FOOD, NUTRITION & SAFETY MAGAZINE BULLETIN JUL 2024

HOW MILK & VADP VALUE ADDED PRODUCTS) CAN IMPROVE NUTRITION & SENSORY

OF

Mr Prashant Bhat

RISK ASSESSMENT (PART 2): ROLE OF RISK ASSESSMENT M GLOBAL REGULATORY FRAMEWORKS Dr. Shagun Sharma, Dr. Jasvir Singh

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PROTEIN HYDROLYSATES: AN OVERVIEW Dr Shashank Bhalkar

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"F PEOPLE HAVE NO BREAD LET THEM EAT CAKE"

This is what apparently uttered by Marie-Antoinette, Queen of France, when told of people's misery. Just before the French Revolution, when she was informed that French peasantry and the working class could not afford bread as it cost them half their income, she uttered the above words either not caring or being oblivious of the ground realities.

We have established by several surveys and research studies that Indians are deficient in proteins and many micronutrients. There have been efforts to stem the problem for decades.

Recently recommendations were made for improving the diet to avoid consumption of HFSS foods and so-called ultra-processed foods. It is easy to understand limiting HFSS foods as these contain excessive amounts of fat, sugar and salt beyond health.

However, the NOVA definition and classification of processed foods is unscientific and very confusing. By adopting them and advising people may create a fear psychosis about food products prepared and packed by food industry. The definition says that bread prepared fresh and sold unpacked is fine but if packed it is unhealthy. So, pav made using maida will be considered better than packed whole wheat bread prepared using atta, even though unpacked may be open to contamination.

There is also caution against using protein supplement powders especially whey protein as it contains branched chain amino acids (BCCA) as it is supposed to increase risk of noncommunicable diseases. The BCCAs are known to repair any damage to muscles during sports and athletics. Advice not to consume protein powders but to eat proteins through foods would affect sportspersons.

Another caution is against chemical nutrients. It is said that naturally present vitamins, minerals and fibre have health benefits, but added ones may be chemicals and may not have much value. There is a modified advice that added nutrients may not contain all the nutrients present in natural foods. Fortification is never attempted to produce superfood with all the nutrients needed in proper proportions but to prevent the deficiency of target nutrients without incurring great cost unaffordable by most target populations.

Thus, it is advised that we should improve our diet and eat only millets, pulses, green leafy vegetables, nuts, curd, milk and fruits for all our meals. When our staff scientists tried to calculate the cost of such meals for a family of four, it was found that it cost roughly Rs 185 per person per day, so about Rs 750 per family per day. So, family must set aside over Rs 20,000 just for food. This is fine for a family earning six figure income but India's population is not well-to-do and this will be beyond the reach of a majority of the population. We should not lose ground reality when advising.

Second problem with the foods that are suggested is that the whole thing is so timeconsuming. Our mothers and grandmothers were whole-time home-makers and would spend hours on cooking. The recommendation would take at least 4 to 5 hours every day and today's home-makers are both working and do not have the time nor energy for doing all this. Actually, food industry gave a lot of convenience to cleaning, washing and cutting and packing fresh, frozen and semi-cooked food or ingredients that are easy to use in preparing traditional meals in a much shorter time. The fear of processed food will not go well women's liberation from drudgery too well.

Secondly, this chemical-phobia is also not clear. We iodised salt and now the problem of iodine deficiency is reduced. FSSAI has also encouraged iron and vitamin fortification of many of our staples including flour, milk, rice and oils which will reduce the deficiencies of many micronutrients. If we spread this fear of chemical nutrients not being of much value, then these programmes to eradicate deficiencies will certainly be obstructed.

Fortification has been shown time and again to be the most cost-effective means of removing nutrient deficiencies especially in a population with lower income. We strongly support it.

Prof Jagadish Pai, Editor, PFNDAI



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FRUGTOSE NOT GLUCOSE



By Dr Sesikeran, B, MD, FAMS, Former Director, National Institute of Nutrition (ICMR) Hyderabad, Chairman-Scientific Advisory Committee & Hon, Scientific Director, PFNDAI

in addition to 29% Sucrose.

Sugar particularly added sugar is the modern-day poison. Most lifestyle disorders seem to have a common denominator of excessive intake of sugar and sugar containing products.

Sugar is a disaccharide with one molecule of glucose which is the good guy and one molecule of fructose that is actually the reason for sugar being the villain. Fructose ironically will be low glycaemic when compared with glucose which is the benchmark of glycemicity. Fructose is present in natural sources like fruits and honey. Modern food processing industry developed a beneficial sometimes extensively and gainfully used product called High Fructose Corn Syrup (HFCS) which finds its way into a whole range of processed or ultra processed foods and beverages. The absorption of fructose from products is higher, faster and stronger (Apologies to the Olympic Games) compared with fructose entangled in fibre rich fruits. The load of fructose from a whole fruit is much lower than that from fruit juice or sweetened beverage. Fructose is almost twice (+70%) as sweet as glucose. The fructose content of some of the commonly used so called "Healthy" replacements for sugar are for example 40% in honey, 22% in jaggery in addition to 58% Sucrose and 22% in Dates

The no added sugar or zero sugar options contain these sources of fructose. Fruits like mango which contains 7% fructose, Custard Apple has 9% fructose, Guava with 4% fructose, Pomegranate with 1% Fructose, all have much less Fructose than the high fructose corn syrup used in processed and ultra processed foods and beverages. HFCS 42 (in ultra processed foods) or HFCS 55 (in beverages/ soft drinks) have 42% and 55% fructose respectively.

Fructose metabolically facilitates the uptake and storage of glucose in the liver. It helps in maturation of pre adipocytes to mature adipocytes (Fat storage cells) and enables them to store more fat. It pumps energy of glucose from the liver to the muscle during strenuous exercises and thus provides the muscles the required energy even when a person has not had a meal. Fructose gets absorbed passively from the intestine and fructose metabolism is independent of insulin.

Fructose will not cause any spike in plasma glucose and thus it is low Glycemic (Gl of 19 compared to Gl of sucrose of 65) Fructose does not undergo glycolysis unlike glucose and therefore it becomes a ready substrate for lipogenesis or production of fat in the liver. Within the sucrose molecule it is the fructose that is causing most of the adverse health outcomes. Sugar sweetened beverages largely have high fructose corn syrup. This stimulates generation and storage of fat in the body and all the consequences thereof.

Excess fructose stimulates fat synthesis in the tissues and if it does not leave the liver to meet the energy requirement for the muscle in physically active condition it stays back in the liver and accumulates within the hepatocytes. If the VLDL triacyl glycerols(TG) released from the liver do not get utilised they get stored in the viscera as abdominal fat and in the muscles and lead to insulin resistance and the entire spectrum of metabolic syndrome.

Non-alcoholic fatty liver disease(NAFLD), type 2 diabetes mellitus and complications of diabetes like chronic kidney disease, retinal damage etc are the chain of events as a result of lipogenesis. Advanced Glycation End (AGE)products which are the molecular basis for the vascular complications of diabetes also increase in relation to fructose intake.

Finally we may conclude that labelling for added sugar is only half the information of caution to the consumer. True warning must come from a new index called fructose index which indicates the amount of fructose as percent of energy in a serving of the food that will inform the consumer of the real harm that is inherent to that particular food or beverage.

I gratefully acknowledge the contributions of Ms Arohi Bapna and Dr Govindarajan Raghavan my co-authors of the original draft article (pending publication)from where I have sourced this information. The compositional data has been obtained from the ICMR NIN Indian Food Composition Tables.





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Despite FSSA 2006 replacing PFA in 2011, regulatory practice has not changed. The thinking that product standards keep consumers safe, has delayed moving to a preventive system.

Merely stating a product shall be free from dirt, filth, insect fragments or fungus infestations, does not render foods safe. It reflects poorly when standards openly acknowledge that products placed on the market should be free from dead insects and rodent contamination. Worse, maida standards require the product to be free from rodent hair and excreta or politely refer to filth as impurities of animal origin. Clever drafting: these are not standards or specifications, but manifestations of unhygienic conditions. Wouldn't such observations in a household kitchen be alarming enough for a frantic clean-up, so that only safe food is served at the table? So why are we testing unhygienically prepared foods in the market sold for

consumption? PFA was not a food safety law, FSSA is. Yet we fail to act differently.

FSSA defines food safety as "the assurance that food is acceptable for human consumption according to its intended use". Spoilage microorganisms such as total plate count (TPC), yeast and mould (fungus), foul odours, and filth indicate poor hygiene conditions and complacent manufacturing. The Food Safety Management System (FSMS) requires every FBO to deploy appropriate tools like GMP, GHP, and HACCP to ensure the manufacturing of safe food. Food businesses are licensed on their demonstrable ability to produce safe food.

Even at this entry stage, licensing is distracted with product compositions and categorizing foods instead of ensuring the facility's preparedness to make them. Consequently, FSMS instead of operating as a preventive system is reduced to a

document checklist ticked in audits and inspections. A watchful media exposes the behavioural component of food safety when failures occur in the marketplace. When something goes wrong, businesses profess strict adherence to standards and authorities then follow through testing a sweep of products in the market. One denies failure and another hastily seeks to confirm that failure. Then, everyone moves on to the next event. Take milk adulteration: every festival - and we have many - State FDAs prepare for 'adulterated' sweets and other milk products to flood the market. Food safety is now a calendar event for surveillance activity.

However, this is not due to weak enforcement but a wrong approach to food safety. Now FDAs are being directed to " undertake enforcement sampling of food products across the country" to ensure the availability of safe food. Firstly, markets are the wrong place to test for safety, the product shouldn't even get there. Secondly, there can never be an enforcement capability existing or created to inspect all products and all batches to keep consumers safe. It can only oversee the resilience of a supply chain(s), licensed to produce safe food(s). The current approach is using a scarce resource ineffectively and unwittingly increasing its burden. FSSAI and businesses need to mark the calendar year for moving to a preventive system: twelve years have passed.



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HOW MILK & VADP (VALUE ADDED PRODUCTS) CAN IMPROVE NUTRITION & SENSORY OF FOODD

AUTHORS Mr Prashant Bhat Chief R&D Officer, Mother Dairy Fruits & Vegetables Pvt Ltd

> stands at the second position as the most populous country in the world. Balancing out the nutritional status of a country is really challenging when it comes to a

developing nation like India and thus 'Targeted Population Nutrition' is required. This means, what suits us, in geography of India might not suit the other population outside the nation.

Ever since we as Indians have grown up having milk and milk products. Dairy and its consumption are frequently included as important elements in a healthy and balanced diet.

Background: Malnutrition, in all forms, including undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and resulting dietrelated noncommunicable diseases is always being at an alarming stage even after achieving food security. Malnutrition remains one of major causes of mortality and morbidity in Indian subcontinent. It can affect all age groups, like young children and women of reproductive age; tend to be among the most at risk. India with a population of 1.42 billion population





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It is the first food for mammals and provides all the necessary energy and nutrients to ensure proper growth and development, being crucial in respect to bone mass formation. However, several controversies arise from consumption of milk and milk products during adulthood. Despite controversies, studies confirm the nutritional importance of milk in the human diet and reinforce the possible role of its consumption in preventing several chronic conditions. Thus, the present article reviews the main aspects of nutritional profile of dairy and establishes several associations between its nutritious role and its milk constituent's advancement to improve the sensory of various food products.

Significance of Dairy Nutrition

Nutrition plays a significant role and is the basic element of a healthy life. Adequate nutrition is essential in the early stages of life. Nutritional status, at all ages is the basic element as it continues for lifelong, which fosters physical & mental growth as well as cognitive development. Value creation of dairy in India comes from both organized and unorganized milk & milk products.

However, there are immense opportunities in value added products segment with 54.4 % of business in the dairy segment coming from Value Added Products. The total value creation from dairy is approx. Rs 10.5 lakh crores of which nearly half comes from liquid milk and the rest from value added dairy products. Hence there is an immense opportunity where value added dairy in packaged forms can deliver all the key consumer need states of health & wellness, energy, indulgence, and hydration.

Though milk is a complete food in itself, sometimes the presence of saturated fat content in milk is projected as a concern. However, it is important to note, that milk contains many natural sources of nutrients like protein, calcium etc which are important for growth and development. Among saturated fatty acids, the most important are palmitic (30%), myristic (11%), and stearic (12%). Short-chain fatty acids also can be found and make up 11% of SFAs, mainly butyric (4.4%) and caproic

(2.4%). The saturated fatty acid (SFA) present in milk lipid fraction palmitic, myristic and lauric exert quite stable metabolic effects in blood lipids. Milk also contains natural occurring trans-fatty acids like vaccenic acid (2.7%) and conjugated linoleic acid (0.34%-1.37%).

Evidence reveals that r-TFA (ruminants trans-fats) generated during biohydrogenation (such as rumenic CLA, vaccenic and t-palmitoleic acids) are associated with health benefits. The main biological active isomers of CLA are known to play an important protective role in cardiovascular diseases, obesity, bone health, Immune and inflammatory responses.

Additionally, milk is the only food that contains 'lactose'. This lactose not being easily soluble, it favours the growth of lactic acid bacilli (good bacteria) in the intestine, which decreases the pH. The drop in pH favours the calcium absorption which is abundantly available in milk profile.





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Galactose molecule of lactose is also known for essential for the synthesis of myelin sheath, which allows electrical impulses to transmit quickly and efficiently along the nerve cells. Milk is low in GI (Glycaemic index) and low in GL (Glycaemic Load) which makes it as preferred source of carbohydrate.

COVER STORY

Milk has been naturally recognized for several other elements such as calcium, phosphorus, magnesium, zinc, and selenium. The calcium-phosphorus ratio in milk is 1:2:1, regarded as highly favourable for bone development. The vitamin fraction is composed by fat soluble vitamins A, D, and E and water-soluble B complex vitamins such as thiamine and riboflavin.

Milk is also considered as an important and best source of protein source taking in to account the digestibility markers like the essential amino acid score and protein-digestibility corrected amino acid score. It contains essential amino acids which a human body cannot synthesize and are important for body

functions. Apart from the highquality and biological value, milk proteins and several bioactive peptides resulting from their enzymatic hydrolysis have shown multiple biological roles that could exert a protective action in human health. This milk protein also provides sensory properties of functionalised foods

Milk Nutrients & Improved Sensory Properties:

Food processing also affects the nutritional and functional properties of milk proteins by imparting new functions. Basic 'Millard Reaction' process where heat application affects the 'sugar-protein' mixture of the milk. The lactose reacts most readily with the milk protein and develops a rich brown colour on heating. This reaction provides a rich mouthfeel and caramelized flavour and aroma to the product.

Milk proteins can also interact with food constituents, i.e. volatile compounds and polyphenols, influencing their delivery and sensory perception during the consumption of food (Zhang, Kang, Zhang, & Lorenzo, 2021; figure mentioned below).

Milk proteins can be added to foods with the aim of improving their structure, flavour profile, nutritional and other functional properties. These precursors of bioactive peptides, making them suitable for functional food applications. Below figure explains the effect of applications of milk proteins.

Milk proteins are versatile and can be used to develop customised milk proteinbased ingredients with the most desired functional properties. Their binding properties with volatile and phenolic compounds improve the flavour perception, helping to reduce fat, sugar and salt in foods.

Such interactions between milk proteins and food matrix components can change the protein structure imparting new functional properties.



PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

MILK PROTEIN INTERACTION

PHENOLIC COMPOUNDS

- Improvement of sensory perception.
- Stabilisation of protein secondary structure.
- Improvement of proteins properties.
- Improvement of phenolic
- properties.

VOLATILE COMPOUNDS

- Regulation of flavour release.
- Change in Protein structure
- New protein functions
- Indirect effects on aroma release
- Influence on flavour perception

Effects of the interaction of milk proteins with volatile and phenolic compounds.

Depending on the food formulation and purpose, the milk constituents can be used in optimizing the technological and sensory properties of food.

Conclusion:

From the above reviews, it is evident that the nutritional richness of milk is unquestionable; it is a good source of high biological value proteins with multivalent roles in immune function, as well as nutrient transport and absorption and important vitamins and essential minerals. The constant association of milk consumption in a healthy diet has made milk a recommended food for all ages. Thus, the role of dairy is recognised for its excellent nutritional and functional properties.

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RISK ASSESSMENT (PART 2) ROLE OF RISK ASSESSMENT IN GLOBAL REGULATORY FRAMEWORKS#



Dr. Shagun Sharma, Founder: FoodScito (foodscitoss@gmail.com)

#This article is part of a series of articles to be published on the topic of Risk Assessment.

Introduction

Global international trade is increased to a great extent necessitating the need of analysing safety standards of food so as to match the international food safety standards emphasising over risk analysis approach. This article is part of a series of articles to be published on the topic of Risk Assessment. In continuation to the previous article explaining the history and



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fundamentals of risk assessment, the present article aims at reviewing the risk analysis strategies employed by different countries including European Union, USA, Australia-New Zealand, Japan, China, and India to the extent that these are available in public domain.

European Union (EU)

EU food law relates to risk as well as associated health effects. Scientifically

evident policies of EU risk analysis separate riskassessment and management indicating independent and transparent working of the risk assessment body: European Food Safety Authority (EFSA) without being affected from the risk managers like European Commission (EC) and associated bodies (Deluyker, 2017). The organizations involved in the risk analysis comprise of EFSA to conduct risk assessment while several European agencies namely, the European Commission, the European Parliament, and individual Member States involved in the development of policies and those deciding over prevention and control of risks owe the responsibility of risk management.

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- Alcoholic and non alcoholic products
- Oil seed, oils and its produts
- Sweets.,confectionary and its products
- Bakery products
- Sugar, Honey & jaggery
- Process, canned food products
- Feeds
- Water
- Ready to eat
- Infant substitute
- Skim Milk Powder

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- Natually occurring toxins(NOT,s)
- Heavy metals and minerals
- Minerals & Toxic heavy metals
- Vitamins
- Antibiotics / Residues
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- Food additives, preservetives and artificial sweetners
- Synthetic food colour
- Antioxidents
- Packaged Drinking analysis as per IS 14543
- Drinking water as per IS 10500
- Process water IS 4251
- Shelf life study(Ambient @ Acclerated)
- Microbiological testing (Bacterial and pathogens)
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Risk Assessment (Part 2): Role of Risk Assessment in global regulatory frameworks



Risk assessment utilizes updated scientific data as its basis. In the era of innovations, at times there is insufficient data for the scientific evaluation of risk.

