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INDIA'S RISK-BASED APPROACH FOR SAFE INTAKE OF VITAMINS AND MINERALS
PART 1: RISK ASSESSMENT

Dr Joseph I Lewis

RETHINKING HFSS FOODS: TOWARDS BALANCED NUTRITION AND INFORMED POLICY IN THE PROCESSED FOOD ERA
Ms Subhaprada Nishtala

ROLE OF FOOD PROCESSING IN SUSTAINABILITY AND REDUCTION OF FOOD WASTE
Dr. Malathy Venkatesan

HEMP PROTEIN: WHERE NUTRITION MEETS SUSTAINABILITY
Dr. Ashish Bhobe &
Ms. Sanyukta Telange

OMEGA-3 FATTY ACIDS: THE MISSING LINK IN INDIAN NUTRITION
Ms Meenu Yadav

FOOD PACKAGING: AN OVERVIEW
Dr. Shashank Bhalkar

UNDERUTILIZED SOURCES OF MICRONUTRIENTS:
Ms Simran Vichare

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PFNDAI Bulletin MAY 2025

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Editor: Dr. J. S. Pai

INDEX

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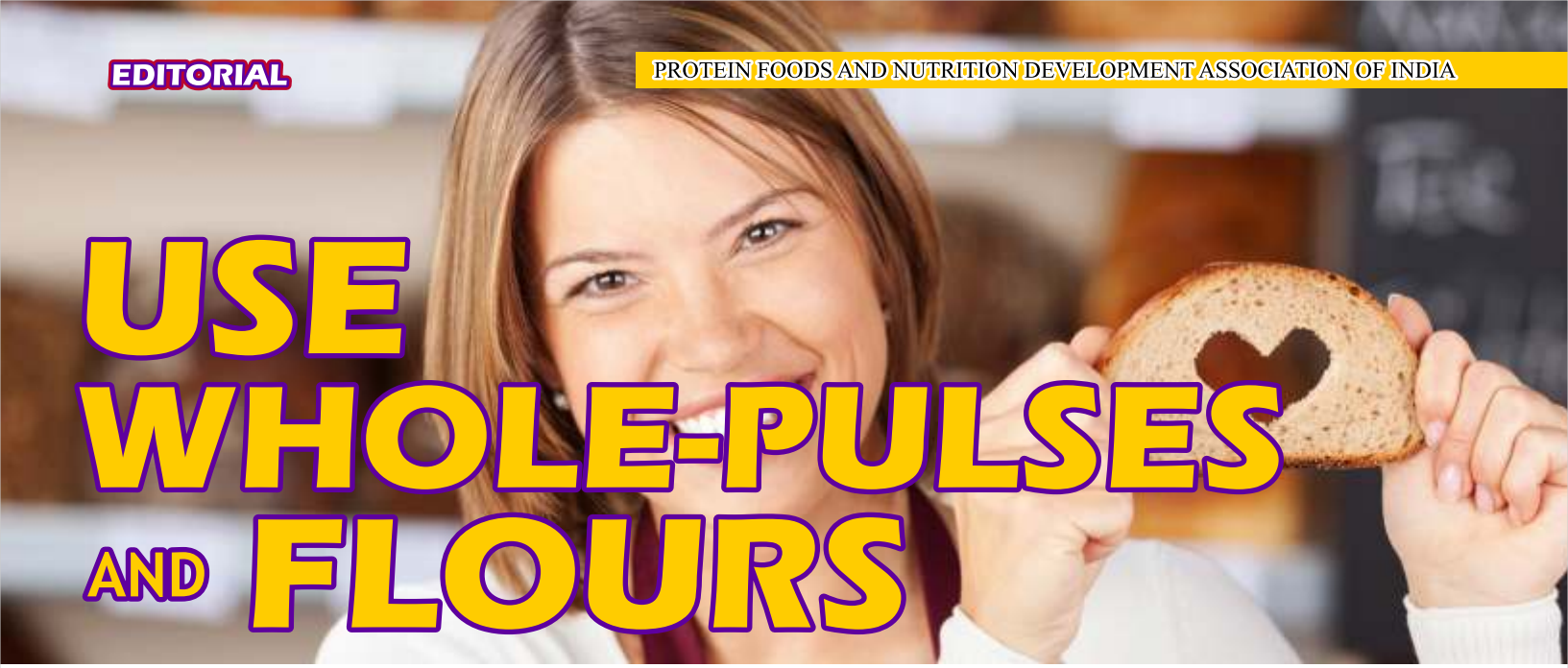

USE WHOLE-PULSES AND FLOURS

Whole grains are healthier because most contain outer layer that has some nutrients such as dietary fibre, some micronutrients including vitamins and minerals. There is a slight loss of antinutritional factors such as oxalate, phytate etc. but many could also be removed by soaking, fermentation and other means.

