gaps.

Keywords: Environmental, greenhouse gas, crossbreeding, cell-based meat, sustainability

#### Sustainable and Healthy Ingredients for the Development of Functional Foods Obtained from Grape Seeds

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The by-products derived from the Vitis vinifera L processing industry contain different bioactive molecules such as polyphenols, anthocyanins, tannins and flavonoids which can be recovered and reused following circular economy policies. These ingredients can be later integrated into functional foods, nutraceutical supplements and cosmetics, aimed at a broad population niche including the elderly, athletes, and healthy people for disease prevention. In this work, seeds from Vitis vinifera L were evaluated for their minerals and phenolics content to enable the development of healthier and more sustainable foods, supplements, and cosmeticsunder a circular economy concept to meet market demand, while giving added value to underexploited food waste. The analysis of minerals by inductively coupled plasma - optical emission spectrometry (ICP-OES) from seed fibres, after a dehydration process, showed levels of valuable macronutrients such as Ca (7.8 g/kg), K (3.9 g/kg), Mg (1.4 g/kg), P (3.3 g/kg) and micronutrients like Fe (0.1 g/kg) and Mn (0.02 g/kg). The phenolic profile performed by liquid chromatography - mass spectrometry (LC-MS) revealed catechin, dihydroxybenzoic acid, quercetin, salicylic acid, rutin and resveratrol as main phenolics. In addition, this raw materialwas extracted by supercritical fluid extraction (SCFE) at 20 MPa to produce an oily extract richin vanillic acid, hydroxytyrosol and oleacin. Therefore, this work has also addressed the evaluation of by-products from grape processing extracted by environmentally friendly extraction techniques (SCFE) to produce functional, natural, and sustainable extracts.

*Keywords*: Grape seeds, *Vitis vinifera* L, supercritical fluid extraction, phenolics, minerals, functional foods.

#### Hydrogel Beads as Carriers of Bioactive Compounds

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Bioactive compounds (BCs) are effective to combat and prevent detrimental health problems such as diabetes, obesity and cancer. Their incorporation in foods is challenging, however, due to low aqueous solubility, temperature instability and susceptibility to enzymes encountered in the digestive tract, to name a few. Toward this end, carrier systems that could effectively protectBCs and deliver are in high demand, and food-grade polysaccharides such as carrageenan, starch and xanthan are a couple of successful examples. Herein, curcumin and  $\kappa$ -carrageenan (KC) have been chosen as the model BC and carrier system, respectively. Curcumin is a natural polyphenol derived from turmeric, specifically the Curcuma longa. It is a preventative agent for many human diseases due to its anti-oxidative, antiinflammatory, and anti-cancer effects. Like many BCs, curcumin also possesses low systemic bioactivity upon ingestion due to its low tolerance to gastrointestinal conditions. KC is a naturally occurring polysaccharide derived from red seaweed. It is edible and non-toxic. Herein, curcumin has been encapsulated in KC hydrogel beads and release during simulated gastro-intestinal conditions is evaluated. Its release is more prominent in the Simulated Gastric Liquid (SGL) conditions compared to Simulated Intestinal Liquid (SIL) and aqueous conditions with the cumulative release amount of  $2.32 \pm 0.121$  mg/mL in 60 hours. The outcome aids to design and develop innovative dietary supplements, functional foods, and therapeutic foods not only with curcumin but also with several other bioactive compounds.