Thus, in case of scientific uncertainty, use of

precautionary

principle' could be of key importance where risk assessment identifies the probable harms so as to implement provisional actions and meanwhile additional data can be collected for advanced risk assessment (Boer, 2022). This permits the risk managers to frame a provisionary management activity in view of probable adverse effects as identified by the first risk assessment, thereby ensuring utmost consumer safety. Furthermore, risk managers need to consider precautionary principle only after considering the outcome of risk assessment and should not replace it. Taking into account uncertainty and variability, FESA's assessment recommends multiple strategies of action utilizing various scientific evidences (EFSA, 2017a). In case of

foods, 'absence of risk' approach has also been used for identifying the safe levels of exposure (Tijhuis et al., 2012). The *methodologies*

include novel non animal based techniques which could be addressed to gather risk assessment information (Knight et al., 2021). Recently, the TTC concept i.e. 'threshold of toxicological concern' is applied for risk assessment (Kroes et al., 2005) so as to assess the level of exposure of a specific hazard below which there is no substantial harm.

Risk management explains the protocol of integrating the conclusions drawn from risk assessment with other aspects such as legal, social, economic capabilities, and risk benefit analysis, to develop suitable guidelines. The roles and responsibilities of risk management agencies involved in decision making are mentioned in the specific protocols. While communicating to and with consumers, maintaining transparency is the key and can be achieved by adopting Transparency Regulation which further elucidates the roles and measures of risk communication. It propels FFSA to release technical bulletins, and effective suggestions for applicants and associates, thereby

tailoring an advanced EUwide food safety risk communication plan so as to ensure an effective communication to consumers (EFSA, 2021). These measures increase the awareness and comprehension regarding various matters such as deviations in risk assessment and confirm the transparency of risk management expressions (https://eurlex.europa.eu/legalcontent/EN/TXT/PDF/?uri=C ELEX:32019R1381).

USA

Traditionally, the US control system was dependent on 'reasonable certainty of no harm' policy while the Food Safety Modernization Act (FSMA) emphasized the necessity of risk based strategy, HACCP system and need for external auditing agencies and auditors. Risk based framework underlines the preventive approach towards food safety issues highlighting the need to carry out hazard analysis and adopt preventive actions by the food establishments:



Risk Assessment (Part 2): Role of Risk Assessment in global regulatory frameworks

compliance to scientific specifications by the farmers so as to have safe cultivation of the agricultural produce; adoption of foreign supplier verification program; and formulation of appropriate standards

(https://www.europarl.euro pa.eu/RegData/etudes/STU D/2015/536324/IPOL_STU(2

015)536324 EN.pdf). Food risk analysis framework involves risk assessment, risk comparison and ranking, and prioritization of risk mitigation factors. Ranking relates to consumer health whereas risk reduction opportunities consider viability, finance, and social factors. *Quantitative risk*

assessment is used to decide the upper levels of pesticide residues and processing- and packaging related chemicals. Additionally, microbial risk assessment is carried out to analyse the pathogens of concern in foods and assist regulatory policies for their control (Taylor and Hoffmann, 2001). The *mandate* of risk analysis lies on the concept of effective and continuous communication between policy makers and those involved in data generation ensuring a coordinated approach. The use of some risk analysis tools such as QPRAM and FDA-iRISK enhance its scope. However, unlike EU framework, it appears that there is no

structural separation between risk assessment and risk management in US frameworks.

Australia-New Zealand

Food Standards Australia New Zealand (FSANZ) utilizes risk analysis framework to develop novel food policies, evaluate suggested amendments to present food standards, for supervision and inspection related tasks, evaluate food processing protocols, and undertake rising food safety concerns. Risk analysis mandate of FSANZ presents an open and distinctly clear platform emphasising over increased community awareness regarding conclusion framing procedures and uplift discussion about significant food safety risks. *Risk assessment* model is adopted to assess the occurrence and severity of risks originating from chemicals, microbes and nutrients. Each risk assessment is carried out case-by-case utilizing the available data to decide the severity of risk. The methodology employed by FSANZ includes dietary modelling technique for

modelling technique for estimating the exposure of chemicals and nutrients. Microbiological exposure assessments by FSANZ may exploit predictive mathematical models to envisage the multiplication, destruction and viability of microbial hazards in the food chain. Several quantitative models namely, deterministic and probabilistic may be developed depending on the available information.

Risk management is an

informational and decisive process at FSANZ, which identifies the issue, keeping in view the risk assessment, socio-economic and other related aspects; creates, signifies and choses the option imparting the highest gain to the population. Based on AS/NZS ISO 31000:2009 Risk Management-Principles and Guidelines, FSANZ describes the term 'risk appetite' in terms of concentration and kind of risk agreed to retain. The proportions of risk still present even after risk management activities undertaken to reduce the same is defined as 'residual risk'. FSANZ considers both regulatory and nonregulatory measures to risk management.





Regulatory measures involve standards in the code (both end-product- and outcomebased) which focus on managing food-related health risks to attain an acceptable level of health protection. Non-regulatory measures that aim to deal with an identified hazard are not mentioned in the code and include industry codes of practice, guidelines, educational content like factual data by FSANZ and standards developed by other authorized agencies such as Standards Australia.

Risk communication at

FSANZ is the interactive dialogue about the risk and associated issues amongst assessors, managers, media, concerned parties, and the society. It is a continuous procedure with an objective of maximum involvement of interested sectors and the community reaching the conclusion. A number of communication strategies are employed for interactive, effective and focused communication namely, passive, responsive, educative, and proactive. Passive communication refers to notifying the food issue to the interested

groups while responsive communication is applied to community perceiving a higher degree of food risk as compared to scientific evidence. Educative communication strategies are of key importance in case where community is uninformed of probable high risk as indicated by the scientific findings whereas Proactive communication strategies are useful where the scientific data and the social awareness of the food related safety concern signifies a high risk (https://www.foodstandards .gov.au/sites/default/files/ publications/riskanalysisfoo dregulation/Documents/risk -analysis-food-regulationfull-pdf.pdf).

Japan

The present structure of

Japan features clear separation between risk assessment and management body where the former is placed into the Food Safety Commission (FSC) under the Food Safety Basic Act while the latter is administered by three departments namely, the Ministry of Health, Labour and Welfare (MHLW), the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Consumer Affairs Agency (CAA) (https://www.mhlw.go.jp/e nglish/policy/healthmedical/food/dl/pamphlet. pdf). FSC was established in

2003 and comprises of 7 commissioners, 12 expert

committees with more than 200 experts, and approximately 100 secretariat employees (https://www.cao.go.jp/en /pmf/pmf 22.pdf). The sequential procedure of risk assessment carried out by Food Safety Commission of Japan (FSCJ) begins with the commission receiving a request from the risk managers which is then assigned to the expert committee of relevance in order to develop a layout of risk assessment and report to the commission for further discussion. The commission finalizes the same and notify it to the risk managers. The agencies involved in risk

management develop the standards and guidelines on the basis of conclusions drawn from the risk assessment. The secretariat communicates with risk managers and other stakeholders to promote risk communication. FSCJ advances *risk*

communication based on a report developed by the expert committee on planning entitled "Future Direction of Risk Communication" (https://www.fsc.go.jp/eng lish/index.data/Broucher20 18.pdf).



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China

National Center for Food Safety Risk Assessment

(CFSA) of China was established in 2011 as the sole technical establishment to carry out risk assessment nationwide, whereas risk management is handled by China Food & Drug Administration. CFSA works as the council of the National expert committee for food safety risk assessment. Toxicology being the basis of food safety risk assessment framework, CFSA formally notified the "Food Toxicology Program" in 2013 and commenced the advancement and implementation of innovative techniques.

This program enhanced the potential of China's food safety emergency response and provided scientific assurance for food safety risk- assessment and management with sound repository and database over toxicity of chemicals. It also supported the research on emerging toxicants using novel methodologies. Over a period of ten years of continuous development the "New Risk Identification and Toxicity Screening New Technology Platform" has been progressively

developed including various innovative methodologies namely, toxicological threshold of concern, quantitative structure activity relationship, rapid detection technologies based on cell modelling, alternative and systematic toxicological methods (Yang et al., 2023).

India

Risk analysis framework of Food Safety and Standards Authority of India (FSSAI) is based on a number of underlying principles including use of available data and methodologies, recognition of uncertainty, tailoring the risk management approach to the risk, involvement of interested and affected groups, open communication, and review of regulatory response (fssai.gov.in). In order to strengthen food safety systems, FSSAI established risk

assessment cell

(RAC) to carry out risk assessment for products, processes and activities posing risk to human health.

RAC provides an effective framework for determining the relative urgency of food safety concerns and the remedial measures for their control. Rationale of RAC includes data collection and interpretation, providing scientific expertise to manage food hazards, communicating risk assessment findings amongst stakeholders, and coordinating in establishing food safety standards. A number of scientific panels and committees are constituted by FSSAI to carry out risk assessment including panels for functional foods. nutraceuticals, food additives, flavorings, contaminants in food chain, biological hazards, pesticides, antibiotic residues, labelling and claims, genetically modified organisms, and foods, fish and fisheries products, and methods of sampling and analysis. In addition to that, state food testing laboratories, referral- and recognised laboratories are authorized by FSSAI to conduct risk assessment activities.



Risk Assessment (Part 2): Role of Risk Assessment in global regulatory frameworks

FSSAI performs risk

management activities

through setting up standards, MRLs for contaminants, heavy metals and contaminants, etc. Moreover, advisories are issued to consumers on food safety aspects such as ban on artificial ripening of fruits with calcium carbide, etc. Examples of risk management include monitoring of imported foods with some food safety concern, and acting on INFOSAN warnings, etc.

Risk communication is

dealt through electronic and print media, outdoor publicity, social media platforms and website itself (https://www.fao.org/filead min/templates/rap/files/m eetings/2013/130617_2.4.p df).

Risk assessment protocols utilize a data-driven approach varying depending on nature of risk, its severity, and scientific evidences. RAC emphasizes on collecting and merging the relevant data from multiple sources including academia, research and government authorities so as to have a clear picture of associated risks helpful in developing surveillance schemes of action.

RAC work structure begins with developing a risk profile with detailed information regarding the nature of food commodity and describing the probable ways of exposure to a specific hazard followed by experts' decision on risk assessment to be done or not. Thereafter, a request proposal is issued by the panel to commission risk

assessment and collected data is interpreted for further decision, which if approved would be forwarded to the regulators for developing risk management policies and guidelines. Authority would also develop effective means of risk communication amongst internal and external stakeholders (https://fssai.gov.in/cms/Ri sk-Assessment.php).

Conclusion

The core theory behind the risk analysis approach of all the countries revolves around ensuring food safety and public health by emphasizing over riskassessment, management, and communication utilizing the available scientific evidences effectively. EU brings the concept of precautionary principle while the USA focuses over risk comparison, ranking and prioritization of mitigation factors along with risk assessment. FSANZ involves both regulatory and nonregulatory measures along with novel modelling techniques whereas both EU



and Japan lays down clear structural separation between risk assessment and management achieved through precisely mentioned roles and responsibilities of different agencies. On the other hand, China focusses on toxicology program whereas Indian risk analysis framework depends on scientific panels, functioning within FSSAI but consisting of independent scientists. However, the risk analysis mandate of food legislation of all the nations underlines the need of effective dialogue amongst internal and external stakeholders. To sum up, with minor differences amongst the risk analysis methodologies, the basic concept of risk analysis remains the same globally which is very well in line with the FAO/Codex framework.



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PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

PROTEIN FORTIFICATION: HOW **DIETARY PROTEIN** COULD BE **IMPROVED?**

AUTHOR Prof Jagadish Pai, Editor, PFNDAI

Importance of protein in diet

Protein is present in entire body including muscle, bone, skin, hair and in every tissue. Enzymes catalysing various chemical reactions in the body are proteins as well as haemoglobin that carries oxygen in blood and lipoproteins that carry fatty acids. Proteins are made of amino acids, some of which cannot be made by our body and are called essential amino acids and must be supplied in diet. Proteins containing adequate amounts of these essential amino acids are of higher quality than those that lack them. Therefore, we not only must have enough of proteins but also higher quality proteins so we can make all the body proteins needed to carry our function of remaining healthy.

It has been estimated that adults must have about 0.8 g of protein per kg body weight per day. For Indians ICMR has estimated about 0.83 g per kg bw per day. This is of course approximate, as the actual needs will depend on adults being less or more active, their age, whether male or female etc. It has been established several times that most Indians are deficient in protein intake. For children it will affect both mental and physical growth giving them the handicap throughout life. For adults, capacity to do work and concentrate as well as health will be adversely affected due to protein deficiency. Even seniors will have severe health issues due to lack of protein. Although their caloric needs go down,



seniors still need same amount of protein and its lack will result in sarcopenia. Thus, we must ensure that throughout life we do not suffer from protein deficiency and look at various ways of increasing protein intake in our diet.

Benefits of protein fortification

Diets could be changed we could eat many protein-rich foods to remove the protein deficiency. However, changing of diet is very difficult in normal household as people are used to particular foods and would love to continue the same diet without much changes.



In hospitals the severe dietary changes are possible because normally patients may not have a choice of food and will have to consume what is given or allowed by the dietician of the hospital. After the patient goes home, may go back to original diet. Same would happen when change of diet is recommended. After some time, they may not want to continue that because it may consist of foods not to their liking. So continuing for longer periods is difficult.

Fortification of food on the other hand allows same foods to be used in diet but with additional ingredients to make the foods richer in foods. Person consuming fortified foods will continue to enjoy almost the same food and most likely continue the high protein diet for much longer time.

Sources of Protein

Although each food, whether animal or plant, has proteins in it, there are some that have much more than the others. Among the animal foods, meat, poultry, fish, eggs and milk & dairy products are most common sources of proteins in our diet. Although some vegetarians would accept milk and dairy products while some others would accept egg and products, but the vegans would not consume any foods from animal source.

There are many plant sources of proteins that are commonly in our diet and these are from such groups like cereals, legumes and nuts and seeds. We normally have wheat, rice, corn and millets in our daily diet. These contain lesser amounts of proteins than legumes. Among legumes, pulses do not contain much oil, and some examples are chickpeas, lentils, peas, beans. There are some legumes that contain oils e.g. peanuts and soybeans. Originally, they were used for their oil contents and

using the de-oiled cakes for animal feed. Since they contain good amounts of proteins, increasing amounts are being used for making protein foods and ingredients.

There are some seeds and nuts such as mustard, sunflower and safflower seeds and almonds, cashew & pistachio etc that contain good amounts of proteins and can be used to supplement the protein needs.

The amounts of protein as well as the quality of proteins differ in different protein sources and following table gives a glimpse of the same.

Although any of these could be used for increasing the dietary consumption of protein there are only some that could be used for fortification.

Protein Contents of Different Foods (g/100g)

Beef leg 22.64 Goat leg 22.07 Sheep leg 21.42 Chicken breast 21.81 Egg whole 13.28 Mackerel 21.51 Pomfret white 19.02 Prawns tiger 14.25 Milk cow 3.26 Milk buffalo 3.68 Mustard seeds 19.51 Sesame seeds 21.61 Flax seeds 18.55 Sunflower seeds 23.53

Bajra 10.96 Corn 8.80 Rice 7.94 Wheat 10.59 Quinoa 13.11 Chickpea 18.77 Lentil 22.49 Peas 20.43 Field bean 19.9 Soybean 37.80 Peanut 23.65 Almond 18.41 Cashew 18.78 Pistachio 23.35





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& CONCENTRATION*



As most Indians would not like to have meat, fish and poultry products in their fortified foods these are not the choices of proteins even though they are very highquality proteins. Secondly their costs are so high, the fortified foods would be very expensive. Eggs are also problematic in the similar sense as many vegetarians would not touch the products containing them, although they not only are easy to incorporate in many foods and are not very expensive.

Thus, commonly the plantbased proteins are the prime-choices for fortification but here also cost consideration is needed to make the final product not very expensive. Therefore, many nuts like almonds, cashew and pistachio are not considered as they are quite expensive.

Although cereals are not very expensive, the protein contents are modest so the process of extracting proteins from them would involve many steps and make the final product expensive.

Although milk contains fairly

low levels of protein, this protein is not just extremely high quality but also easy to concentrate as fat and sugar can be fairly easily removed. It has always been the prime choice in protein fortification since early days of fortification. Milk is produced in large quantities and is a very unstable commodity, and can spoil due to microbes unless properly protected by processing and packaging. After the fluid milk requirements, there would be various products such as curd and cheese are prepared, the remaining milk could be easily dried in various forms like whole and skim milk powders that would be shelf stable. These were the early protein sources used for making fortified foods. Later there were many more products were formed useful in fortification such as casein, milk protein concentrates and whey protein isolates etc. of different costs and applications. Thus, milk proteins have always been one of the prime ingredients in fortification of foods. It had advantages such as no colour, flavour and taste so it could be mixed with any food ingredients with a variety of colours and flavours which made it easier. Another big advantage was that it would elevate most lower quality proteins of other ingredients so the overall protein quality was high.

Among legumes, most are already consumed and but could become a good source of proteins because of their good proportion in the raw materials and their easy acceptability. Some concerns about their antinutritional factors could be overcome by heat treatment. Green peas and chickpeas (Bengal gram) have been used to prepare the proteins sources for fortification and their use is increasing. Their digestibility is somewhat lower than the animal protein but this could be improved by preparing concentrates and isolates removing substances interfering in the digestion of proteins.

Oil-bearing legumes such as peanuts (groundnuts) and soya beans have been used as protein sources for fortification for guite some time. Their big advantage is their cost. These are grown mostly for their oil content and after oil is recovered, the residue is high in protein which earlier was used for animal feed. As these could be used to improve the quality of human diet, these have been used in a variety of food products. Soya especially is very useful as it has the same protein quality as animal proteins and its addition to vegetarian ingredients improves the value of the entire protein content.

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Protein Fortification Methods

There are various ways in which fortification by protein can be achieved. Simplest has been done in traditional Indian diet by mixing cereal-based and pulse-based foods in a meal such as rice or roti along with dal where cereal grains have more carbs and less proteins whereas pulses contain much more of proteins. Also, the combination will improve slightly the quality of protein as some limiting amino acids from one will be provided by other. Similarly, the other sources such as nuts and seeds and animal foods if nonvegetarian foods are acceptable may be part of the diet.

However, if there are socioeconomic constraints to making change in the diet by introducing the proteinrich food in the diet, the simplest way is addition of protein isolates or concentrates to the existing diet. There are many such ingredients available that could be easily added. Some are plant-based while others may be mostly dairy products. While using such products, it is advisable to seek the professional help from a health professional, nutrition or family doctor who can guide the type and amount of such material to be incorporated in the diet.