Whole wheat flour (atta) has always been promoted by health professionals as opposed to refined flour (maida) that loses many nutrients including dietary fibre, iron, B vitamins among others.

Refined wheat flour has some advantages in making bread as bran particles tend to interfere with the formation of gluten network that is essential for trapping gas during yeast fermentation that increases volume of dough making it soft and light. Subsequently, the bread made is also soft and highly acceptable. Now that we know that dietary fibre is lost in refining, we are now recommending whole wheat flour bread. We make chapatis and rotis from atta although, naan is prepared mostly from maida.

We use a lot of pulses, including chana or Bengal gram, lentils or masur, black gram or udad and others in various culinary preparations. Chana is normally made into dal which along with other dals becomes a staple for most Indians.

Chana dal is prepared after removing the outer shell and then splitting the pulse into two. This is then heated and ground to powder to make chana dal flour or besan. It is quite nutritious with good amount of protein and fair amount of dietary fibre, although it is possible to get more fibre.

Many of the dals are staples in Indian cooking. Even the besan is used for preparing many different products including potato vada, bhajiyas, sev, papdi, Mysore pak, and of course the dhokla. Thus, besan and chana dal provide good nutrition in Indian traditional diet and in many of our tasty snacks. As cereals provide more of carbs and less than necessary amounts of proteins, this combination of rice and dal or roti and dal give additional proteins and very much needed dietary fibre. Even our traditional snacks provide taste and nutrition.

Then what is the problem? We are only using part of the nutrients from chana. We are throwing the outer shell that has a large proportion of dietary fibre and many micronutrients. Here also there are some antinutritional factors but those could be reduced greatly by various traditional means we already have been using such as soaking and fermentation.

There is already whole chana flour that has been used although less commonly than besan, some call it sattu. There is no standard definition for sattu but some prepare it using roasted with shell but others prepare roasted without shell. Why not use whole chana flour instead of besan?

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There are a couple of products where besan works much better. One clear example is dhokla, the fermented soft product which is so tasty and flavourful that it has become quite popular globally. Whole chana roasted flour has coarser structure and when dough is made for fermentation, it will not rise as much because the gas structure would be broken by tiny shell particle or because of denatured protein and dhokla would be dense and not so fluffy and light.

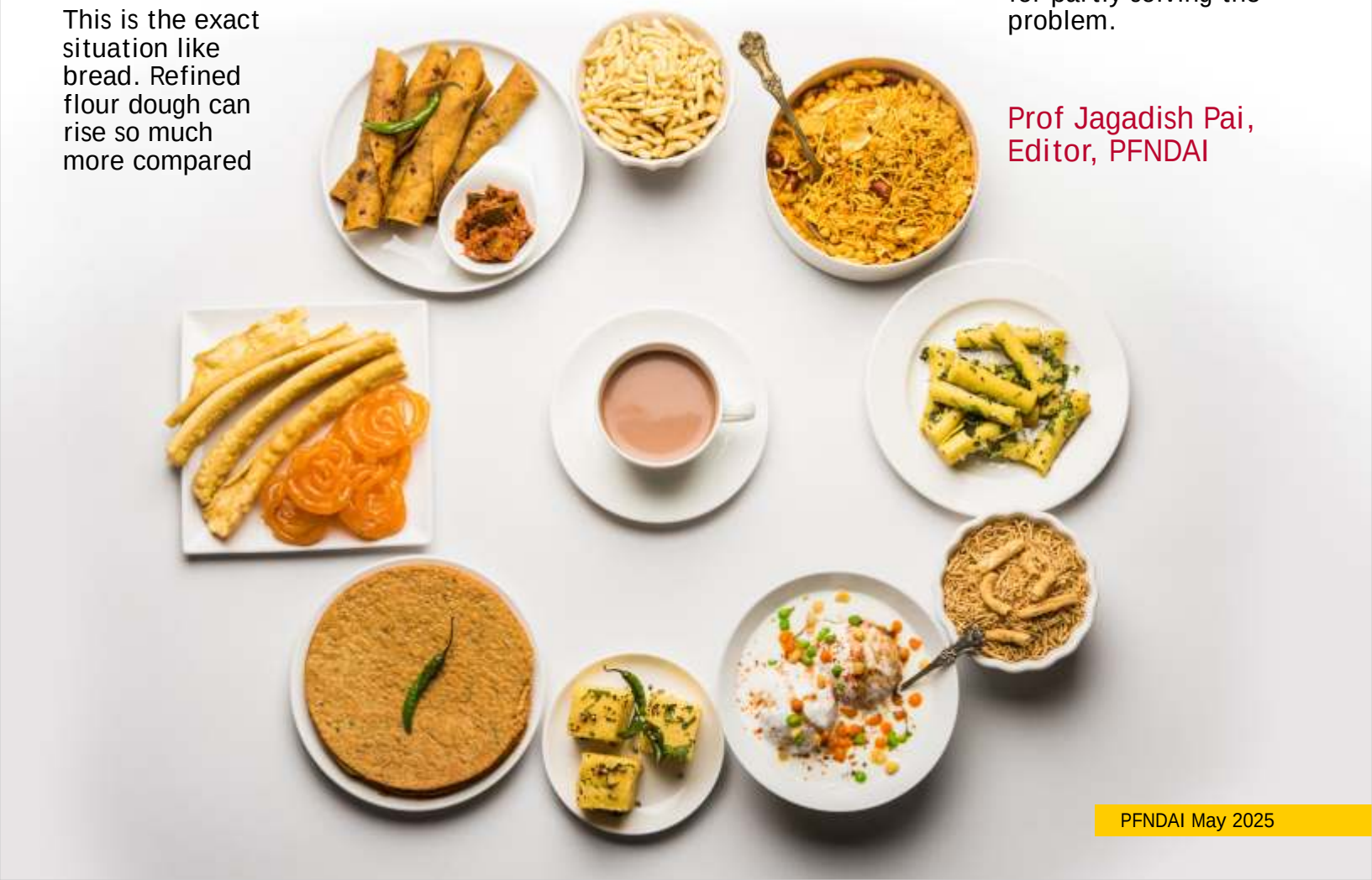
This is the exact situation like bread. Refined flour dough can rise so much more compared to whole wheat flour. However, now we have many technological advances to make a lighter and fluffier bread even with whole wheat flour. The similar things can also be tried for whole chana flour based dhokla.