Keywords: Bioactive compounds, carriers, kappa-carrageenan, hydrogel beads

#### Influence On the Human Body Due to The Relationship Between Phenolic Compounds Intake and the Human Gut Microbiota

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Polyphenol refers to a group of several thousand distinct compounds found in plant foods that provide antioxidant, anti-inflammatory, anticarcinogenic cardioprotective activity and all include at least two phenolic rings in their structure. The biological activity of these compounds depends upon the intestinal absorption and their nonabsorbable nature after ingestion is converted to active form through the presence of gut microbiota. The interrelationship of gut microbiota and polyphenol metabolites plays a crucial role in regulation of host gut balance. The human gut is habitat to a diverse microbial population. The beneficial role of gutmicrobiota is vulnerable to the effects of medication, age, underlying condition genetics and nutritional habits. The bioactivity, bioavailability of phenolic metabolites is affected by gut microbiota, primarily after consumption of food possessing high molecular-weight polyphenols. The biochemical steps involved in several of these bacteria have been explored. The influence of these consumed polyphenols on the human gut flora, however, largely unresolved. Polyphenols have been shown to have prebiotic characteristics as well as antibacterial activity against pathogenic gut microorganisms. Dietary polyphenols have been demonstrated to be beneficial in a variety of illnesses, as well as having a significant impact on he gut microbiota due to its symbiotic relation. Furthermore, due to heterogeneity in gut microbiota makeup, there may be a wide range of responses to polyphenols, make analyzing these interactions challenging. However, more investigation is expected as some factors such as dietary source, variability; cohabitation with other bioactive compounds makes it difficult to understand the relations between dietary polyphenols and gut microorganisms.

Keywords: polyphenols, antioxidant, bioavailability, gut microbiota, absorption, pathogens

#### Effect Of Cooking on Resistant Starch Content of Rice: A Review

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Diabetes is known as the 'Silent Killer' in today's fast-moving world. India is deemed as the world's capital of diabetes, close to hitting the alarming mark of 69.9 M by 2025. Dietary factoris amongst other factors responsible for diabetes as per current research data. The diabetic population is advised to restrict high glycemic foods like sugar and sugary foods, sugary soft drinks, white bread, potatoes, and white rice, leaving the limited options for the affected to consume. Especially rice being a staple food in the Asian population contributes a major portion to hyperglycemia, which is also restricted in diabetes. People consuming 3-4 servings/day of rice are 1.5 times more likely to have diabetes. The current study collected review from various sources viz. Wos, PubMed, Scopus, Medline. The data from studies collected revealed that resistant starch (RS) and slight modifications in the cooking methods and storage conditions of cooked rice may have a significant impact on the glycemic index ofrice opening new avenues for diabetic patients to consume it. The anti-diabetic mode of actionof resistant starch attributes to the lowering of postprandial glucose and insulin response in thebody. Thus, making better alternatives for the various chronic diseases using the properties of such substances will help in making the varied food products like rice flakes, puffed rice, etc. opening the doors for people suffering from diabetes and obesity to consume rice in a variety of ways.

Keywords: diabetes, cereals, rice, glycemic index, food processing, resistant starch

#### **Evaluation Of Nutritional and Anti-Microbial Activity of Chicory Root Extract**

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Chicory is a medicinally important plant that belongs to the family *Asteraceae*. All parts of thisplant are pharmacologically useful due to the presence of several medicinally important compounds. The present study was done to determine the nutrient content of chicory root andto assess the antibacterial properties of chicory root. Chicory root were collected and then powdered and extracted for further analysis. The preliminary analysis of chicory root powder includes moisture, protein, ash, fat, crude fiber, calcium, and zinc content. The results indicatedthat chicory root was found to be higher in moisture (70.20 g/100g), ash (4.18 g/100g), crude fiber (6.10 g/100 g/100g) and calcium (178.75 mg/100g). The extracts of chicory root possessantimicrobial activity against gram positive bacteria like *Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa*. Therefore, it has a potential to be used as antibacterial drugfor the relief of mild digestive disorders such as feeling of flatulence, abdominal fullness, temporally loss of appetite and slow digestion. Further it can used to develop food products which can improve health and prevent different disease and disorders.