For guite some time such materials as soya granules, chunks or badi available in consumer markets have been used to improve the protein quality and contents of the diet without much added expense. Some of these are extremely useful as they can be added with little or no change in taste or aroma and mouthfeel especially when added to some spicy curries or dals. They also increase the dietary fibre content as a secondary benefit besides protein fortification.

Popular Protein-fortified Foods

Since the awareness of protein with respect to its importance and the problems of deficiency among consumers has grown, there have appeared many food products in the consumer market with higher protein contents. Again, it would be wise to consult health professionals about their amounts and frequency of consumption in addition to regular diet.

There are also protein-rich powders or supplements that could be used by adding to hot milk or water to make a protein-rich beverages. These may contain besides proteins, good amounts of carbs, fats, and other micronutrients. These are easy to consume at any time and place if one can get milk or water.

Even more convenient are protein bars that require no preparation and can be eaten any place and carried easily. These are prepared with other ingredients to make them appealing so care must be taken about sugar and fat consumption along with proteins. Their popularity is for people who may not have regular meal times and places where they could get balanced meal. Nowadays there are many jobs that necessitate a lot of travel and this does not make it easy to have ideal conditions for lunch or even carrying lunch boxes.

Another type is protein-rich snacks. As Indians love snacks and it would be easier to tell them eat healthier snacks than telling them to avoid snacks. Snacks are something people look forward to and asking them not to eat them and rather only consume 3 healthy meals per day would be difficult.



Protein Fortification: How Dietary Protein Could be Improved?

There are many snacks that are loaded with sugar, fat and salt but slowly many new ones are appearing that are healthier with lesser of these and more of proteins, dietary fibre and micronutrients. Proper use of ingredients and technology would enable preparation of snacks that are healthy with higher amounts protein.

We need to realise that people do not eat nutrients but foods that they love. Foods have many significances like culture, emotion, affection, religious and festive occasions, friendship and celebration. Indians express their feelings traditionally with foods and to deny them these pleasures would be difficult if not impossible. Therefore, when we give them advice, this aspect should be considered. Even the prisoners and patients in hospitals protest if they are given foods they don't like even when they may be healthiest and most appropriate for them.

Future is good as many in food industry are preparing products with consideration for nutrition and health besides just taste and flavour. With proper awareness both consumers and manufacturers could be guided to healthy eating. Even the government and regulatory body, FSSAI is encouraging fortification as a means to promote health and nutrition of common people with fortification of staples with micronutrients. This will certainly fuel fortification of food products with essential nutrients including protein.

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PROTEIN HYDROLYSATES B AN OVERVIEW



Proteins are major macronutrients that are responsible for many biological functions apart from building blocks. Therefore, they play a major role in human nutrition. The amphoteric nature and large three-dimensional structure make them also display excellent functional properties which are useful in many product development applications.

Protein hydrolysates are products derived from the partial hydrolysis of proteins and are a mixture of

AUTHOR Dr Shashank Bhalkar, Executive Director, PFNDAI

polypeptides, oligopeptides, and amino acids.

Protein hydrolysis can be achieved by acid, alkali, or enzyme treatment of proteins. In the process of hydrolysis, the large complex protein molecules get converted into smaller simple molecules. This makes them highly digestible, and less allergenic compared to the parent protein. Therefore, they form an important ingredient in specialised dietary supplements. The earliest application of protein hydrolysate was as a nutrient for microbes. This use in the microbiological media has been there for decades. Their much wider applications such as flavour enhancers, emulsifiers, antifreezing, and foaming in foods make them a very important functional additive. Recently, protein

hydrolysates have been found to be useful in many other biotechnology applications like biostimulants in horticulture; or plant, animal, and insect cell culture etc. Recently specially hydrolysed protein hydrolysates called Bioactive Peptides have found applications in food, medicine, and cosmetics.

Manufacturing of Protein hydrolysates:

Sources of protein are used to manufacture the hydrolysates depend on the end use. They include Soy, Casein, gelatine, whey, etc (1). Protein hydrolysates are commercially manufactured by three processes: Acid, Alkali, or Enzymatic hydrolysis. In any process, the proteins with 8-20% solids are suspended/ solubilised in water by adding alkali and heating to 200 degrees F. (2)

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*As per NielsenIQ Retail Intex data for period MAT Sep'23 for the India market in Muesli Sub-Segment of Breakfast Cereals. Log on to http://www.kelloggs.com/en-in/products/muesli.html for details. Acid hydrolysis is the oldest method of hydrolysis. Generally, hydrochloric, or sulphuric acids are used. The process requires glasslined reactors that can withstand high pressures and temperatures. The factors responsible for the process are the type of acid, temperatures (250-280 degrees F), and pressure (32-45 PSI). This is done for 2-8 hours. The hydrolysis is uncontrolled and terminated by releasing pressure. Some of the essential amino acids like tryptophan, methionine, and cysteine, are destroyed in this process. Amino acids and minute amounts of smaller peptides are produced. Glutamine and asparagine are converted into glutamic and aspartic acid. A significant amount of salt is produced in the process. Therefore, salts are partially or completely removed by, nanofiltration and /or ion exchange. These hydrolysates are generally used as flavour enhancers.

Alkaline hydrolysis is a simple process. Protein is solubilised by heating. This is followed by adding alkaline agents like Calcium, Sodium, or Potassium hydroxide and maintaining to desired temperature (80-130 degrees F). These conditions are maintained for several hours till the desired degree of hydrolysis is attained. Finally, the product is pasteurised, evaporated, and spray-dried.

Enzymatic hydrolysis is very important as it is in mild conditions and enzymes being specific in action lead to tailor-made products as desired by applications. Before hydrolysis, the protein is treated with alkali (sodium or potassium hydroxide) to make a soluble salt. This may be sodium or potassium proteinate. Then pH is adjusted to the enzyme pH optimum value. The enzymes could be proteases extracted from plant, animal, and microbial sources. This being an enzymatic process, the specific temperature and pH

must be maintained in the reaction. Recently proteolytic enzymes used also come from the fermentation process. The commonly used enzymes are pancreatin, trypsin, pepsin from animals or papain, bromelain from plants or bacteria, and fungal from the fermentation process. The hydrolysis could be one step by a single enzyme or multiple steps by many enzymes depending on the end productrequirement. The hydrolysis is stopped by heating or changing the pH to inactivate the enzymes.

Following Fig. 1 is the schematic diagram of a typical protein hydrolysate process.

Fig. 1. Protein Hydrolysate Process


Protein Hydrolysates: An overview

In the case of enzymatic hydrolysis, the reaction can take 1 to several hours. There could be microbial contamination. Therefore, bacteriostatic or bactericidal preservatives are conventionally used which are removed or evaporated in downstream processing. Better treatments like pulse electric field, UV or Ozone can be explored for this purpose. These chemicals can be avoided by shortening the reaction time of hydrolysis to less than four hours by use of enzymes that are active at higher temperatures, or using enzymes that have optimum pH which is acidic. Many post-hydrolysis treatments are important to get the desired product especially when the end use is in nutrition, medicinal, or cosmetics products (3). Ultrafiltration will remove high molecular weight proteins and peptides. Further hydrolysis by exoprotease helps reduce the bitterness. Similarly activated carbon will reduce bitterness. Aromatic amino acids are removed by adsorption chromatography.

Protein hydrolysates display many Techno-functional properties which make them important ingredient in food applications. (3)

Solubility -

This is the most important techno-functional property

of a new protein ingredient. Reduction in the secondary structure and release of smaller polypeptides are responsible for the improvement in solubility. Various crops have been

studied for the solubility of their hydrolysates. Barley protein hydrolysates are soluble at a pH range of 10-12. Wheat protein hydrolysates are soluble at pH 4-6. Soy protein hydrolysates are soluble in a wide range of pH 2-9. These properties help them for use in the protein supplementation depending upon the product characteristics. For example, soy hydrolysates with solubility in a wide pH range can be used in fruit juices.

Emulsifying properties-

Proteins have emulsification properties to form stable food emulsions. Many protein hydrolysates are studied and showed improvement in the emulsification capacity. The emulsification is more at a lower degree of hydrolysis and less at a higher degree of hydrolysis. Limited hydrolysis improves the emulsification by exposing hydrophobic amino acid residues to oil and hydrophilic with water.

Foaming -

Foaming provides a unique



texture to the range of food and beverages like ice cream, cakes, meringues, champagne, and beer. This improves consumer acceptance because of the appearance. Foaming properties of proteins such as wheat germ and okara are improved upon the hydrolysis. The foaming capacity increases with the degree of hydrolysis, but the foam stability is decreased. This is attributed to the larger component proteins in a partially hydrolysed protein.

Gelation-

Gelling is very important characteristic for bakery and meat products. Soy protein has an excellent gelling property, however the hydrolysates show poor gelling properties. This is attributed to the lower surface hydrophobicity and short peptide chain length of the hydrolysates. Efforts are on to improve the gelling properties of hydrolysates. For example, addition of 0.2M sodium chloride can accelerate the gel formation of sunflower protein hydrolysate but it is with lower gel strength.



Protein hydrolysates and **Bioactive Peptides** applications: (3), (4) Short-chain peptides are found to be more efficiently utilised compared to an equivalent mixture of amino acids. Recently, there has been growing interest in the novel Bioactive peptides that are being continuously discovered. Originally, they are found within the bigger protein molecules and do not exhibit physiological activity. They become active after the cleavage of the parent protein by enzymatic hydrolysis. They have bio-activity which makes them useful in many applications. These compounds have medicinal, cosmetic, and nutritional properties. Bioactive peptides with biogenic, opioid, immunomodulatory, salt/metal binding, antihypertensive, and antimicrobial properties are produced by enzymatic hydrolysis. Various animal, plant, and microbial sources are used to derive Bioactive Peptides. Animal sources such as Blood from slaughterhouses, meat and aquatic animals, Camel/ goat milk, eggs, fish are used. Commonly used plant sources are soy, gluten, or

by-products like Brewer's Spent Grain, wheat bran and Okara.

Antioxidant properties -Soy protein

hydrolysates using Flavourzyme and Chymotrypsin were found to have antioxidant potential greater than that of Soy isolate. The release of bound antioxidant phenolics or copper chelating agents were responsible. Soy protein hydrolysates posttreated with ultrafiltration resulting in low molecular weight fractions (less than 10KDa) showed maximum activity. Other protein sources like rapeseed, sunflower, and wheatgerm showed similar effects. Fermentation of Okara by Bacillus subtilis B2 also showed improved antioxidant ability.

Anti-hypertensive-

Generally, Angiotensinconverting enzyme (ACE) inhibitors are the drugs used to control hypertension. Wheat germ hydrolysate and its dominant peptide were found to reduce mean arterial pressure in hypertensive rats. The bioactive peptide could be metabolised by aminopeptidase to form ACE inhibitory metabolite inducing a reduction in blood pressure after absorption. Many other

sources of protein that include wheat germ, soy also showed similar activity. These low molecular weight peptides showed stability in simulated in vitro gastric digestion. The ACE inhibitory stability was proven in a wide range of temperatures (20 - 100 degree C) and pH (2 - 10). Therefore, these peptides can be considered to formulate anti-hypertensive functional foods. Hydrolysates from the range of other crops such as potato, spinach, corn, sunflower, peanut, and rapeseed have shown ACE inhibitory effects.

Cardiovascular Diseases-

Consumption of vegetable proteins has shown a cholesterol-lowering effect vs animal protein. The rate of body fat disappearance was observed in an animal study on genetically obese mice and dietary obese rats fed on soy isolate or hydrolysate. Sunflower hydrolysates using alcalase or pepsin inhibit intestinal absorption of cholesterol and increase its excretion along with bile salts.



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Exercise and performance enhancement-

Post-exercise glycogen synthesis rate is important for determining the time required for recovery. Studies have shown carbohydrate and wheat protein hydrolysate with amino acids mixture administered to cyclists for a five-hour period exercise increases glycogen synthesis as compared to administrating carbohydrates alone. It is suggested that hydrolysates particularly containing diand tri-peptides are found more effective than either intact proteins or free amino acids. This makes them very useful in sports nutrition.

Other clinical applications-

Phenylketonuric infants can be treated with phenylalanine-free protein hydrolysates and have shown positive physical growth and mental development. Hydrolysates low in phenylalanine using casein, whey can be used. Patients with chronic liver failure need a diet with proteins with high BCAA. Casein or Sunflower protein hydrolysates can be used.

Newer applications-Protein

hydrolysates are finding major use in Biotechnology as a nitrogen source in industrial fermentation. Plant materials are now recommended over animal sources to protect against the spread of BSE from bovine animals. Non-bovine plant hydrolysates are replacing Tryptone. Corn gluten hydrolysates are used in the weed control spray. Corn, gluten, and soy hydrolysates are also developed as herbicides.

Cryoprotective agents (5)-

Aquatic products are known for their delicacy and high nutritive value. The way to preserve them is by freezing them. However, during frozen storage and freezethaw during transportation will cause oxidation and degradation of the product. Many cryoprotective agents are currently used, such as polyphosphates, sugars, alcohols, or their combination. Antifreeze peptides obtained by use of specific enzymes on variety of agricultural byproducts can effectively replace the chemical agents.

Protein hydrolysates in cosmetics (6)-

There is growing consumer demand for "vegan" or "cruelty-free" cosmetics products. From ancient times, plant protein matrices in the form of cereal and flours as cosmetics to give shine to skin and hair. Protein hydrolysates are used in cosmetics for skin care to increase the elasticity and hydration of skin. Now wheat proteins are used in place of keratin for this purpose.

Protein hydrolysates as Biostimulants (7)-

Agro-industrial byproducts of animal origin (leather, viscera, feathers, and blood) and plant origin (vegetables, hay, legume crops) can be hydrolysed by acid or enzymes and these hydrolysates are excellent biostimulants for horticulture. They improve the performance of several horticultural crops including shoot, root biomass, and productivity. Application of protein hydrolysates to leaves and root, increases the N and Fe metabolism. This is because of several reasons such as increased soil microbial activity and the improvement of micronutrient mobility and solubility.

Safety considerations (3) (8)-

In United States use of Protein hydrolysates in food products is generally allowed and in Europe they have GRAS status. Similar to intact proteins, a history of safe use of the intake of their hydrolysates does not raise the concern about the safety provided proteolytic enzymes used are of Food Grade.



It is noteworthy that most of the applications as Bio peptides is based on animal studies a risk-based approach is required when used in foods.

When a novel ingredient such as Bio peptide is used where there is a change in nutritional value or metabolic effect that products might fall under novel food regulations. In India they may fall under FSS (non-specified food and food ingredients) Regulations 2017.

Protein hydrolysates Market (9)-

Protein hydrolysates market was USD 945.2 million in 2022 and is expected to grow to USD 1425.3 million by 2030.

It is expected to grow significantly in the coming years. This is because of rising awareness of the health benefits of Protein hydrolysates and also rising demand of functional foods and nutritional supplements.

Protein hydrolysates have come a long way from just an ingredient for microbial media to plethora of applications making them an important ingredient/ additive in food, medicine, agriculture, cosmetics, and biotechnology. Therefore, they are an important tool for the product developers.

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MEAT & **HUMAN DIET**

AUTHOR Ms Simran Vichare, Nutritionist, PFNDAI

From an evolutionary point of view as well as historically, humans have valued meat as a wholesome and highly symbolic diet. Meat has been consumed by humans and their hominin ancestors for more than three million years.

It has a complex role in human nutrition that includes evolutionary, nutritional, and cultural factors. Earlier, drier grasslands and semiforested areas expanded as a result of slow climate change. Although there were more grazing animals than in wetland forests, the availability of digestible plant foods decreased. This resulted in a change in nutrition toward fat and protein as well as the physiological and metabolic

changes that eventually gave rise to modern humans. Considering the evolutionary background of human diets, the nutritional content of meat, and its influence on current health is necessary to understand its significance.

To what degree can meat be considered as a part of the speciesadapted diet of humans, and therefore as an appropriate food from a physiological perspective? • Brain development:

Humans have larger brains than would be

expected for their body sizes because of "encephalization." It required energetic compensation to support a large brain. The gut was the only organ with size variation to



compensate for the metabolic demand of a larger brain. A higherquality diet with more energy-dense, lessdigestible foods that require less processing in the digestive system was needed, this matches a diet high in fat and protein derived from animals. This change in diet probably provided the nutrients needed for cognitive development. Iron, important fatty acids, and other minerals that are vital for brain development can be found in abundance in anat (1)





• Digestive changes: Due to our omnivorous nature, our digestive systems are capable of absorbing both plant and animal sources of nutrition. This adaptability to a variety of food sources is a result of evolution. The human gut is indicative of dependence on a highquality diet primarily consisting of meat, with a simple stomach, a comparatively extended small intestine, and a shortened colon and cecum. Humans have a unique digestive system that shows characteristics that support a diet higher in quality, i.e. a diet having meat.

• Dental changes:

Evolutionary changes in the human cranium and teeth are adaptations to changes in nutrition, especially the introduction of meat. Meat in the diet provided the nutrients needed for brain growth, resulting in greater cranial capacity. Simultaneously, modifications in the size, thickness, and shape of teeth and jaws indicate adaptations to a more diversified diet requiring less intense chewing. These evolutionary alterations reflect how dietary changes affect the physical growth of humans.

What are the key nutrients that meat provides that could potentially become challenging to obtain from other sources in meat-free diets? It has been stated that while developing food-based dietary guidelines, public health policy should consider the abovementioned evolutionary data. Because of the density and bioavailability of its nutrients, meat has become

an important component of diets nowadays. Limiting its consumption would mean that additional foods, supplements, or fortification would have to be consumed to get these nutrients (2).

Because meat has a high nutritional value and provides essential nutrients that are vital for various body functions, it plays a key part in the human diet. To fully understand its benefits and how it fits into a balanced diet, one must be aware of its nutritional profile. The main things that people on meat-free diets should be aware of are: 1) Protein:

The nutritional value of proteins varies. Because indispensable amino acids (IAA) are the building blocks for the synthesis of body proteins, it is important to take into account the quantity and digestibility of IAA in meals. As a result, protein quality matters. The Digestible Indispensable Amino Acid Score (DIAAS), which takes into account a food's IAA levels and provides calculations of its actual ileal digestibility, is the best way to describe the quality of protein. If all of the absorbed IAA are useful, a food receives a score of 1 or higher; if only some of the absorbed IAA are usable, the food receives a lower value.

DIAAS levels for meat range from 0.8 to 1.4, while values for the majority of plant proteins are significantly less due to complex plant cell structures and the presence of fibre and anti-nutritional factors. As meat includes all nine of the essential amino acids (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine) that the body is unable to produce on its own, it is a great source of complete protein. This is essential for hormone and enzyme production, as well as for the development, maintenance, and repair of muscles.