On the other hand, most products in which besan is used can easily switch to sattu with very little problem is acceptability of snacks. Our health professionals should advocate the use of sattu or whole chana flour instead of besan in many such products.

Even in our daily dal and rice or roti, we can use whole chana. In fact, some very tasty Punjabi chhole recipes are made with whole chana. It takes a little more time to cook as the outer shell slows down cooking. There is famous Mahabaleshwar chana that is whole roasted chana with black shell intact. Masur can be cooked whole or after making dal without shell. Whole masur is more nutritious.

Let us not just criticise industry for using refined ingredients for making products; let us also try to make home cooking more nutritious. Especially because Indians are deficient in proteins and also prone to diabetes, this would be an ideal ingredient for partly solving the problem.

Prof Jagadish Pai,
Editor, PFNDAI



2 cups of Bournvita contains 50% RDA of Vitamin D, Iron and Zinc that support bones, cognitive and immune function thus supporting strength. For children (7-9 yrs.), ICMR -NIN, 2020. For more details, refer to the pack.

WHAT DOES IT TAKE FOR HOUSEHOLDS TO EAT HEALTHILY?

AUTHOR

Dr Joseph I Lewis,

Chairman, Scientific Advisory Committee, PFNDAI

The food-health pathway is straightforward. It begins with foods consumed from all sources (diet), which provide beneficial or harmful quantities of nutrients that lead to health or disease.

Although diets are pivotal to nutrient intake and health, aside from advice, little has been done to support them further. Labelling, a primary intervention measure in most countries, assumes that dietary practices are equivalent. The belief that the regulatory impact in low- and middle-income countries (LMIC), where staple diets contribute over 60% of daily energy, will be similar to that in high-income countries (HIC) is baseless.

For example, over 75% of salt in HIC comes from packaged foods, while a similar amount is found in home-cooked foods in India. Adding front-of-pack (FOP) depictions, whether graphic or algorithmically qualified, by symbol or grade, is less educational than an informative panel. Whatever the measure, a transformative shift in the food health pathway occurs when households begin to eat healthily.

Benjamin Franklin's quote, "Tell me and I forget, teach me and I may remember, involve me and I learn," inspires confidence in the use of nutrition tools. The iconic food pyramid advises consuming a greater number of servings from food groups, starting at the bottom and tapering to fewer foods that are high in fat, salt, and sugar. It was originally intended to educate and guide households in developing healthy diets.

A lack of organised and sustained effort, influenced by differing scholarly viewpoints, limited the pyramid to advice rather than practice. Since its introduction, several versions have emerged. First, the pyramid transformed into "My Plate" (NIN 2024), losing its intuitive proportioning of food groups.