Keywords: Nutraceutical; Asteraceae, pharmacology, antimicrobial activity, mild digestive disorders

#### Modified Starch – An Ingredient Possessing Value Added Attributes for Innumerable Applications in Food Industry

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Starch is one of the most important but versatile food elements, with value-added properties for a wide range of industrial uses. More than 50 different plants can be used to extract the starch, which is used to make sauces, puddings, pie fillings, and soups. Frozen food can also be coated with starch to keep them from leaking when defrosted. However, not all starches are the same. The quality granular shape, size, amylose content, and viscosity of these polysaccharides, as well as how they thicken and flavor the end products. Modified starches are intended to compensate for one or more of native starches' flaws, such as loss of viscosity and thickening power during cooking and storage, especially at low pH, retrogradationproperties, syneresis, and so on. Thickening agents, emulsifiers, and stabilizers are all functions found in modified starches. Physical, enzymatic, and chemical processing methods are used tocreate modified starches from native starches. Modified starch, which is phosphate-bonded, can absorb more water and keep ingredients together. The modified starches based on their functional uses can be used as fat replacer/fat mimetic, texture improver, high nutritional claim, high shear and temperature stability, and flavor oil encapsulation. Currently, several forms of commercially modified starch are available in the market with potato, corn, wheat, and tapiocastarches at the top of the list. However, there are several unknown natural starches, such as those derived from fruit processing waste. Furthermore, these fruit by-products are regarded as an underutilized carbohydrate sources. Although there are few published studies on starch extracted from fruits seeds and other waste items, it is expected that more new sources would be investigated in the future in response to specific starch-based product industries anddemands.

*Keywords-* Modified starch, polysaccharides, retrogradation, stabilizers, starch, syneresis, underutilized, viscosity.

#### Banana Peel Cellulose: A Valuable Resource to Develop Biodegradable Plastics

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Plastics are strong, flexible, and cost-effective materials, and thus desirable for packaging and other applications. However, they take over 700 years to decompose and thus environmental and health concerns of plastics disposal are huge. A smaller percentage of plastics is being incinerated but the rest ends up in landfills and oceans exterminating millions of marine animals each year. Furthermore, as plastics are made from fossil fuels, they consume around 1.5 million barrels of oil every year. The detrimental impacts of plastics along with the oil depletion necessitate the design and development of alternative materials. Towards this end, cellulose extract from biowaste such as banana peel standouts as a viable option to develop biodegradable plastics. Herein, cellulose was extracted from banana peels using 5% KOH and 1% NaClO2 solutions. Later, 68% ZnCl2 was used to solubilize the extracted cellulose and CaCl2 to promote interactions among the solubilized cellulose chains toward forming gelling solutions comprised of nanofibrils and preparing films. Results reveal that the addition of calcium chloride improves films transparency significantly. More interestingly, tensile strengthincreases and is much higher than the control polyethylene films. On the other hand, moisture absorption, water solubility, water vapor permeability and elongation at break decrease. The films are biodegradable that depend on the crosslinking calcium ions amount and soil moistureconditions. The outcome suggests that banana peel extract based biodegradable films not onlyaid to solve the plastic problems but also serve as a value-addition to the banana processing industry.

Keywords: plastics, banana peel, cellulose, biodegradability, tensile strength

#### Phenolic Compounds, Fatty Acids and Minerals Composition of Different By-Products from Olea Europea L.

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Nowadays food industry is searching for ingredients from different natural sources with antioxidant, anti-inflammatory, and antiviral properties, among others, that may increase the health benefits of food products. In this work, we evaluate the content in phenolic compounds(PC), fatty acids (FA) and minerals profile of several by-products from the Olea europaea L. processed industry, including olive cake, olive water, olive fiber and olive leaves. Analysis of PC were performed by liquid chromatography-mass spectrometry (LC-MS). The fatty acid (FA) content was obtained by gas chromatography coupled to flame ionization detector (GC- FID). Finally, the analysis of the mineral content was performed by inductively coupled plasma optical emission spectrometry (ICP-OES). Different proportions of each determination were found depending on the by-product, but common characteristics and different ranges could be highlighted. The PC content analysis showed dihydroxybenzoic acid, hydroxytyrosol and oleacein as the main compounds. In terms of FA content, as it may be expected, olive water and olive leaves did not show significant values. However, olive fibers showed a healthy lipidfraction of monounsaturated fatty acids (MUFAs) (71%), composed of oleic acid and a polyunsaturated fatty acids (PUFAs) fraction (11%) of α-linolenic acid. Finally, the mineral profile results showed relevant values of K and Mg in olive cake and fibers (~ 5 g/kg K and  $\sim 0.5$  g/kg Mg). Therefore, the by-products derived from the olive processing industry are secondary but valuable products, from which different bioactive molecules can be recovered and reused, for various purposes following circular economy policies.