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After considering bioavailability, a survey revealed that more than 100 countries have insufficient

countries have insufficient protein supplies. Low dietary diversity, especially limited access to animal foods, was the reason for reduced bioavailability in these mainly lower-income nations (3). Despite the widespread belief that people in wealthy societies consume excessive amounts of protein-that is, more than the 0.8 g per kg of body weight recommended daily allowance-this statement fails to take into account the impact of highquality protein. Plant-based choices often have lower DIAAS values, so it is possible to meet the same protein target with them, but one will need to use special dietary techniques. The effects of dietary protein quality are significant not only for individuals with protein deficiencies but also for those with relatively lowcalorie intakes and daily protein targets above the RDA.

2) Micronutrients:

Meat is a rich source of vital micronutrients that are important to many physiological functions and have a major impact on general health. Vitamin B12 in particular among these vitamins since it is essential for red blood cell formation, DNA synthesis, and neuron function. Since meat is mostly found in animal products, it is essential for maintaining sufficient levels of B12, particularly in societies with minimal dietary diversity. Other B vitamins that are abundant in meat include riboflavin (B2),niacin (B3), and pyridoxine (B6). These vitamins are essential for maintaining healthy skin, energy metabolism, and neurological function.

In addition, vitamin D-found in meat, especially in fatty fish and liver-is necessary for the body to absorb calcium, maintain healthy bones, support the immune system, and reduce inflammation. Meat supplies significant levels of heme iron, which the body absorbs more easily than non-heme iron from plant sources. Heme iron is essential for oxygen transport and prevents anaemia. Another essential element that is often found in meat is zinc, which is necessary for wound healing, DNA synthesis, and immune system activity. Also, zinc is better absorbed from animal-sourced foods where it is in a proteinbound form. Meats and shellfish include selenium, which is necessary for thyroid hormone metabolism and antioxidant defence mechanisms. Because meat has a high bioavailability for many

micronutrients, the body can absorb and utilize them efficiently. This emphasizes the importance of meat in a balanced diet to prevent deficiencies and promote optimal health (4).For populations consuming majorly plant-sourced food and a lower proportion of animal-sourced food, higher recommended intakes have been set to account for the above-mentioned differences in bioavailability and prevent deficiencies (5).

3) Omega 3 fatty acids:

Although they are present in plants, especially α linolenic acid, the longer chain forms, EPA and DHA, are exclusively present in marine animals and land herbivores. Their significance is in their role as precursors for a variety of eicosanoids that influence the cardiovascular system and reduce chronic inflammation, as well as their importance for cell membrane structure and tissue health, particularly for the brain, heart, and retina (1). Hence consumption of EPA and DHA from animal tissue is necessary.





Points to consider while choosing meat:

Consuming meat has numerous health benefits but one should be aware while choosing a type of meat. Red meat (mutton, beef, pork, lamb) has high iron and B vitamins as compared with others but is also high in saturated fats hence associated with various health risks. Saturated fats can increase levels of LDL (low-density lipoprotein) cholesterol in the blood & hence high intake of red and processed meats is linked to an increased risk of coronary heart disease (6). It can contribute to weight gain and obesity thereby promoting inflammation, insulin resistance, and other chronic diseases. Whereas, white meat (chicken and fish) is leaner than red meat, lower in saturated fats, and a good source of protein. Some varieties (especially fish) are high in healthy omega-3 fatty acids which contribute to cardiovascular health by reducing triglycerides and lowering blood pressure. Hence one should reflect on these points while choosing the type of meat to eat considering their health.

What would be the implications of a substantial reduction in meat consumption on human nutrition and well-being at large?

The effects depend on several factors, such as how effectively populations and individuals can substitute other nutritional sources for the nutrients obtained from meat. Limiting meat consumption brings some potential risks, which differ depending on the population, context, and life stages that require specific nutrition for example, nutrient-dense, bioavailable foods to meet the needs of women of reproductive age, pregnant or nursing women, infants, young children, and older adults.

Developmental and cognitive issues arise when a strict vegetarian diet leaves shortages in these nutrients. Numerous studies conducted in low- and middle-income groups show children's behaviour, verbal ability, activity level, and cognitive development are all strongly associated with their intake of food derived from animals

(7).Reducing meat consumption without adequate dietary planning may result in deficiencies in important minerals including iron, zinc, vitamin B12, and omega-3 fatty acids, which may cause anaemia, weakened immune systems, and cognitive problems. Maintaining muscular mass and strength requires consuming enough protein, especially for elders. If substitute sources of protein are not available, there may be detrimental effects on the health and function of the muscles.

Apart from health outcomes, reducing meat consumption may affect food security in areas where meat acts as the main source of nutrients, particularly if alternative nutrient sources are more expensive or less readily available. A transition from meat eating would require modifications to agricultural methods and an increase in the production of plantbased diets. Farmers and other businesses that depend on the production of animals may have to deal with the economic effects of this. A large portion of many traditional and cultural diets include meat. Changes in culture and acceptance of new eating habits can be difficult to tackle.

Meat & Human Diet

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Comparison of agricultural resources needed for different meats:

One of the biggest problems of an increasing population while reducing the environmental challenges associated with food production is feeding. The table G below covers the e extent to which food (f production affects the o environment, particularly concerning land use and other points (8,9).

Environmental impacts of food production: Talking about the

	Pigs	Goat	Chicken	Seafood
Land use	Moderate- for growing feed crop	Moderate - for grazing	Less than others	Minimal
Water use	Moderate	Moderate- for feed crop irrigation	Less- for hydration of animals & feed crop irrigation	Variable- Depending on species & farming methods
Feed	Good FCR	Moderate FCR	Efficient FCR - requires less feed to produce a kg of meat	Variable FCR
Greenhouse emission	Moderate	Moderate- Produces methane	Low	Low to moderate

(FCR- Feed Conversion Rate- It is defined as the amount of feed required to produce one unit of body weight gain).

environmental impact of meats in general, the below image will give an overall picture of the environmental impact of various foods in terms of Greenhouse gas emissions across the supply chain. It outlines the emissions associated with land use change, farming, animal feed, processing, transport, retail, packaging, and losses.



The graph shows how crucial it is to recognize and take action against greenhouse gas emissions at every stage of the food production and consumption process. It highlights how important it is to adopt sustainable behaviours and make knowledgeable choices regarding purchases to reduce the effects of climate change.

Conclusion:

Meat is a nutrient-dense food that is ideal for meeting the dietary needs of humans. It has been shown to play a significant role in human evolution and it is still a valuable source of nutrition in the current environment, but to reduce any potential health hazards, it should be carefully taken within the guidelines of a balanced diet. Removal or large reductions of meat from the diet, as well as prevention of increases where consumption is low, either of an individual or population, carries a risk that must be appreciated when considering its value in future food systems.

But still, a nutritional gap in terms of protein deficiency is seen within many societies, the reasons could be affordability and accessibility. In cases like such, 'cultured meat' (labgrown/ cell-based meat) can be used. It is produced by cultivating animal cells in a controlled environment. bypassing the need for traditional animal farming. This technique has less use of resources hence environmentally sustainable and gives all customized nutritional benefits that can be beneficial in addressing problems of malnutrition & protein deficiency. Countries like Singapore, the US, and Israel have approved its production and as technology advances it shall be accepted by others too as the adoption of cultured meat could become a viable solution for many nutritional problems.

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ROLE OF ENZAMES IN BAAKERA PRODUCES



Baking is one of the oldest cooking method known to mankind. Since wheat meal was discovered, people have created a wide range of bakery goods. From the daily bread that is a staple food of many to the delicate pastries, bakery products are integral to our diets..

India is the second-largest producer of biscuits and breads in the baked goods sector and these products are consumed almost daily(1).Bread, cakes, cookies, biscuits, buns, and puffs are the most popular bakery items. In addition,

REPORTEY Ms. Sanyukta Telange, Food Technologist & Regulatory Support, PFNDAI

> Indian flatbreads like naan, kulcha, or chapati are commonly liked items. The common ingredients used are flour, water, yeast, and salt; additional ingredients are added depending on the product.

The production of bakery products involves:

• Mixing: Combining ingredients to form a uniform dough or batter.

• Fermentation and proofing: Allowing dough to rise through yeast activity, which enhances texture and flavour.

• Baking: Cooking the product at the right temperature and time to achieve the desired texture.

• Cooling and Packaging: Ensuring the product is properly cooled and packaged to maintain freshness.

Production of bread involves mixing ingredients to form a dough, which allows for the formation of a gluten network. Mixing needs to be just right as too much mixing will reduce the elastic properties of the dough, whereas undermixing may cause small unmixed patches which will remain unrisen giving a bread of poor quality. Fermentation involves yeast acting as leavening agents. Leavening agents cause the dough to expand by releasing gases into the mixture. Here yeast utilizes the sugar to produce CO2 and alcohol. Along with yeast, lactic acid bacteria also act as leavening agents for products like sourdough bread and dosa. The dough gradually transforms into a smooth, extensible dough with good gas-holding properties. The trapped gases from yeast fermentation create a structure resembling a sponge, with walls surrounding the air cells.

Kneading dough helps reduce large gas bubbles, forming smaller, uniformly

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distributed bubbles and creates the fine crumb structure required for bread. It is necessary to allow the dough to rest during fermentation. The dough fills with more gas bubbles during proving, and when this process has gone far enough, the dough is placed in the oven to bake.

During baking, the liquids are evaporated, and gases expand due to the heat which in turn increases the size of the dough. This is, referred to as "ovenspring". The reducing sugars formed during dough making and leavening, undergo caramelization or Maillard reaction to create brown crust. Baking thus transforms raw dough into a baked good with a firm, dry crust and soft crumb.

However, during storage the bread undergoes staling. It shortens the products' shelf life, which increases the firmness of the crumb and lessens its flavour and aroma, all of which affect consumer acceptance. Staling is caused by starch retrogradation. The crystalline structures of two components of starch, amylose and amylopectin are lost when heated. These structures recrystallize when they cool. When the baked bread cools, amylose instantly recrystallizes, which is why we can slice the bread without it collapsing. Amylopectin realigns during the storage period. This increased crystallinity of starch, release of water from the system leads to the changes in texture of the bread, making it hard and crumbly

(2, 3, 4, 6).

Flatbreads like Naan, Pita are prepared similarly, with the exception that some are unleavened, such as the Indian Roti or Chapati. These can be made quickly, as they do require little to no proofing, and can be cooked in just a few minutes by placing them on a hot surface, such as a pan or the wall of an oven (used for Tandoor roti). The high heat causes bubbles to quickly vaporize, creating a temporary puff. In cases where puffing is not desired, such as with crackers, the dough is "docked" or poked to prevent puffing. The same goes for biscuits and pastries, except that they use shortenings like butter in the dough and are leavened using baking powder rather than yeast. Fats also create a flaky texture in pastry doughs, forming horizontal layers that separate and expand during baking (8). When making cake, batter is used

in place of dough, and more sugar and fat are added than flour to reduce the toughening due to the formation of gluten. The ingredients mixed together form an emulsion and air is incorporated as well. The lecithin in eggs stabilizes the emulsion giving a smooth and uniform texture to the batter. The batter is then baked at the appropriate temperature and is ready(5, 6).

How do Enzymes help?

Proteins like glutenin & gliadin in wheat flour are one of the major components of the flour. A minor part of these proteins has endogenous enzymes like amylase and protease but are too low to be of significance, hence malted barley flour or enzymes are added for optimal activity (6). Many challenges can arise during the making of these products which can be resolved by enzymes. For bread and cakes, common issues include uneven texture, lack of colour on the crust, and reduced volume, often resulting from underfermentation and insufficient sugars.



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Amylases are particularly effective in reducing these problems. These enzymes break down starch into fermentable sugars, which not only aids yeast fermentation but also improves bread flavour and crust colour through the Maillard reaction. The breakdown of starch by amylases results in oligosaccharides, which enhance the sweetness and colour of the crust. Amylases act as anti-staling stimulates the activity of beneficial bacteria in the gut. Lower loaf volume is because of poorly hydrated gluten. Xylanases make the free water available for the gluten thus raising the loaf volume and enhancing oven spring (7,9,10).

In various baked goods, reducing mixing time, and regulating gluten strength is critical for optimal dough

agents by reducing starch retrograda tion, ensuring the bread remains fresh for a longer



period. They help maintain a softer texture and extend the shelf-life of bread and cakes.

In bread, achieving adequate oven spring and proper dough handling can be challenging. Xylanases derived from various microorganisms, break down the insoluble arabinoxylan which interferes with the gluten network. It improves gas retention by stabilizing the gas cells which creates a uniform crumb structure. Xylanases increase the concentration of beneficial arabinoxylo-oligosaccharides (AXOS), enhancing the nutritional profile of the bread. AXOS display prebiotic properties as it

consistency. Proteases are helpful in this regard. They break down peptide bonds in gluten proteins. They soften highgluten mixtures and regulate the

gluten strength making the dough easier to handle. Optimal use of enzyme makes the gluten film extensible and helps retain more gas however excessive enzyme may weaken the dough and produce bread of poor quality. In pastries, biscuits, and cookies, proteases are added to reduce gluten elasticity as a more tender crumb is desired. Proteases minimize dough shrinkage after moulding and sheeting and improve the spread ratio of cookies. This ensures the final product has a desirable texture and consistency.

Lipases are useful as they improve dough strength, stability, and machinability.



These enzymes break down triacylglycerols (TAG), improving the distribution of fats within the dough. Stronger polar and hydrophilic structures are formed during this breakdown, and as they combine with gluten and water, they form a stronger gluten network (10). Firstgeneration lipases are naturally available. They remove the fatty acids from 1 and 3 positions in TAG enhancing dough strength and stability. Secondgeneration and thirdgeneration lipases are protein-engineered enzymes and are said to produce better results in dough processes that involve no time and high-speed mixing. In comparison to the firstgeneration lipases, the second-generation lipases act simultaneously on TAG, diacylgalactolipids, and phospholipids, resulting in more polar lipids, a larger volume increase, improved dough stability and a fine breadcrumb structure. Furthermore, a thirdgeneration lipase improves the volume and crumb structure by increasing the expansion of the gluten network. Lipases also retard staling by delaying starch retrogradation.



Maintaining dough elasticity and springiness is vital for the overall structure of the final baked product.

Transglutaminases,

enhance the dough's elasticity and water-holding capacity. This results in a dough that is stable and springy, giving a better final product. Preventing oxidation in bread dough is another important aspect to consider. Oxidases, such as glucose oxidase, extend the shelf life by removing residual glucose and oxygen. This enzyme promotes the formation of disulfide bonds in the aluten network, enhancing dough strength, gas retention, and overall bread volume. Sourced mainly from Aspergillus niger, glucose oxidase serves as an alternative to potassium bromate, a carcinogenic substance banned in many countries. Lipoxygenase helps bleach flour pigments by oxidizing carotenoids, resulting in a whiter and more visually appealing crumb.

Apart from these specific applications, other enzymes also play significant roles in improving bakery products.

Asparaginase, for

example, reduces acrylamide formation during baking. This enzyme converts asparagine into aspartic acid and ammonium, eliminating the precursor to acrylamide, a potential human carcinogen. Laccase enhances crumb structure, softness, dough strength, and stability. It reduces stickiness and improves dough machinability, making the baking process more efficient.

Gluten-free bakery

products - Since more and more people are becoming intolerant to gluten, they have to consume a glutenfree diet. This presents a challenge as bread and other bakery products are staples to many. Gluten-free products differ in sensory properties as compared to traditional bakery products and have shorter shelf life. Breads without aluten typically have a less elastic crumb that solidifies more quickly and crumbles easily. To overcome this enzymes like amylase, protease, transglutaminase and oxidases are used in glutenfree products to prevent the retrogradation of starch and improve dough characteristics. Many products are made by using milled legumes, seeds, nuts and naturally gluten-free cereals like rice and oats. To achieve sufficient bread volume, crumb softness, and shelf life, basic glutenfree ingredients like glutenfree flour and starches, hydrocolloids, fruit or vegetable fibre, proteins

from various sources and enzymes are added (11).

Since enzymes are thought of as clean-label compounds, they can be used as an alternative to chemical compounds when making bakery products. They remain inactive after baking as their protein structure is denatured. Hence, these enzymes not only solve common baking problems but also improve the overall quality of baked goods, ensuring better texture, flavour, and shelflife.Psychrophilic enzymes are being suggested as additives in the baking industry as they have higher activity and stability at lower temperatures. These enzymes can be beneficial in the early stages like mixing and proofing that are carried out at lower or room temperatures. Researchers have shown that lower dosages of psychrophilic xylanases can achieve maximal bread volumes. Due to their higher productivity at low temperatures compared to their mesophilic or thermophilic alternatives, these enzymes can be economically advantageous and have great potential in terms of energy savings (7).



Enzymes play a vital role in enhancing the quality, texture, and shelf-life of these bakery products. From bread and cakes to biscuits and pastries, they address a wide range of challenges faced during production. The organized bakery sector is projected to grow by 70% by 2030, fuelled by investments in research and development, skill enhancement, and the introduction of innovative products(1). With ongoing research and development, enzymes will continue to improve baking, ensuring that consumers enjoy highquality baked goods worldwide.

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WEBINAR ON ROLE OF BALANCED DIET AND CONTROLLED PORTION



Protein Foods & Nutrition Development Association of India (PFNDAI) organized a Webinar on 'Role of Balanced Diet and Controlled Portion' on 21st June 2024. The event was sponsored by Mondelez International.

The welcome address of the

webinar was given by Dr. Shashank Bhalkar, Executive Director at PFNDAI.He thanked



Mondelez International for sponsoring the webinar. He stated that this webinar will cover interesting topics about balanced diets and portion sizes. For proper digestion, it is said that at least 1/3rd of your stomach should be kept empty. Such

REPORT BY Ms. Sanyukta Telange, Food Technologist & Regulatory Support, PFNDAI

> eating practices also help to reduce intake of calories and overeating. With modern culture, people have turned to packaged foods due to lack of time. Food scientists and product developers have developed a range of processed foods that are nutritious. Understanding a food label is critical as it helps consumers make an informed decision to buy the right foods. Dr. Bhalkar assured that everyone present in the session will be enriched with knowledge.

Ms. Sanyukta Telange,

Food technologist & Regulatory support at PFNDAI introduced the speakers for the session,



providing a brief about their background, qualifications, and expertise.

Dr. Rita Patil,

Professor at MNWC SNDT Women's University, delivered the



talk on 'Role of a balanced diet in maintaining a healthy lifestyle and Preventing nutrient deficiencies.'