Keywords: Olea europaea L, by-products, bioactive compounds profile, LC-MS, GC-FID, ICP-OES.

#### Adsorption and In Vitro Dissolution Study of Quercetin Loaded into Starch Based Expanded Porous Matrix: Kinetic and Isotherm Study

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Quercetin is a natural polyphenol derived from different plant sources such as onions, apples, tea, etc. It has immense health benefits but insolubility in water and low bioavailability limits its widespread applications. This work attempts to use starch-based expanded porous matrix (SBEPM) to improve the solubility and delivery of quercetin. SBEPM was prepared using high temperature short time (HTST) treatment of pre-conditioned and pre-treated whole rice kernels. Quercetin, with excellent antioxidant and antimicrobial properties, was loaded into starch- based expanded porous matrix through pressure-driven fixed-bed vertical column. Different concentration in range of 0.5-2.5 mg/g was selected for loading based on the toxicity studies of previous literatures. The amount of quercetin loaded into the starch based expanded porousmatrix was evaluated using UV-vis spectrophotometer. Its adsorption process in SBEPM was assessed with isotherm and kinetic models. The obtained isotherm data were fitted into Langmuir and Freundlich model and the kinetic experimental data were fitted into pseudo-firstand pseudo-second order. In addition, the in vitro dissolution of quercetin loaded onto SBEPMwas also evaluated. The successful loading of quercetin in the porous matrix was confirmed byimages obtained by field emission scanning electron microscopy. The results suggest that the adsorption behavior of SBEPM with quercetin was best explained using Langmuir (monolayer adsorption) isotherm. The further analysis demonstrated that the adsorption process followed pseudosecond-order kinetics with a linear regression coefficient (R2) of <sup>3</sup>0.99. The dissolutionstudies results indicate the better solubility of quercetin incorporated in SBEPM than unloaded samples. These results warrant further investigation into quercetin loaded SBEPM and their ability to increase the absorption of quercetin in vivo.

Keywords: delivery, starch based expanded porous matrix, dissolution, adsorption

#### Applications Of Brewer's Spent Grains (Bsg) In Food Industry

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Beer is one of the oldest and widely consumed beverages, being third widely consumed beverage after water and tea. Brewer's Spent Grain is termed as food waste which is a by- product of Brewing Industry. It is the leftover solid residue obtained after wort production. Outof all food produced for human consumption, about 1/3rd is wasted producing landfill accumulation and increasing greenhouse emissions. Globally, around 30 million tons of BSG is produced every year. BSG is a rich source of protein, fibre, and phenolic compounds (hydroxycinnamic acids). These phenolic acids have many biofunctions such as antioxidant, anticarcinogenic, antiatherogenic, anti-inflammatory activities, etc. The main aim is to use thisby-product as a potential human food source which also helps in reducing food waste in food supply chain. The applications in food industries includes, manufacturing of pretzels, dog treats, flour, pizza dough, etc. The products made from BSG are rich in fibre and protein but low in shelf life because of high moisture content present in BSG.

Keywords: beer, brewer's spent grain, fibre, protein, phenolic compound

#### Development Of an Antioxidant Rich Snack Bar for Lactating Mothers

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Post -delivery and birth, lactating mothers (LM) and neonates are exposed to oxidative stress.HM is considered as the ideal food for the infants and the composition of HM is affected by maternal nutritional factors. Many studies have shown that HM restrains the oxidative stress and oxidative damage in newborns, therefore a product with high amounts of antioxidants could improve their oxidative status and antioxidant content of human milk (HM). A ready toeat snack bar was formulated using Response surface methodology (RSM) and were analyzed for proximate composition, acceptability tests and antioxidant activity. Locally available ingredients (Soyabean, Sesame, Gum, Skimmed milk powder, Amaranth, Almonds, Jaggery, Dry ginger and Clarified Butter) which are high in antioxidants were selected and utilized for the preparation of the snack bar. The scores obtained for organoleptic evaluation were 8 out of10 for overall acceptability. The Antioxidant analysis showed 56.83% of DPPH activity; 10.35mg CAE/g TPC. The development of the products for lactating women which are antioxidant rich, can enhance the antioxidant capacity of HM and decrease oxidative stress. Such products can be ideal supplements for working lactating mothers or with large families.

Keywords: Oxidative stress; antioxidants; human milk; lactating mothers; functional food

#### **Sports Nutrition**

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This presentation is about sports nutrition Sports Nutrition is a science that has food for growth and development, physiological state, and physical functioning. Successful performance depends on optimum nutrition and correct coaching. Sports nutrition focuses its studies on the kind in addition because the amount of liquids associated food taken by anathlete Additionally, it deals with the intake of nutrients like vitamins, minerals, supplements and biological substances that embody carbohydrates, proteins and fats Nutrition could be avital a part of several sports coaching regimens, being well-liked in strength sports (such as an aerobic exercise and bodybuilding) and sturdiness sports (e.g. cycling, running, swimming, and rowing). Nutrition is vital for associate athlete because of it provides energy needed to perform the activity. The food they take leaves a bearing on strength, training, performance, and recovery. Not only the type of food is important for sport nutrition but also the time is equally important for what they eat during the day. A well-balanced andvaried diet can sometimes be enough to satisfy the organic process desires of most physically active folks. The information below offer recommendation on a way to eat and drink well whereas being active, to assist US feel energetic, perform well, and recover quicker. A normaldiet containing one, 800-2,400 calories per day (25- 35 kcal/kg bodyweight) generally provides enough energy for exercise (where one exercise session burns 200-400 calories). We tend to get our energy and nutrients chiefly from the macronutrients: carbohydrates, macromolecule, and fat. The subsequent recommendation is predicated on the energy and nutrient needs of adults normally concerned fitness programmes (e.g., elbow grease 30-40 minutes per day, three times per week), though carbo loading for athletes is in short mentioned precise desires can vary supported individual factors like age, gender, height, and activity level.

Keywords: sports nutrition, optimum nutrition, exercise, performance

#### Shelf-Life Analysis of a Calcium Enriched Nutrimix Flour for Lactating Mothers (0-6 Months)

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A Calcium-rich nutrimix flour was developed for lactating mothers; optimized by the responsesurface methodology (RSM) to supplement one-third calcium needs of lactating mother as perRDA. The mixing ratio is formulated from a variety of ingredients as Finger Millet (*Eleusine coracana-* 37.5%), Semolina (*Durum wheat -* 11.25%), Green Gram (*Vigna radiate -* 27.5%), Amaranth Seeds (*Amaranthus -* 8.75%), and gingelly seeds (*Sesamum indicum -* 15%) respectively. The shelf-life study of the developed calcium enriched nutrimix flour was conducted to observe and record the changes in moisture, total ash, total fat, acidity, and free fatty acid value under ambient conditions  $(28^{\circ}C \pm 1^{\circ}C)$  and accelerated condition  $(38^{\circ}C \pm 1^{\circ}C)RH - 90\%$  for 90 days. The moisture content of the nutrimix flour stored under the ambient conditions of  $(28^{\circ}C \pm 1^{\circ}C) RH - 90\%$  it varied from 7.74% to 8.9% over a period of 56 days. Total Ash, Total Fat remained almost unchanged over the period of 90 and56 days respectively and were detected around 1.2% and 4.1% respectively. Acidity and Free Fatty acids were non-significant in the samples.

Keywords: Lactating mothers, nutrimix flour, calcium enriched, shelf life



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