She stated that a balanced diet is crucial for overall health and well-being, as it provides energy, fuels muscles, repairs injured tissue, aids growth, and contributes to overall health. A diverse diet should include cereals, pulses, legumes, meats, vegetables, and fruits. Protein intake should be increased, as India predominantly consumes carbohydrates. She elaborated on "My Plate", RDA (Recommended Dietary Allowances), EAR (Estimated Average Requirement), and TUL (Tolerable Upper Limit). Carbohydrates are energygiving staples, while fats and oils are concentrated sources of energy.

Proteins are body-building foods and are essential for cell structure. She further stated that malnutrition has increased over the years, with micronutrient deficiencies still a problem. She listed the factors contributing to obesity including lack of physical activity, unhealthy eating behaviours, and genetics. Maintaining normal weight requires balanced meals, regular exercise, or moderate physical activity. She elaborated on the misconception that processed foods cause obesity. Processed foods extend the shelf life. maintain sensory properties, improve nutritive properties, ensure safety and most importantly are convenient. She concluded the talk by highlighting the need for good nutrition for health and well-being, moderate physical activity and not following a sedentary lifestyle.

Ms. Pei Gee

Chew, Senior Manager, Nutrition Strategy & Communicatio ns, Mondelez International



gave a talk on 'Mindfulness while eating and making food choices.' She started the talk by stating that snacking is a common global practice. State of snacking report published by Mondelez shows that 70% of consumers snack twice

daily. Today, consumers are more concerned with their health and consider nutritive values and portion size when making food choices. They also pay attention to hunger levels and sensory experiences. Portion size is crucial, and studies have shown that oversizing portions leads to increased daily energy intake. Satisfaction refers to the general appreciation of food within a broader context, influenced by sensory properties, energy content, appetite/hunger, and food value. She highlighted that adjusting portion size to deliver satisfaction can help consumers control portions, especially when discussing prepacked foods. Mindful eating involves making conscious and deliberate food choices, focusing on the sensorial experience and being aware of hunger and satiety signals. Six behavioural tips were displayed to help consumers guide them toward mindful eating. She concluded the talk by stating that portion size, satisfaction, and mindfulness play crucial roles in promoting mindful eating and reducing calorie consumption.

Ms. Shipra

Sehgal, Manager, Scientific Affairs and Regulatory Affairs at Mondelez International talked about



'Understanding food labels and serving sizes in packaged foods'.She

discussed the importance of food labels in consumer decision-making. In India, authorities like FSSAI and Legal Metrology play a crucial role in setting labelling criteria. The food label display ingredients that are used in the manufacture of food in descending order of their composition by weight or volume. The list of ingredients additionally includes information about additives used in the product. These additives are evaluated by local and international bodies like FSSAI, CODEX, JECFA (Joint FAO/WHO Expert Committee on Food Additives), and EFSA (European Food Safety Authority). Other than Ingredients list, FSSAI also mandates to declare the 8 major ingredients that trigger food allergies. Labels also display a declaration for certain specific ingredients like polyols and sweeteners etc. Nutritional information is another important parameter, after the review of labelling regulations in 2020 an elaborated format for 100g, per serve, and % RDA per serve was

established, the extensive nutritional information helps consumers make informed choices. In India, Advertising and claims are governed by regulatory framework and well-known bodies which are Food Safety and Standard Authority of India (FSSAI), the Advertising Standards Council of India (ASCI) and Department of Consumer Affairs, Consumer Protection Act, 2019, FSSAI advertisement and claims regulation has given a definite framework to define the claims and its criteria. Ms. Shipra emphasized the importance of simplifying consumercentric information on labels to empower consumers to make the right choices.

After every presentation, Dr. Bhalkar coordinated the questions raised by the attendees. The speakers enthusiastically answered the questions raised.



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Limited, Herbalife. India: Ms. Nitika Vig, Nutrition Strategy and Comm Sr. Specialist, Mondelez International. Ms. Nupur Agarrwal, Manager Nutrition Science, ITC Limited as

panellists.





Dr. Jasvir asked the questions to each panellist. He moderated the session well and expressed that this discussion would bring out areas of importance and help continue the journey toward healthy lifestyles. Dr. Alka emphasized the importance of a healthy lifestyle, including proper nutrition, optimal activity, stress management, and sleep quality. She highlighted the need for 0.8-1g protein per kg body weight, which is often overlooked in Indian diets. contributing to metabolic syndrome. Dr. Veena highlighted the importance of a healthy lifestyle, emphasizing physical activity for physical and mental health. She elaborated on portion and serve sizes, labelling information, and mindful eating to help consumers balance their diets and maintain physiology. Ms.

Nupur emphasized the food industry's role in promoting a healthy lifestyle, the need for consumers to read labels, and classify food as a meal or a snack. She also highlighted that the food industry needs to create awareness and expel misleading claims and notions on social media. Ms. Nitika discussed the evolution of consumer snacking patterns in India, emphasizing the importance of mindful snacking. She highlighted the growing awareness of portion size and sustainable snacking, particularly among the younger population. She also highlighted Mondelez's voluntary initiative to display a mindful portion logo, which effectively communicates its message.

At the end of the session,

Ms. Samreen Shaikh, Jr.

food technologist at PFNDAI gave a vote of thanks to the webinar sponsor,



speakers, and panellists, along with her PFNDAI team members for making the webinar a success. She also thanked the attendees for patiently attending the webinar.

The entire webinar recording is available on the following link:

https://fb.watch/ttUDSboa as/

REGULATORY ROUND UP

Dear Readers, Please find below new notifications, orders, etc. since the last round-up

Provision to FBOs to update the filed modification application of

<u>license/registration in FoSCoS:</u> Under the present system, once a license is under the modification process, no new modification is permitted till the modified license is issued.

This was causing a delay. In line with the increasing ease of doing business, FOSCOS has now been modified to facilitate FBO to add a new modification when the previous one is still in the process.

Unauthorized use of liquid Nitrogen in food by Food serving establishments/ restaurants, bars etc.: Unauthorised use of liquid nitrogen for making food items look attractive may result in direct consumption which is hazardous to health. The advisory suggests that such a



AUTHOR Dr Shashank Bhalkar, Executive Director, PFNDAI executivedirector@pfndai.org

use will be considered noncompliance and a violation of the FSS Act 2006.

Validity of FSSAI recognised

Food Testing Laboratories: A list of FSSAI recognised laboratories with NABL validity as on 05.06.2024 is published.

<u>Clarification regarding</u> <u>selling/marketing of</u> <u>Reconstituted fruit juices as</u> 100% Fruit Juices: As per Food

Authority, the claim "100 fruit juice" in a product which is prepared by reconstituting fruit juice concentrate is misleading and not in line with the regulation.

Therefore, FBOs have been requested to exhaust the present laminate with such claims before 01.09.2024. Further, the order states that the word "reconstituted" shall appear under the list of ingredients.

Re-operationalisation of draft FSS (Health Supplements, Nutraceuticals, FSDU, FSMP, and Prebiotic and Probiotic Food) Regulations, 2022 : This order re-operationalises provisions in the above draft with effect from 01.01.2024. This allows the use of all the food additives and GMP table as per Codex in all categories in various formats till there is finalisation of notification of these regulations.

Re-operationalisation of FSS (Licensing and Registration of Food Business) Amendment Regulations, 2021: This order re-operationalises the above regulations of 2021 for the various sections of licensing and registration. The enforcement of these regulations shall commence only after final regulations are notified.

Re-operationalisation of FSS (L and D) Amendment Regulations 2022 related to Labelling Requirements of the non-retail container, minimally processed food, tolerance limit, warning statement related to pan masala, etc: Provisions regarding labelling requirements for various products mentioned above were notified on 30.11.2024. These are re-operationalised from 01.01.2024.



FSSAI test methods for testing fortificants (Iron, Vitamin B9, and Vitamin B12) in Fortified Rice, Fortified Rice Kernel, and Vitamin-Mineral Premix for

Fortified Rice Kernel : The order makes testing of Fortified Rice (FR), Fortified Rice Kernel (FEK), and Vitamin-Mineral Premix for FR mandatory by all the FSSAI notified testing laboratories only by FSSAI test methods. The reference for the methods is given in the order. The laboratories which do not comply will be removed from the approved list.

Directions to FBOs to prohibit

sale/food recall in respect of **Unsafe Food** Samples : This order is related to sampling by Food Safety



Officers and subsequently FSSAI primary testing laboratory and declaring the product as "Unsafe". Under these circumstances, the Designated Officer shall direct the FBO to stop the sale of the lot declared as unsafe. The FBO can exercise the option for reanalysis by the reference laboratory which shall be considered as final. If the

reference laboratory confirms the primary laboratory findings(that the product is unsafe) or the FBO does not opt for

reanalysis, the Designated Officer shall direct the FBO to initiate product recall as per FSS (Recall) Procedure.

Notice for inviting stakeholders' comments on the

Basic Food Import **Clearance Fee** (BFICF): The importer or custom house agent shall file an Integrated Declaration form



and shall pay the nonrefundable Basic Food Import Clearance Fee (BFICF). It is proposed to charge Rs. 8400 plus GST per Bill of Entry as the basic fee upon receiving the consignment. FSSAI will bear all expenses of visual inspection, Laboratory Testing fees, etc. comments and suggestions are invited from the stakeholders on this basic fee on or before the 15thJuly 2024 in the prescribed format attached with the order.

Draft Food Safety and Standards (Food Products Standards and Food Additives) Amendment Regulations, 2024: This draft notification is an amendment related to various

standards such as ultrapasteurization, Whey Protein **Concentrate and Whey Protein** Isolate, Textured soy protein, High Fructose Corn Syrup (HFCS), Saffron, Juniper berries etc. This is published on 5th June 2024 and is circulated for comments/suggestions to be submitted within sixty days

Draft notification on Food Safety and Standards (Food Products Standards and Food Additives) Amendment Regulations, 2024: This draft

notification is an amendment in standards of Synthetic Syrup, Culinary pastes/ Fruits and vegetable



sauces, Maize flour, Flattened rice etc. These are circulated for comments/ suggestions within sixty days of the Gazette notification.

Draft Notification of Food

Safety and **Standards** (Alcoholic Beverages) Amendment Regulations, 2024: There is an amendment in the



regulation regarding the value of "Esters expressed as ethyl acetate" in the case of Fruit Wine (other than Grape wine). These are circulated for comments/suggestions within sixty days of the Gazette notification.



An omega-6 fatty acid may reduce the risk for bipolar disorder Science Daily April 30, 2024

A genetic propensity to higher circulating levels of lipids containing arachidonic acid, an omega-6 polyunsaturated fatty acid found in eggs, poultry, and seafood, has been found to be linked with a lower risk for bipolar disorder, according to a new study in Biological Psychiatry, published by Elsevier.

This new evidence paves the way for potential lifestyle or dietary interventions. Bipolar disorder is a complex and challenging mental health condition that affects millions of people worldwide. The new research findings shed light on the role of metabolites, specifically lipids, in the development and progression of the disorder. By identifying specific metabolites associated with bipolar disorder, researchers hope to develop targeted interventions that address the underlying

RESEARCH IM HEALTH & NUTRITION

metabolic imbalances contributing to the disease.

The study's focus on the FADS1/2/3 gene cluster and its role in mediating the association between bipolar disorder and lipid levels provides valuable insights into the biological mechanisms underlying the condition. The discovery of a potential causal relationship between arachidonic acid and bipolar disorder opens up new possibilities for preventive and therapeutic interventions, such as dietary supplements or targeted nutritional strategies. By addressing metabolic imbalances early in life through proper nutrition, it may be

possible to reduce the risk of developing bipolar disorder and improve overall brain health and functioning. The research paves the way for future studies to explore the link between metabolites and mental health disorders, offering hope for more effective treatment options and personalized interventions for individuals living with bipolar disorder.

(Stacey et al. A Metabolome-Wide Mendelian Randomization Study Identifies Dysregulated Arachidonic Acid Synthesis as a Potential Causal Risk Factor for Bipolar Disorder. Biological Psychiatry, 2024; https://doi.org/10.1016/j.biop

sych.2024.02.1005)

New research shows ' profound' link between dietary choices and brain health

Science Daily April 24, 2024 University of Warwick

The groundbreaking research published in Nature offers significant insight into the powerful connection between diet and brain health.

The study's findings underscore the importance of maintaining

PFNDAI Jul 2024

a healthy, balanced diet for optimal cognitive function, mental wellbeing, and overall brain health. By analysing the dietary preferences of a large sample of participants, researchers were able to pinpoint the positive impact of a varied diet on brain health, including increased grey matter and superior cognitive performance.

The implications of this

research extend beyond individual choices to highlight the need for public policy interventions that promote accessible and affordable healthy eating options. Lead author Professor Jianfeng Feng emphasizes the importance of establishing healthy food preferences early in life, urging families and schools to offer diverse and nutritious meals to support physical and mental health.



Co-author Wei Cheng stresses the importance of fostering nutritional awareness and healthier eating habits across diverse populations. With the growing body of evidence linking diet to brain health, it is



What we eat can impact our health as well as the environment.

Many studies have looked at the impacts of diets in very general terms focused at the level of food groups. A new study led by researchers at the University of Tokyo explores this issue following a more nuanced dishlevel approach. One of the benefits of this kind of study is that people's connections with their diets vary around the world and have strong cultural clear that action is needed at both the individual and societal levels to promote overall public health and well-being. (Zhang et al. Associations of dietary patterns with brain health from behavioral,

associations. Knowledge of the impacts of diets using dishes rather than broad food groups can help individuals make informed choices and those in the food industry improve their practices.

The study's findings highlight the importance of considering both nutritional and environmental factors when making dietary choices. By analysing individual dishes rather than broad food categories, researchers were able to uncover specific tradeoffs and patterns that can help consumers make more informed decisions about their meals. This nuanced approach also takes into account cultural preferences and ingredient availability, emphasizing the need for context-specific strategies to promote sustainable eating habits.

neuroimaging, biochemical and genetic analyses. Nature Mental Health, 2024; <u>https://www.nature.com/articl</u> <u>es/s44220-024-00226-0</u>)

The researchers advocate for a mixed diet approach that offers a balance between meeting daily nutrient requirements and minimizing carbon footprints. This strategy not only supports good health outcomes but also contributes to environmental sustainability. By choosing a variety of dishes with diverse ingredients, consumers can enjoy a wider range of flavours while making environmentally conscious choices. The study underscores the idea that small changes in dietary habits, such as incorporating more plantbased options and moderating consumption of certain items, can lead to positive outcomes for both personal health and the planet.

(Yin Long et al. Mixed diets can meet nutrient requirements with lower carbon footprints. Science Advances, 2024; 10 (15) <u>https://www.science.org/doi/1</u> 0.1126/sciadv.adh1077)

New study challenges one-size-fits-all approach to vitamin D supplementation guidelines

Science Daily May 2, 2024

A new study from Trinity College Dublin scientists, sheds light on the complexities of achieving optimal vitamin D

status across diverse populations.

Despite substantial research on the determinants of vitamin D, levels of vitamin D deficiency remain high. The study was recently published in the journal Clinical Nutrition.

Dr. Margaret M. Brennan's research on vitamin D levels among different ethnic groups at northern latitudes sheds light on the importance of addressing vitamin D deficiency as a population health issue. By analysing data from a large cohort in the UK, the authors were able to identify key determinants of vitamin D status and how they interact with each other. The study revealed that ambient UVB levels play a crucial role in vitamin D synthesis, even in regions with limited sunlight like the UK.

Professor Lina Zgaga, the principal investigator of the study, emphasized the need for tailored recommendations for vitamin D supplementation based on individual factors such as age, sex, BMI, cholesterol levels, and vitamin D supplementation habits.

PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

The findings suggest that a onesize-fits-all approach may not be effective in optimizing vitamin D status, and personalized strategies should be considered. Co-principal investigator Rasha Shraim highlighted the influence of natural environmental factors, like sunlight, on health and encouraged researchers and public health bodies to consider these factors in their work. Overall, the authors hope that their research will contribute to the development of more targeted guidelines for vitamin D supplementation and lead to further discussions on optimizing vitamin D status for better health outcomes.



Participants with slower brain aging had nutrient profile similar to Mediterranean diet

Scientists have long been studying the brain with a goal of aiding healthier aging. While much is known about risk factors for accelerated brain aging, less has been uncovered to identify ways to prevent cognitive decline. The study's findings are significant because they offer a

Bacopa and the brain: Study highlights mood and memory benefits

By Asia Sherman 29-Mar-2024 -NutraIngredients USA

A first clinical trial sponsored by Indian ingredient supplier Samriddh on the effects of its Bacopa monnieri extract reports significant

alimpse into how specific nutrients can impact brain health and cognitive function as individuals age. By identifying a nutrient profile associated with slower brain aging, researchers can potentially develop interventions to promote healthy brain aging and cognitive performance. The study's comprehensive approach, which combines brain imaging, blood biomarkers, and cognitive assessments, provides a more robust understanding of the relationship between nutrition and brain health than previous studies that relied on food frequency questionnaires.

The researchers' future plans to conduct randomized controlled trials to isolate specific nutrients and assess their impact on cognitive function

improvements to emotional and cognitive well-being in a group of healthy adults.

"This is the most comprehensive single study done on Bacopa, and the results of our study demonstrate the potential of Bacopa extract as a safe and effective ingredient to support memory, cognition, stress and sleep quality in healthy adults," said Aditya Jain, founder and CEO at Samriddh. The study, published in the Journal of Psychiatry and (Brennan et al. Ambient ultraviolet-B radiation, supplements and other factors interact to impact vitamin D status differently depending on ethnicity: A cross-sectional study. Clinical Nutrition, 2024; 43 (6): 1308. <u>https://www.clini</u> calnutritionjournal.com/article /S0261-5614(24)00113-4/fulltext)

and brain health could pave the way for personalized dietary interventions to support brain health in aging populations. Additionally, the upcoming special collection in the Journal of Nutrition, focusing on nutrition's impact on brain health, will further contribute to the growing body of research in this field. Overall, the study highlights the importance of nutrition in maintaining optimal brain health and cognitive function, and the potential for targeted interventions to support healthy brain aging.

(Christopher E. Zwilling, Jisheng Wu, Aron K. Barbey. Investigating nutrient biomarkers of healthy brain aging: a multimodal brain imaging study. npj Aging, 2024; 10 (1) <u>https://www.nature.com</u> /articles/s41514-024-00150-8)

Cognitive Behavior was conducted by researchers at the BGS Global Institute of Medical Sciences and Leads Clinical Research and Bio Services in Karnataka, India. Bacopa monnieri, an herb known as Brahmi or water hyssop, has a long history of use in Ayurveda as a nerveslash-brain tonic. A perennial creeper found in marshy wetlands throughout South and Southeast Asia, its bioactive bacosides are thought to interact with the brain's

dopamine and serotonin systems and promote neuron communication.

Enhancing the bioavailability of Bacopa is crucial to maximizing its cognitive benefits, as highlighted by recent research conducted by Samriddh. By utilizing their proprietary BioEnhanced Active Technology (BEAT), B-Lit Bacopa has been shown to have improved water solubility, leading to better PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

absorption in the body. In a clinical trial involving 80 healthy adults, significant improvements in memory, focus, concentration, reasoning, and mental flexibility were observed in those taking B-Lit Bacopa compared to a placebo group. Additionally, reductions in cortisol levels and an increase in BDNF levels were noted, indicating positive effects on neuroplasticity. These findings, in conjunction with the innovative bioavailability technology, represent a significant advancement in the field of cognitive health and overall well-being. (https://www.gavinpublishers.c om/article/view/effect-ofbacopa-monnieri-extract-onmemory-and--cognitive-skillsin-adult-humans-a-randomizeddouble-blind-placebocontrolled-study)

Gut health: Why this consumer trend is here to stay By Donna Eastlake 14-Mar-2024 - Food Navigator USA

The growing interest in gut health and the microbiome has led to a surge in the development and consumption of gut-friendly products.

These products, which contain prebiotics and probiotics, aim to support the beneficial bacteria in the gut and promote overall digestive health. Consumers are increasingly aware of the connection between gut health and overall well-being, with scientific research highlighting the importance of a healthy gut in maintaining a strong immune system and preventing chronic diseases.

As awareness of the gut microbiome continues to grow, the market for gut-friendly products is expanding rapidly. Food and drink companies are now focusing on creating innovative products that cater to consumers looking to improve their gut health naturally. Probiotic-infused products, such as yogurt,

Eating fatty food in the days leading up to surgery may prompt a heightened inflammatory response in the brain that interferes for weeks with memory-related cognitive function in older adults -- and, new research in animals suggests, even in young adults.

The study conducted by researchers at The Ohio State University sheds light on the detrimental effects of a highfat diet and surgical procedure on memory in aged and young adult rats. The research demonstrated that just three days on a high-fat diet caused impairments in fear-related memory that lasted for up to two weeks in aged rats, similar to the effects seen in younger rats that underwent surgery after consuming fatty food. The team identified brain inflammation as the underlying cause of these memory deficits, specifically pointing to a protein that activates the immune response.

Moreover, the study illustrated that taking a DHA omega-3

kombucha, and kefir, have become increasingly popular, with sales skyrocketing in recent years.

Additionally, the rise of personalized gut-health solutions, such as those offered by brands like Zoe, is expected to further drive the growth of the gut-friendly trend in the future. With advancements in technology and consumer understanding, the future of gut health products looks promising as more people prioritize their digestive health in their overall wellness routine. (https://www.food navigator-usa.com/Article/ 2024/03/14/Gut-health-Why-thisconsumer-trend-is-here-to-stay)

fatty acid supplement before the unhealthy diet and surgical procedure prevented the memory issues associated with both interventions. This finding suggests that DHA supplementation may have a protective effect against inflammatory

Fatty food before surgery may impair memory in old, young adults Science Daily March 15, 2024

PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

responses in the brain triggered by a high-fat diet and surgery. The research highlights the importance of understanding how everyday life events, such as diet and medical procedures, can impact brain health and

Blueberry Ingredient

Nutraceuticals World Breaking

These findings suggest that the

consumption of a whole-

low-dose wild blueberry

formulation, may have

specifically in the form of a

blueberry ingredient,

May Improve

Cognition in

Older Adults

News 04, 24, 24

cognitive function, especially in aging individuals who may already have a primed inflammatory profile in the brain. This study underscores the potential benefits of incorporating DHA supplements

potential benefits for cognitive function in older adults.

The standardized high concentrations of polyphenols present in the blueberry extract are believed to play a role in improving cognitive performance, particularly in areas such as executive function and memory.

The results of the two clinical trials conducted by Givaudan and the University of Reading researchers provide valuable insights into the potential cognitive benefits of blueberry supplementation. as a preventive measure to mitigate memory impairments in response to inflammatory triggers.

(https://www.sciencedirect.co m/science/article/abs/pii/S088 9159123004105?via%3Dihub)

While the effects observed were subtle and limited to specific measures, such as blood pressure and post-lunch cognitive decline, the findings indicate a promising avenue for further research in this area.

With cognitive impairment being a common challenge faced by aging populations, interventions like blueberry supplementation could offer a natural and potentially effective way to support cognitive health in older adults. (Nutrients 2024, 16(8), 1180; https://doi.org/10.3390/nu16081180)

Both low-FODMAP and low carb/high fat/high protein diets reduced symptoms significantly more than medications over a month-long period.

The results of this study highlight the importance of dietary interventions in the treatment of IBS, and suggest that dietary changes may be more effective in alleviating symptoms than medication alone.

The low-FODMAP diet and the low carb/high protein/high fat diet both showed significant improvements in IBS symptoms, with a higher percentage of participants experiencing relief compared to the medicationonly group.

The fact that participants in

the dietary treatment groups still experienced significant symptom relief at the sixmonth follow-up, despite partially returning to previous eating habits, further supports the efficacy of these dietary patterns in managing IBS symptoms long-term.

The study's findings have implications for the development of personalized treatment plans for individuals with IBS, as they suggest that different dietary patterns may be more effective for different patients based on their specific symptoms and needs.

Further research in this area may help clinicians tailor treatment plans to individual patients, ultimately leading to more effective symptom management and improved Dietary Treatment More Effective than Medicines for IBS Nutraceuticals World Breaking News 04.23.24

quality of life for those living with IBS.

Overall, this study emphasizes the significance of diet in the management of IBS, and highlights the potential benefits of dietary interventions as a first-line treatment for IBS patients.

(https://www.thelancet.com/j ournals/langas/article/PIIS2468 -1253(24)00045-1/abstract)

Shatavari Root Extract May Benefit Menopause Symptoms: Study

Nutraceuticals World Breaking News 04.10.24

A branded extract Aspuruswas associated with reductions in self-reported hot flashes, night sweats, and mood/sleep issues in 70 women.

These findings are particularly important in the context of the growing interest in natural and plant-based remedies for menopausal symptoms. Aspurus, derived from the Shatavari plant, offers a promising alternative for women who are seeking relief from symptoms like hot flashes and mood swings without the potential side effects of conventional hormone therapies. The results of this study provide scientific evidence to support the use of Shatavari extract in menopausal support supplements.

The positive outcomes observed in the study also suggest that further research into the efficacy of Shatavari extract in addressing menopausal

Study Shines Light on Cholesterol-Reducing Mechanism of Probiotic Blend

Nutraceuticals World Breaking News 04.11.24

A branded probiotic mix AB-Life significantly reduced non-HDL cholesterol by changing bile salt metabolism in the gut, a new human clinical trial found.

The findings from this study are significant in that they shed light on the potential mechanism of action by which probiotics may impact cholesterol levels and ultimately cardiovascular health. By demonstrating the effect of specific probiotic

strains on bile acid metabolism, lipoprotein profiles, and LDL particle size, researchers have provided valuable insights into how these probiotics may offer protection against atherosclerosis and other cardiovascular diseases. The ability of blend of strains, Lactiplantibacillus plantarum KABP 011, KABP 012, and KABP 013 to lower cholesterol levels and reduce markers associated with cardiovascular risk highlights the therapeutic potential of probiotics in the management of dyslipidemia and other metabolic disorders.

As cardiovascular diseases continue to be a leading cause of mortality globally, the development of effective interventions is paramount. The research conducted on AB-Life

High-fat, sugary diets in teens may permanently harm memory, study flags 16 Apr 2024 Nutrition Insight A mouse-model study suggests that teenagers who consume a diet high in fats and sugars may experience long-term disruptions in their brain's memory function. symptoms is warranted. With the increasing demand for women's health supplements, there is a need for safe and effective natural remedies that can help women navigate the challenges of menopause. Aspurus represents a potential solution that can improve the quality of life for women experiencing menopausal symptoms and offers hope for a more comfortable transition into this new phase of life. (https://www.cureus.com/artic les/235469-efficacy-and-safetyof-shatavari-root-extract-forthe-management-ofmenopausal-symptoms-adouble-blind-multicenterrandomized-controlled-trial#!/)

by Kaneka Probiotics represents a promising advancement in the field of probiotics, offering a precise and targeted approach to addressing critical health challenges such as atherosclerosis. By leveraging the scientific expertise in the biotics space, researchers and developers can continue to explore the potential benefits of probiotic formulations in supporting lipid metabolism, gut health, and overall cardiovascular function. These findings pave the way for further research and innovation in the use of probiotics as a therapeutic intervention in the prevention and management of cardiovascular diseases.

(https://academic.oup.com/cardi ovascres/article/120/7/708/76344 48?login=false)

Led by a team from the University of Southern California (USC), US, the study delved into previous research that links poor diet to Alzheimer's disease. The research team notes that individuals with Alzheimer's often exhibit lower levels of a neurotransmitter called acetylcholine in the brain, which is crucial for memory and other cognitive functions. The neurotransmitter also powers important memory functions that occur within the hippocampus.

The findings of this study highlight the significant impact that a high-fat, sugary diet can have on cognitive function and memory. The research not only emphasizes the importance of maintaining a healthy diet from a young age but also reveals the lasting effects of poor dietary choices on brain health throughout adulthood. The fact that memory deficits caused by a junk food diet could be reversed with medication is promising, but it underscores the need for early intervention and prevention measures to combat the detrimental effects of unhealthy eating habits.

As the study's authors warn, the prevalence of unhealthy diets

among adolescents is a growing concern that could have longterm consequences on cognitive health. By understanding the link between diet and brain function, public health initiatives can work towards promoting healthier eating habits to prevent cognitive decline later in life. The study serves as a wake-up call to the importance of making mindful food choices, particularly during crucial developmental stages, in order to protect and maintain cognitive function in the long run.

Research flags protein quality and digestibility variations in plant-based meats 23 Apr 2024 Food Ingredients First

Several plant-based meat alternatives contained more carbohydrates, less protein and a reduced amino acid content than meat-based versions after comparing plant-based steaks and cured meat alternatives with their animal-based counterparts, according to a recent study.

The small-scale study compared three plant-based steaks with veal steak and three plantbased cold-cut options with ham and beef cold cuts. They measured the fat, salt and protein content of each product. According to the researchers, the nutritional value, protein quality and digestibility of plant-based products depend significantly on using a "good blending of protein sources and processes applied to produce them."

Consumers are becoming increasingly conscious of the environmental and ethical implications of their food choices, leading to a surge in demand for plant-based alternatives to meat. However, in order for these products to be successful in replacing traditional animal-based meats, they need to offer comparable nutritional profiles. The recent study highlighted in the Journal of Agricultural and Food Chemistry emphasizes the importance of assessing amino acid profiles and digestibility of plant-based proteins. It is crucial for brands to effectively communicate these differences to consumers to help them make informed decisions when

choosing meat substitutes. The market for plant-based meat alternatives is rapidly evolving to meet consumer demands for products that not only mimic the taste and texture of meat but also offer similar nutritional value and cooking experience. As the plant-based meat market continues to expand, manufacturers are working to improve the quality, taste, and nutritional content of these products. Research shows that plant-based alternatives like vegetable burgers, minced meat, and sausages can offer better nutritional value than their animal-based counterparts. However, there is still a need for further development and refinement to ensure that plant-based proteins can provide a complete source of essential amino acids and meet the nutritional needs of consumers. (https://pubs.acs.org/doi/10.1 021/acs.jafc.3c08956)

SFOOD SCIENCE INDUSTRY NEWS

Chocolate that harnesses the full potential of the cocoa fruit

Science Daily May 21, 2024

Researchers at ETH Zurich have teamed up with the food industry to produce a wholefruit variety of chocolate. This helps increase the value creation of cocoa farming -and is healthier.

Chocolate, a beloved treat for many, may soon undergo a transformation thanks to the innovative research being conducted by ETH Zurich and its partners in the chocolate industry. By exploring the untapped potential of the cocoa fruit, researchers are not only looking to increase the profitability of cocoa cultivation but also create a healthier indulgence for consumers. Through a collaborative effort with start-up Koa and Swiss chocolate manufacturer

Felchlin, a new recipe for cocoa-fruit chocolate has been developed that utilizes more parts of the cocoa fruit than traditional chocolate production methods. This new chocolate is not only sweeter and more sustainable but also healthier, boasting a higher fibre content and lower saturated fat levels than conventional dark chocolate.

The journey to perfecting the recipe for cocoa-fruit chocolate was not an easy one, as researchers had to strike a delicate balance between

regions affected by malnutrition.

The versatility of the SuperAA platform opens up new possibilities for producing a range of proteins beyond just egg protein, offering potential solutions for addressing global challenges such as eggflation and supply chain instability. By harnessing the resilience and adaptability of potato plants, PoLoPo is not only creating economic opportunities for agri-tech and potato farming, but also offering a viable alternative for farmers to cultivate high-value crops. With ongoing research and development, the company aims to expand its protein production capabilities to

sweetness and texture. By utilizing cocoa gel as a sweetener, researchers were able to achieve a chocolate that contains less saturated fat and more fibre, offering consumers a healthier alternative to traditional chocolate. Additionally, the development of cocoa-fruit chocolate opens up new opportunities for small-scale cocoa farmers by allowing them to diversify their products and generate income from multiple value creation streams. While cocoa-fruit chocolate may not be available in stores just yet, the work being done by ETH Zurich and its partners offers a promising example of how technology, nutrition, and sustainability can work together to improve the value-creation chain of cocoa cultivation. (Mishra et al. Valorization of cocoa pod side streams improves nutritional and sustainability aspects of chocolate. Nature Food, 2024; https://www.nature.com/articl es/s43016-024-00967-20)

The innovative approach taken by PoLoPo in utilizing potatoes as a platform for producing proteins marks a significant advancement in the biotech and agricultural industries.

By turning potato plants into "micro-biofactories" for manufacturing target amino acids, the SuperAA platform offers a sustainable and resource-efficient solution for protein production, reducing the environmental impact associated with traditional animal farming practices. This breakthrough technology not only benefits the food and beverage industry by providing high-quality proteins for a variety of applications, but also supports food security in

Potato to protein: Israeli start-up leverages molecular farming to formulate patatin and ovalbumin

> 02 Apr 2024 Food Ingredients First Insha Naureen

include dairy proteins and explore additional crop options, further revolutionizing the food production industry and contributing to a more sustainable and stable future. (https://www.foodingredientsfirst.co m/news/potato-to-protein-israelistart-up-leverages-molecular-farmingto-formulate-patatin-andovalbumin.html)

PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

Penn State food scientist Gregory Ziegler experiments with substituting rice flour and/or oat flour to reduce the sugar content of chocolate.

Gregory Ziegler and his colleagues at Penn State University have made significant strides in their research to find a sugar substitute for chocolate that maintains the texture and flavour of the sweet treat. By replacing sugar with oat flour and sweet rice flour, the researchers found that they could reduce sugar content by 25% without negatively impacting the overall taste and sweetness of the chocolate. In fact, the chocolates with oat flour were preferred for their smoother texture and overall sweetness liking.

This research not only has implications for reducing sugar content in chocolate but also opens up possibilities for adding additional health benefits to this popular indulgence. By incorporating a small granular starch that is a resistant starch, the chocolate could potentially become a source of dietary fibre. This innovative approach could lead to the development of healthier chocolate options that still satisfy consumer

Casein... from potatoes? Molecular farming startup Finally Foods emerges from stealth April 2, 2024 Elaine Watson AGF

Finally, Foods is an Israeli startup that is utilizing molecular farming to produce dairy proteins in potatoes.

The founders, Dr. Basia J. Vinocur and Dafna Gabbay, have leveraged AI-powered technology from Evogene to optimize the process of developing plants expressing

The demand for colouring food ingredients that offer clean label options is on the rise in the food and beverage industry.

Consumers are increasingly looking for natural and sustainable options that still deliver vivid colours and stable results. Suppliers like GNT, Givaudan Sense Colour, ADM, and Döhler are at the forefront high levels of casein proteins. The company has received preseed funding from The Kitchen FoodTech Hub (TKH) by Strauss Group and the Israeli Innovation Authority, with Evogene holding a c.40% stake in the company.

While some companies in the 'animal-free dairy' space are focused on building consumer brands, Finally Foods is a B2B business, aiming to be an ingredient company rather than a direct supplier to consumers. By using computational predictive biology and modelling biological systems, the company is able to simulate and predict how plant

of developing innovative solutions in the realm of natural food colours. From exploring novel pigment sources through biotechnology to launching new ingredients that deliver intense colours in low pH applications, these suppliers are continuously evolving to meet the changing demands of the market.

Keeping Chocolate Sweet While Cutting Sugar

Food Science & Industry News

By Danielle Beurteaux, Food Technology Magazine April 2, 2024

cravings for sweetness and texture. Gregory Ziegler and his team continue to explore these possibilities, demonstrating their commitment to innovation in the food science industry. (https://ift.onlinelibrary.wiley. com/doi/full/10.1111/1750-3841.16923)

modifications will affect protein expression levels, streamlining the R&D process. Additionally, Finally Foods is working towards producing multiple casein proteins in one plant, a feat that would set them apart in the molecular farming space. The company is also focusing on downstream processing and purification of the proteins, aiming to develop a cost-effective and efficient system for extraction. (https://agfundernews.com/casei n-from-potatoes-molecularfarming-startup-finally-foodsemerges-fromstealth?utm_medium=email&utm_ source=rasa_io&utm_campaign=ne wsletter)

Natural colour creativity: Exploring unconventional bold hues, stunning shades and self-expression 03 Apr 2024 Food Ingredients First By Elizabeth Green Consumers are seeking products with clean labels, but they are also unwilling to compromise on taste or appearance. This has led to a rise in the use of naturally-derived colour solutions from botanical and plant extracts. Suppliers are focusing on stability, PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

consistency, and costeffectiveness to ensure that their natural colours can meet the expectations of both consumers and food companies. With trends like Healthy Hedonism and Regeneration Rising shaping consumer preferences, the future of

Natural sugar reduction: Spotlight on stevia's health benefits, taste and sustainability 05Apr 2024 Food Ingredients First By Jolanda van Hal

Stevia sweeteners are gaining popularity among healthconscious consumers looking to reduce their sugar intake.

With increasing demand for functional beverages and foods, suppliers like Ingredion and Cargill are at the forefront of providing natural stevia sweeteners that offer both health benefits and great taste. Megan DeStefano from

The functional food and beverage market is booming, with an expectation to reach a \$500 billion valuation by 2028 due to consumer demand for health-boosting products.

With health and wellness becoming a top priority for consumers globally, the demand for functional foods and beverages is on the rise. These products offer added health benefits beyond basic nutrition, catering to consumers looking to improve their overall wellbeing. From energy drinks and protein bars to fortified dairy products and plant-based alternatives, the market for functional foods and beverages is diverse and constantly Ingredion emphasizes the importance of taste in stevia products, highlighting the need for innovation to ensure a positive consumer eating experience. Cargill's Alyssa Leyva also notes the shift towards customized nutrition and lower caloric options, with stevia serving as a viable solution for those seeking to reduce sugar in their diets.

In addition to its health benefits, stevia also offers potential gut health advantages. Cargill recently conducted a study on the impact of stevia on the gut microbiome, finding that the sweetener was well tolerated

evolving to meet consumer demands.

As the market for functional foods and beverages continues to expand, it is important for companies to stay abreast of consumer preferences and trends. Understanding the key functional benefits that consumers seek out, such as energy/less fatigue, weight management, and digestive health, can help companies develop products that resonate with their target audience. Additionally, knowing the top functional ingredients consumers are looking for, such as protein, fibre, and essential vitamins and minerals, can guide product development and natural colours in the F&B industry looks bright and colourful. (https://www.foodingredientsfi

rst.com/news/natural-colorcreativity-exploringunconventional-bold-huesstunning-shades-and-selfexpression.html)

and did not significantly affect gut microflora or short-chain fatty acid production. This research adds to the growing body of evidence supporting the safety and health benefits of stevia as a sugar alternative. Both Ingredion and Cargill are committed to sustainability in their stevia products, ensuring traceability and ethical sourcing practices throughout the supply chain. With a focus on innovation, taste, and sustainability, stevia sweeteners are poised to continue their growth in the F&B industry as consumers prioritize healthier options with lower sugar content. (https://jn.nutrition.org/article/S 0022-3166(24)00110-X/fulltext)

Consumer demand drives explosive growth in functional foods, beverages market

Rachel French, April 4, 2024, Food & Beverage Insider

marketing strategies to ensure success in this competitive market. By staying informed and innovative, companies can capitalize on the growing demand for functional foods and beverages and carve out a successful niche in this lucrative industry.

(https://www.foodbeverageinsider.co m/market-trends-analysis/consumerdemand-drives-explosive-growth-infunctional-foods-beverages-market)

PFNDAI Jul 2024

A new, low-cost method that enables multiple core materials to be encapsulated and delivered to standards demanded by the nutraceutical and food and beverage industries has been developed by Canadian researchers.

The liquid-liquid encapsulation system developed by Sushanta Mitra and his team at the Waterloo Institute for Nanotechnology offers a promising solution for a variety of industries, including nutraceuticals and beverages. By encapsulating core materials in a liquid form, the technology provides a stable and protective shell layer that allows for timely release of cargo material to targeted areas. This innovative approach

Vitamin B1 is an essential micronutrient for human beings. Its deficiency is the cause of numerous diseases of the nervous and cardiovascular systems.

Researchers have achieved a significant advance in the fight against vitamin B1 deficiency, frequently associated with a rice-based diet. By specifically targeting the nourishing tissues of the rice grain, the scientists have succeeded in considerably increasing its vitamin B1 content, without compromising agronomic yield. These results could help solve a major public health problem in regions where rice is the staple food.

Vitamin B1 deficiency is a

Consumers today are on the hunt for products that offer high protein content, as they look to incorporate more of it into their diets. not only reduces operating costs in the nutraceutical industry but also opens up opportunities for the development and production of new products by encapsulating multiple core materials in a single parcel.

Furthermore, the liquid-liquid encapsulation system addresses issues related to storage, temperature, and humidity. By using temperature-sensitive polymers and moisture barrier materials, the finished product remains stable even in changing environmental conditions. The team's efforts to integrate a curing stage into the prototype machine will allow for individual capsules to be extracted on demand, increasing the technology's

serious health concern in populations that rely heavily on rice as their main food source. The processing of rice grains removes a significant amount of vitamin B1, leading to widespread deficiencies and related illnesses such as beriberi. To address this issue, researchers have focused on biofortifying rice to increase its vitamin B1 content, specifically targeting the endosperm where the majority of the nutrients are stored.

Through genetic modification, researchers have successfully increased the vitamin B1 content in rice grains without affecting the plant's agronomic characteristics or yield. This promising development offers a potential solution to the

From protein-packed pancakes and cereals to vegan burgers and yogurt with added protein, F&B manufacturers are innovating to meet this demand. Innovation enables low-cost encapsulation for timed release of bioactives

> Will Chu | Apr 05, 2024 Vitafoods Insights

Food Science & Industry News

efficiency and versatility. With plans to scale up and develop a customer-ready benchtop encapsulation machine, Mitra and his team are seeking commercial partners to further explore the potential applications of this groundbreaking technology. (https://www.vitafoodsinsights. com/innovative-technologiesformats/innovation-enableslow-cost-encapsulation-timedrelease-bioactives)



widespread vitamin B1 deficiencies in rice-consuming populations, providing a readily available and sustainable source of this essential nutrient. Further research and regulatory steps will be necessary to ensure the safe and widespread cultivation of biofortified rice varieties, but the potential impact on global health and nutrition is significant.

(https://onlinelibrary.wiley.com/d oi/10.1111/pbi.14348)

Propelling proteins: Manufacturers innovate hybrid concepts and diversify offerings as consumer appetite

10 Apr 2024 Food Ingredients First Insha Naureen This trend is evident in the growth of protein ingredients being used in F&B launches globally, with bakery, ready meals, meat, fish, and eggs leading the way.

With consumers looking for nutrient-dense options that keep them full longer, products like ready-to-drink protein beverages and protein bars have seen a surge in popularity. Brands are focusing on creating products that balance pleasure with health benefits, offering indulgent flavours with added protein but fewer calories. This demand for high-quality protein is driving manufacturers to develop formulations that cater to various needs, from performance-boosting shakes to protein-enriched ice creams and desserts. Additionally, sustainability is becoming a key

Cocoa crisis: Bio-based tech and regenerative agriculture help alleviate market upheaval

16 Apr 2024 Food Ingredients First Gaynor Selby

In response to the challenges facing the cocoa industry, companies are stepping up with innovative solutions to mitigate the impact of climate change, disease, and biodiversity loss on cocoa crop yields in West Africa. initiative are focusing on regenerative agriculture and bio-based technologies to improve soil health and increase farmer incomes in regions like Côte d'Ivoire. By developing biochar from cocoa pods and other agricultural waste, farmers are able to improve soil moisture retention and rejuvenate depleted lands, leading to higher yields and more sustainable farming practices.

Furthermore, companies are pioneering sustainable and fair cocoa supply chains by working directly with farmers to promote organic farming practices and eliminate child

In this column, the author describes the global prevalence of food intolerances and provides insight into state-ofscience ingredient replacement and removal methods when formulating gluten-free and

lactose-free foods.

Projects like the BIO4Africa

Food intolerances and allergies have become an increasingly prevalent issue in recent years, affecting a substantial portion of the global population. With estimates suggesting that up to 20% of individuals in industrialized countries have been diagnosed with at least one food intolerance or allergy,

it is clear that this is a significant public health concern. The causes of food intolerance can range from immune system reactions to certain food components to organic dysfunctions in the body. Some of the most common intolerances stem from the consumption of lactose, casein, and gluten, with symptoms ranging from digestive discomfort to allergic reactions. As a result, product developers are faced with the challenge of creating foods that are safe and enjoyable for all consumers, including those with food intolerances. By

concern for consumers, leading to a shift towards locally sourced and plant-based protein options that are not only good for people but also for the planet.

(https://www.innovamarketinsights.c om/trends/top-10-trends-for-2024/),

(https://www.foodingredientsfirst.co m/news/propelling-proteinsmanufacturers-innovate-hybridconcepts-and-diversify-offerings-asconsumer-appetite-increases.html)

labour. Planet A Foods is even developing cocoa-free chocolate alternatives using locally sourced ingredients like oats and sunflower seeds, reducing the carbon footprint of traditional chocolate production. With cocoa prices on the rise due to supply shortages and underinvestment, these efforts to innovate and diversify the industry are crucial in ensuring the future sustainability of cocoa production and chocolate consumption globally. (https://www.foodingredientsfi rst.com/news/cocoa-crisis-biobased-tech-and-regenerativeagriculture-help-alleviatemarket-upheaval.html)



By Iuliana Vintila, Associate Prof. Food & Catering Sci & Tech, Dunarea de Jos Univ of Galati, Romania, April 5, 2024 Food Technology Magazine

understanding the root causes of intolerance and utilizing appropriate methods to eliminate triggering components from their products, developers can ensure that their formulations are allergen-free and nutritious for all consumers to enjoy. Developing gluten-free products requires a comprehensive understanding of the potential health risks associated with gluten intolerance and the regulatory requirements set forth by the FDA. Utilizing cutting-edge technological solutions, developers can create products that are safe and compliant with gluten-free labelling rules. By incorporating genetically modified wheat varieties, biotechnologically modified gluten, and alternative ingredients such as pseudo-cereals and legumes, developers can create functional and nutritious gluten-free foods. Enriching formulations with protein fortification agents and additives for improved texture and binding properties further enhance the quality of glutenfree products. Food companies have embraced a wide range of ingredients and processing technologies to meet the growing demand for gluten-free options, offering consumers a diverse selection of safe and delicious products to enjoy.

products has become a priority for many food companies as a large portion of the population is lactose intolerant. With the demand for dairy alternatives on the rise, product developers are focusing on removing or reducing lactose from traditional dairy products. The FDA has strict guidelines on what can be labelled as lactose-free, requiring products to contain no lactose at all. Enzymatic hydrolysis is a common method used to break down lactose into glucose and galactose, making dairy products more easily digestible for those with lactose intolerance. Other methods such as membrane separation, microfiltration, and fermentation are also utilized to create lactose-free alternatives.

In addition to finding ways to remove lactose from products, developers must also ensure that their lactose-free alternatives are fortified with essential nutrients to maintain the nutritional quality of the food. As the demand for lactose-free products continues to grow, the industry is constantly innovating to meet the needs of consumers with lactose intolerance.

With the ever-expanding market for free-from products, product developers have a ripe opportunity to create innovative and functional food items for consumers with food intolerances and allergies. Despite the challenges that come with formulating these products, such as maintaining sensory appeal and nutritional value, advancements in food science and technology provide exciting prospects for the future. Companies can capitalize on consumer demand for safe and wholesome options by continuously improving their product offerings to cater to a diverse range of dietary restrictions and preferences. As the market for free-from products continues to grow, so too do the possibilities for inclusive and accessible food choices for all.

(https://www.ift.org/news-andpublications/food-technologymagazine/issues/2024/april/columns/ ingredients-how-to-formulate-forfood-intolerances)

Developing lactose-free

The latest edition of Mondelez's annual State of Snacking report has found that consumers in many markets across APAC are turning to snacks as an important means of fulfilling nutritional needs.

The Mondelez State of Snacking 2023 report highlights the increasing trend of mindful snacking among consumers in the APAC region. With a focus on nutritional needs, moodboosting, and well-being, consumers in countries like China, India, Australia, and New Zealand are making health-conscious decisions when it comes to their snacking choices. Furthermore, the report identifies a growing interest in sustainable packaging, with consumers expressing a desire for biodegradable options and a willingness to pay more for environmentally friendly snacks.

In addition, the study reveals that portion control plays a key role in consumers' snacking habits, with a majority reporting feeling more 'in control' when moderating their snack portions. This aligns with Mondelez's strategy of promoting mindful snacking and Snack spotlight: Survey finds satisfying nutritional needs to be a primary APAC snacking motivation

> By Pearly Neo 15-Apr-2024 – Food Navigator Asia

offering personalized snacks tailored to individual health and nutrition needs. As consumers in the APAC region continue to prioritize wellness and sustainability in their snacking choices, companies in the food and beverage industry will need to adapt to meet these evolving consumer preferences. Health and cultural factors instead of altruistic messaging have greater impact on promoting sustainable dietary habits in Asia By/Audrey Yow 11-Apr-2024 -

Food Navigator Asia

New evidence suggests that brands and government need to scrap altruistic messaging about climate change and focus on health and culture to promote sustainable eating in Asia.

Overall, the research conducted in Asia shed light on the complexities of promoting

sustainable diets in the region. Despite the clear environmental benefits and growing global awareness of the need for dietary shifts, Asian consumers remain largely resistant to change. This

highlights the importance of culturally tailored messaging and education campaigns to effectively promote sustainable diets in Asia.

Moving forward, policymakers and stakeholders must take into account the unique cultural. economic, and dietary factors

Harnessing the power of postbiotics: Creating innovative immunity-enhancing products for the F&B sector 08-Apr-2024 Food Navigator USA

In today's health-conscious world, consumers increasingly seek innovative products that can support their immune health.

There has been a shift in the consumer mindset towards preventive healthcare rather than solely relying on reactive treatments. Consumers are proactively seeking ways to strengthen their immune systems to prevent illness and maintain overall health. Immunity products are seen as a proactive measure to support immune function and reduce the risk of infections. One emerging area of interest is

postbiotics which are gaining attention for their potential to enhance immunity while expanding product application possibilities. This explores how manufacturers can utilize postbiotics to create innovative immunity products.

Based on the ISAPP (International Scientific Association for Probiotics and Prebiotics) definition, a postbiotic is "a preparation of inanimate microorganisms and / or their components that confers a health benefit on the host". They have been shown to generate various health benefits, including immune modulation, anti-inflammatory properties, and gut health improvement.

With more research being conducted and published, postbiotics are gaining more interest among consumers and industry professionals alike. Indeed, the postbiotics market was valued at \$1.6 billion in 2021, and is estimated to reach \$3 billion by 2031. This interest

BIOI

at play in Asian countries when developing strategies to address climate change through dietary shifts. By emphasizing the personal health benefits of sustainable diets, particularly among older consumers, there is potential to motivate individuals to make the necessary changes for both personal health and environmental well-being. This research serves as a critical step towards understanding and addressing the challenges of promoting sustainable diets in Asia, ultimately contributing to global efforts to mitigate climate change.

(https://www.cell.com/cellreports-sustainability/ful text/S2949-7906(24)00006-5)

is driven by the desire for evidence-based solutions for immune health and overall wellness.

The rise of postbiotics in the health and wellness industry is undeniable, with research supporting their beneficial effects on immune health. A postbiotic ingredient developed by Morinaga Milk Industry Co., Ltd., has shown promising results in supporting immune function in adults and seniors. Clinical studies have demonstrated that intake can reduce the duration and severity of cold symptoms, enhance immune responsiveness to vaccinations, and support overall immune health. With the growing interest in evidence-based solutions for immune support, postbiotics like LAC-Shield[™] are poised to play a significant role in the future of health and wellness products.

(https://www.foodnavigatorusa.com/News/Promotional-Features/How-postbiotics-can-targetimmune-health-in-the-food-beveragesector)
The discussion paper on the classification of processed foods, presenting opportunities and gaps, was recently released by the international NGO Access to Nutrition Initiative (ATNI), based in the Netherlands.

The paper aligns with the organization's mission to make modern diets healthier and more sustainable through the transformation of markets. Overall, the discussion paper on the classification of processed foods by ATNI presents both opportunities and gaps in the industry. It highlights the need for a global classification system to address the increasing consumption of processed foods and associated health risks. The document encourages dialogue among stakeholders to develop solutions that prioritize public health and sustainability.

The implications of

The World Health Organization has funded research analysing the nutritional composition of ultra-processed plant-based burgers, and the findings are out.

Ultra-processed plant-based foods are on the rise, particularly in the out-of-home (OOH)environment. But are they healthy? Fresh research funded by the World Health Organization (WHO) Regional Office for Europe has sought to find out, with a particular focus on one popular food product: ultra-processed plant-based burgers.

Overall, the spotlight on ultraprocessed plant-based foods raises important considerations

implementing a viable classification scheme for processed foods are significant for future research, public health interventions, and policy development. By creating awareness of the risks

associated with consuming highly processed foods, policymakers can incentivize manufacturers to produce healthier options without compromising taste or profitability. The success of initiatives such as the UK's Soft Drinks Industry Levy and the removal of industrial trans fats from food products demonstrates that industry can adapt quickly to meet new standards when incentivized

for consumers and manufacturers alike. While these foods can offer beneficial nutrients such as protein, dietary fibre, and essential minerals, they also contain unhealthy components like sodium, total fat, and saturated fatty acids. The balance between these positive and negative aspects ultimately depends on an individual's dietary patterns and nutritional needs. Furthermore, the lowquality protein content in some plant-based burgers underscores the importance of considering complementary foods to ensure adequate amino acid intake. As the popularity of plant-based diets continues to grow, it is essential for both consumers and food

REGULATORY NEWS

Access to Nutrition Initiative calls for a standardized classification system for processed foods

30 Apr 2024 Nutrition Insight

through regulation and consumer demand. This highlights the importance of collaboration between government, industry, and health experts in transforming food markets to support healthier and more sustainable diets.

(https://accesstonutrition.org/ app/uploads/2024/04/ATNI-Discussion-Paper-Classificationof-Processed-Foods-Final-2.pdf)

manufacturers to be aware of the nutritional implications of ultra-processed plant-based products.

While some ultra-processed plant-based burgers may contain unhealthy levels of fat and salt, the overall debate on the healthiness of ultraprocessed foods continues. Some argue that ultraprocessed foods are designed

Are ultra-processed plant-based burgers healthy? WHO investigates

By Flora Southey 21-Mar-2024 - Food Navigator to encourage overconsumption and lead to poor health outcomes, while others believe that not all ultra-processed foods should be deemed unhealthy. Recent studies have shown a link between ultraprocessed food consumption and negative health effects, including cardiometabolic issues and mental disorders. The focus should be on the nutritional composition of these foods rather than their degree of processing. The WHO recommends a diet based on minimally processed foods that are low in unhealthy elements like sugar, salt, and saturated fats. Awareness of the nutritional composition of plant-based burgers and other ultra-processed foods is crucial for both policymakers and the public to make informed decisions about their health.

(https://www.cambridge.org/c ore/journals/british-journal-ofnutrition/article/nutritionalcomposition-of-ultraprocessedplantbased-foods-in-theoutofhome-environment-amulticountry-survey-withplantbasedburgers/F8367FCF566A1D2D92A 05BB91325FB4C#)

Food Fortification Initiative spotlights lack of regulatory compliance as obstacle to progress 30Apr 2024 Nutrition Insight

Operating in at least 30 countries worldwide, the Food Fortification Initiative (FFI) supports countries to build vital fortification programs that reduce micronutrient deficiencies.

FFI and its partners have recently seen significant improvements in people's iron, folate and vitamin B12 status due to a wheat flour fortification program in

The European Council (EUCO) unveils its revised "breakfast directives," which place stricter rules on the labelling and composition of fruit juices, fruit jams, honey and dehydrated milk used for and in "breakfast" type foodstuffs.

The European Council's updated breakfast directives aim to

Haryana, India, a state with the highest micronutrient deficiencies in the country. The Food Fortification Initiative (FFI) has been instrumental in supporting countries worldwide in building and implementing vital food fortification programs that help reduce micronutrient deficiencies. By working in over 30 countries, FFI has seen significant improvements in people's iron, folate, and vitamin B12 status, particularly through a successful wheat flour fortification program in Haryana, India. While progress has been made, FFI recognizes the need for increased regulatory enforcement and compliance in regions with existing fortification programs to ensure that the necessary nutrients reach those in need.

FFI's approach involves advocating for mandatory

fortification mandates, backed by government regulation and industry compliance, to ensure that fortified foods remain accessible and affordable to all. By prioritizing regions with high rates of micronutrient deficiencies, such as certain states in India, FFI has been able to implement successful fortification programs that have shown positive health impacts. By aligning fortification standards with WHO guidelines and conducting rigorous monitoring and evaluation, FFI aims to continue making strides in combating micronutrient malnutrition and improving public health outcomes globally.

(https://www.nutritioninsight.c om/news/who-takes-action-onfood-fortification-to-tackleglobal-crisis-of-hiddenhunger.html)

provide consumers with more transparency and information about the food they consume. By implementing stricter rules on labelling and composition, the EUCO hopes to reduce food fraud and adulteration while empowering consumers to make healthier choices.



With the new regulations set to enter into force soon, European citizens can expect to see clearer labels on their breakfast products, including fruit juices, jams, honey, and dehydrated milk.

One of the key focuses of the revised regulations is tackling honey adulteration by implementing measures for increased transparency in sourcing. The new labelling rules will provide consumers with information on the countries of origin, helping to combat the practice of adding foreign substances to honey.

Additionally, the regulations introduce new standards for fruit jams, requiring minimum fruit content to be increased to promote healthier diets and support the fruit market. Overall, the EUCO's efforts to improve food labelling and composition are aimed at enhancing consumer awareness and choice while bolstering European production against food fraud.

(https://www.nutritioninsight.c om/news/euco-poised-toenforce-revised-breakfastdirectives-labeling-laws-tocombat-food-fraud.html)

Studies linking ultra-processed foods to poor health must be 'treated with caution', says Scientific Advisory Committee on Nutrition Fiona Holland, Food Matters Live

The findings from previous studies linking high intake of ultra-processed foods (UPFs) to negative health outcomes such as type 2 diabetes, cardiovascular disease, overweight, and obesity are worrisome.

While the evidence is concerning, the Scientific Advisory Committee on

Assessing the safety of additives and other chemicals in food includes scientific study of how much of a chemical is in a food and how much we're likely to eat.

Our food is made up of chemicals, from essential nutrients like potassium in bananas to added preservatives and flavour enhancers. While some chemicals are naturally Nutrition (SACN) stresses the need for better quality research to determine the true impact of UPFs on health. The majority of studies reviewed by SACN are observational and do not take into account important factors such as energy intake, BMI, and socioeconomic status.

The limitations of the NOVA classification system, which categorizes foods as ultraprocessed based solely on how they are processed without considering their nutritional content, further complicates the issue. The broad definition of UPFs includes a wide range of foods, from unhealthy options like ice cream and crisps to healthy choices like

present in foods, others may come from contaminants in the environment. However, the presence of chemicals in food doesn't automatically mean it's unsafe to eat. What matters is the amount of a chemical in a food and how much a person consumes.

To ensure the safety of chemicals in food, scientists at the FDA and other agencies wholemeal bread and cereals, making it challenging to draw conclusions about their overall impact on health. The call for a new food classification system in the UK that considers the nutritional content of foods and more research on the benefits of consuming minimally processed foods is crucial to gaining a better understanding of the relationship between UPFs and health outcomes.

(https://foodmatterslive.com/ article/studies-ultra-processedfoods-poor-health-treated-withcaution/

https://www.gov.uk/governme nt/publications/sacnstatement-on-processed-foodsand-health/sacn-statement-onprocessed-foods-and-healthsummary-report#researchrecommendations)

Is Food Safe if it Has Chemicals? US Food & Drug Administration, Consumer Updates 2 April 2024

consider a variety of factors such as the chemical's safety data, the amount present in food, and the likely PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

Diet Study to provide realistic estimates of nutrients and contaminants in food. It is important for consumers to have accurate information about chemicals in food and to make informed choices about their diet to reduce exposure to harmful chemicals. (https://www.fda.gov/consume rs/consumer-updates/foodsafe-if-it-has-chemicals?utm_m edium=email&utm_source=rasa __io&utm_campaign=newsletter)

Scientists further our understanding of how a foodborne bacterium can survive in food preparation environments Science Daily April 3, 2024 Microbiology Society

Scientists from the Quadram Institute and UK Health Security Agency have discovered that bacterial populations remain stable on factory floor despite cleaning efforts in ready-to-eat food production facilities.

The research conducted by

Maria Diaz and her team sheds light on the complex interactions between bacteria in ready-to-eat food production environments. The fact that L. monocytogenes is supported by a stable community of other bacteria highlights the need for new strategies to effectively eliminate the pathogen. By

understanding the dynamics of these microbial communities, researchers can develop more targeted and effective cleaning methods to prevent cross-contamination and ensure the safety of readyto-eat foods.

The findings of this study

The ruling by the Johannesburg High Court in favour of allowing plant-based products to keep their "meat-like" names on labels is a significant victory for the growing plant-based sector in South Africa.

The decision ensures that popular meat alternatives will not be seized from store shelves and can continue to be labelled in a manner that is familiar to consumers. Companies like Fry's, Urban Vegan, Beyond Meat, and On the Green Side can now continue to offer their plantbased products with confidence.

The issue of regulating the

labelling of plant-based meat alternatives is not unique to South Africa, as similar debates are taking place in Europe as well. The recent decrees in France and proposed legislation in Poland demonstrate the importance of clarifying labelling practices to prevent consumer confusion. ProVeg South Africa is hopeful that the court decision will spark further discussions with the government to establish sensible regulations for the plant-based industry, which can provide healthier alternatives and create jobs in the country. The ruling sets a positive precedent for the future of plant-based products in South Africa and highlights the

demonstrate the importance of ongoing research in food safety and highlight the need for continuous monitoring and improvement in food production facilities. By identifying the factors that contribute to the survival of pathogens like L. monocytogenes, scientists can work towards developing innovative solutions to combat foodborne illnesses and protect public health. This research has the potential to make a significant impact on the food industry, leading to improved safety standards and reduced risk of outbreaks caused by contaminated ready-to-eat foods.

(www.sciencedaily.com/release s/2024/04/240403130427.htm)

importance of collaboration between industry stakeholders and regulatory bodies. (https://www.foodingredientsfi rst.com/news/veggie-victoryin-south-africa-as-court-ruleson-plant-based-nomenclatureamid-alt-meat-pushback.html)

Veggie victory in South Africa as court rules on plant-based nomenclature amid alt-meat pushback 11 Apr 2024 Food Ingredients First

PFNDAI Jul 2024

PROTEIN FOODS AND NUTRITION DEVELOPMENT ASSOCIATION OF INDIA

New analysis of India's regulatory framework for advertising foods that are high in fat, salt and sugar (HFSS)need to be overhauled to better protect children, academics have argued.

Researchers reviewed the regulatory environment in India for advertising HFSS foods and non-alcoholic beverages. They found that there were key shortfalls that need to be addressed to protect children against HFSS marketing. "A robust regulatory framework is needed to protect children from HFSS food marketing, not just what is 'directed' at them, with clear evidence-based food classification criteria," said researchers in The Lancet Regional Health - Southeast Asia. "Young children and adolescents are particularly vulnerable to HFSS food marketing as they lack cognitive ability to discern the commercial intent."

India, as a signatory to the UN

Convention on the Rights of the Child, has a legal obligation to ensure the right to health for all children. However, concerns have been raised by academics about the need for a more robust regulatory framework to protect children from the marketing of High in Fat, Sugar, and Salt (HFSS) foods. Research shows that the consumption of processed foods is higher than that of fruits in Indian households, and the marketing of HFSS foods has been found to negatively impact consumption patterns, particularly among young children.

A recent study conducted a thorough review of existing national-level policies related to HFSS food marketing to children in India. The researchers found that while there are some policies in place, such as guidelines for prevention of misleading advertisements, there are still gaps that need to be addressed. The study highlights the importance of broadening the *Key shortfalls' need to be addressed to protect children from high fat, salt, and sugar food marketing in India By Audrey Yow 03-Apr-2024-

Food Navigator Asia

regulatory scope to include all forms of advertising that children are exposed to, adopting food classification systems for defining junk foods, and restricting HFSS advertisements on TV during peak child viewership times. The researchers emphasized the need for robust regulation and further research to protect children from the harmful impacts of HFSS food marketing in India.

(<u>https://www.thelancet.com/journals</u> /lansea/article/PIIS2772-3682(23) 00175-0/fulltext#%20)



By Sam Mehmet, New Food 13 January 2020

New research suggests that individual soft drink companies in the UK are making a sizeable contribution to sugar reduction, with eight out of the top 10 companies reducing the sugar content of their products by 15 percent or more.

There is said to have been considerable pressure on

industry recently to reduce the sugar content of soft drinks, and in April 2018, the British government increased this pressure by introducing the Soft Drinks Industry Levy (SDIL). The findings of the University of Oxford study highlight the positive impact of sustained pressure on the soft drinks industry to reduce sugar content in their products. The significant reduction in sugar content in soft drinks sold in the UK, largely attributed to reformulation and consumer purchasing behaviour, reflects a shift towards healthier options in the beverage market.

This reduction not only aligns with public health recommen-

dations to reduce sugar intake but also demonstrates that business practices can be successful while promoting healthier choices for consumers.

The study also sheds light on the role of government policies, such as the Soft Drinks Industry Levy (SDIL), in driving positive change in the food and beverage industry. By monitoring the progress made by companies in reducing sugar content and making this information publicly available, researchers hope to encourage further action to improve public health and promote healthier diets. With national and international governments advocating for healthier food options, the study serves as a valuable tool for evaluating the effectiveness of industry initiatives and supporting ongoing efforts to create a healthier food environment for consumers. (https://www.fda.gov/consume rs/consumer-updates/foodsafe-if-it-has-chemicals?utm_m edium=email&utm_source=rasa io&utm_campaign=newsletter)

FSSAI prohibits unauthorized use of liquid Nitrogen in food by the food businesses

Lexplosion June 6, 2024

The Food Safety and Standards Authority of India ("FSSAI") has issued an Advisory prohibiting unauthorized use of liquid Nitrogen as an additive in food by Food serving establishments /restaurants, Bars etc.

It has been noticed that it is being used in restaurants, bars, food serving establishments/ caterers in fairs, marriages etc. to make the food items like ice-creams, cocktails, meetha pan, bakery items like biscuits, desserts etc. more eyepleasing or to add some theatre look at the time of serving. Such unauthorised usage has led to serious health issues/injuries.

The FSSAI has issued this prohibition because using

liquid nitrogen at the point of sale, right before consumption, goes against the intended purpose and technological use of the additive INS 941.

Food businesses that engage in this practice will be considered as non-compliant and may face statutory action under the Food Safety and Security Act 2006. While INS 941 is permitted for use in Dairy based Desserts- Ice cream at the GMP level for specific technological functions, it is not meant to be used in the manner that some food businesses are currently adopting.

It is essential for food businesses to adhere to the regulations set forth by the FSSAI to ensure the safety and quality of the food products being consumed by the public.

(https://lexplosion.in/fssaiprohibits-unauthorized-use-ofliquid-nitrogen-in-food-by-thefood-businesses/ &

https://www.fssai.gov.in/uploa d/advisories/2024/06/665eec45 86728Advisory%20_liquid%20nitr ogen.pdf)

The local government of Shanghai, China has launched a pilot traffic light labelling scheme for sugar sweetened beverages, with grades to be implemented based on not only sugar but also saturated and trans-fat content.

The implementation of Nutri-Score, (translated roughly as the 'Nutritional Choice') traffic light labelling scheme in Shanghai is a positive step towards promoting healthier beverage choices amongst consumers. By clearly categorizing beverages based on their nutritional value, it provides easy-to-understand information that can help individuals make more informed decisions about what they consume. This is particularly important in a market where there is a growing demand for reducedsugar and healthier options.

The inclusion of both prepackaged RTD beverages and freshly-prepared beverages in this pilot scheme shows a comprehensive approach that covers a wide range of products available in the market. Major brands such as Naixue, CHAGEE, and Starbucks have

Nutri-Grade in China: Shanghai launches traffic light labelling pilot for sugar-sweetened beverages By Pearly Neo 16-Apr-2024 -Food Navigator Asia

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already started incorporating these labels on their products, indicating a willingness to support and promote healthier choices for consumers. With the increasing focus on health and wellness, initiatives like the 'Nutritional Choice' labelling scheme are essential for guiding individuals towards making better dietary decisions for their overall well-being.

FDA's 'no questions' letter for Oobli's sweet protein opens doors for international expansion

By Elizabeth Crawford, 15-Apr-2024 – Food Navigator USA

FDA's recent acknowledgement that low-sugar tea and chocolate maker Oobli's novel sweet protein sourced from the Oubli fruit and produced via precision fermentation is GRAS (Generally Recognized As Safe) will grease the rails for the California-based company to expand internationally, CEO Ali Wing told FoodNavigator-USA.

The agency late last month filed a "no questions" letter for Oobli's preparation of brazzein-53, which is one of several sweet proteins derived from the Oubli fruit and which Oobli produces via precision fermentation with an engineered strain of Komagataellaphaffi P-BRZ-013 and which contains the 53amino-acid isoform of brazzein.

The sweet protein, which the company previously selfdetermined as GRAS, is 2,000 to 5,000 times sweeter than sugar and can replace 70% or more of sugar in most food and beverages - including the company's sweet tea and range of chocolates, according to the company. Because it is a protein, or "large molecule," it also does not affect blood sugar, insulin or the gut microbiome like "small molecules," including sugar and many alternative sweeteners, Wing added.

Oobli's decision to file GRAS notifications with the FDA demonstrates the company's commitment to meeting the highest regulatory standards and ensuring the safety of its products. By obtaining a no questions letter from the FDA, Oobli can navigate international regulatory reviews (https://www.foodnavigatorasia.com/Article/2024/04/16/s hanghai-launches-traffic-lightlabelling-pilot-for-sugarsweetened-beverages)

more efficiently, setting the stage for the global introduction of sweet proteins. This achievement is particularly significant given the potential of sweet proteins to revolutionize consumer behaviour by offering a healthier alternative to sugar.

In addition to developing innovative sweet protein products such as chocolates and teas, Oobli aims to educate consumers about the benefits of incorporating sweet proteins into their diets.

By leveraging the inherent trust consumers have in proteins, Oobli hopes to shift consumer perceptions of sweeteners and empower individuals to make healthier choices.

Looking ahead, Oobli plans to expand its product line and collaborate with other manufacturers to incorporate sweet protein ingredients into a variety of food and beverage options, ultimately paving the way for a new era of reduced sugar consumption and improved health outcomes.

FSSAI's Directive to Food Businesses: Remove claim of '100% firuit juice' from label and advertisements Aayushi Goel LexComply Blog June 10

In a bid to enhance transparency and accuracy in food labelling, the Food Safety and Standards Authority of India (FSSAI) has issued a significant directive.

This directive mandates Food Business Operators (FBOs) to remove the claim of "100% Fruit Juices" from the labels and advertisementsof fruit juices with immediate effect. All the FBOs have also been instructed to exhaust all existing pre-printed packaging materials before 1September, 2024.

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The Food Safety and Standards Authority of India (FSSAI) recently addressed the issue of misleading claims made by Food Business Operators (FBOs) regarding reconstituted fruit juices. Many FBOs have been falsely marketing these products as 100 percent fruit juices, when in reality the major ingredient is water and fruit content is only present in limited concentrations. FSSAI emphasized that such claims are misleading and not in line with regulations. FBOs have

been instructed to adhere to the standards set for fruit juices, which include proper labelling and designation of products that are reconstituted. This directive aims to ensure transparency and accuracy in product marketing and to protect consumers from misleading claims.

Together, a food environment can be created where labels are trusted and information is clear, allowing everyone to make better choices for themselves and their families. By supporting initiatives like FSSAI's directive, we can contribute to a healthier and more transparent food system that benefits us all. Let's stay informed, ask questions, and hold companies accountable for the products they provide. With consumer awareness and advocacy, we can shape a future where honesty and integrity are the norm in the food industry.

(https://lexcomply.com/blog/a uthor/aayushi-goel/)

India's food regulator FSSAI warns against selling human milk

MoneyControl News May 26, 2024 / 01:17 PM IST

The market for online human milk sales has expanded rapidly, with milk banks, originally established as nonprofit entities, now gathering milk from nursing mothers and selling it for profit.

India's top food safety body, the Food Safety and Standards Authority of India (FSSAI), has issued a directive to all states to stop granting licenses for the sale or processing of human milk. The advisory, released on May 24, emphasizes that "activities related to the commercialisation of human milk and its products should be immediately stopped."

The strict prohibition on commercial activities involving human milk is aimed at protecting the health and wellbeing of vulnerable newborns and infants. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, as breastmilk provides all the necessary nutrients and antibodies needed for a baby's growth and development.

Commercialization of human milk not only undermines the importance of breastfeeding but also puts infants at risk of consuming contaminated or improperly processed milk. The FSSAI's crackdown on companies involved in the commercialization of human milk sends a strong message about the prioritization of infant health over profitmaking ventures. By taking decisive action against these companies, the regulator is setting a precedent for others who may be considering similar activities.

It is imperative for the government to uphold regulations that protect the most vulnerable members of society and ensure that human milk is used for its intended purpose of nourishing babies, rather than being exploited for commercial gain.

(https://www.moneycontrol.co m/news/trends/health/indiasfood-regulator-fssai-warnsagainst-selling-human-milk-12732211.html)