Secondly, ice cream, biscuits, burgers, samosas, laddu, and other foods, which were placed at the top of the pyramid (NIN, 2011), illustrating foods high in salt, fat, and sugar, and advised to be eaten sparingly, have disappeared. They are now called HFSS. Demeaning foods favour an alienating approach over educating households on dietary quality.

Every multi-ingredient food provides nutrients within a sensory context; for instance, carbohydrates and fats in bread or cake. The dietary challenge for Indians is making thoughtful decisions among various food sources, home-prepared, packaged, ready-to-eat, and catered foods. Excellent tools are available for this purpose.

REGULATORY VIEWPOINT

The Food Frequency Questionnaire (FFQ), which considers “how much, how often,” along with the Diet Diversity Score (DDS), indicating “how many food groups in diets consumed,” and the Food Variety Score (FVS), asking “how much variety within a food group,” would reveal food repetitions and nutrient inadequacies. Dietary corrections are made by alternating with nutrient-dense foods.

Each substitution, apples and oranges for bananas, implies affordability and is captured through the Household Food Insecurity Access Scale (HFIAS). Such indices and scores reveal the vagaries of dietary quality due to the cultural and economic diversity of regions and household segments.

Expected outcomes from current measures, aside from their adoption, are neither specified nor a public health goal within a timeline. The likelihood of influencing dietary behaviours through multiple labelling versions is uncertain.

Dietary tools embedded in households foster a generational transfer of knowledge. Ultimately, what we consume influences how we feel, and the psychological aspect of food remains beyond external control.

INDIA'S RISK-BASED APPROACH FOR SAFE INTAKE OF VITAMINS AND MINERALS

PART 1: RISK ASSESSMENT

AUTHOR
Dr Joseph I Lewis,
Chairman, Scientific Advisory Committee, PFNDAI

Regulatory interventions relating to food safety and nutrition are extensively discussed, but little is known about their impact on achieving public health goals. Under PFA (1954), labelling of nutrients voluntarily added to foods to differentiate them from others was as far as the law would allow. In some products, the mandatory addition of vitamin A to vanaspati and margarine was required to raise their nutritional equivalence to butter and ghee. The PFA focused on adulteration and was less concerned with nutrition adequacy and public health. The regulatory landscape has changed since then (2006).

Authorities began showing concern by including nutrition information on product labels to influence purchase behaviour. In 2008, India started labelling four macronutrients, energy, carbohydrates, fat, and protein, on packaged foods, expanding to 10-12 nutrients (2020) with percentage contribution to the recommended daily allowance, intending to improve total dietary intake. Where packaged foods are not widely or significantly consumed, such measures have limited impact, as in high-income countries (HIC). With supportive scientific regulatory frameworks, more can be done to improve and sustain health and well-being.

Despite national food surveys reporting nutrient deficiencies over four decades, measures to increase total dietary intake have been modest. With newer nutrient-enriched foods available, a shorter timeframe to overcome deficiency by a comfortable margin is possible. Under a risk-based food safety framework, cumulative intakes from conventional foods, fortified foods and supplements are scientifically assessed to be safe up to levels that do not lead to adverse effects.

Regulatory authorities are now empowered to take science-based decisions to reduce population inadequacy. The risk-based methodology is not new or recent, but disregarded.

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Indian regulatory authorities habitually adopt maximum limits for food additives, contaminants, toxins, and residues, relying upon the risk assessments of JECFA, EFSA, and other agencies.

For the first time, FSSAI and ICMR used risk assessment to arrive at the tolerable upper level (TUL) for vitamins and minerals. Those familiar with the four-step risk assessment process will recognise the first two steps specified in FSSAI's terms of reference (4). This also aligns with the Codex approach (1), which states: (a) "upper safe levels of vitamins and minerals are established by scientific risk assessment based on generally accepted scientific data, taking into consideration, as appropriate, the varying degrees of sensitivity of different consumer groups; (b) "the daily intake of vitamins and minerals from other dietary sources" and (c) "When the maximum levels are set, due account may be taken of the reference intake values of vitamins and minerals for the population. This provision should not lead to the setting of maximum levels that are solely based on recommended nutrient intakes (e. g. Population Reference Intake or Recommended Daily Allowance values).Two major regions, the European Union (EU), ASEAN, have followed the Codex approach.

Risk assessment

Risk assessment is the functional domain of independent and relevant scientific experts (2: u/s 13;14), who, on conclusion of the assessment, submit the scientific opinion [2:u/s(15.5d);(16.2i);(18.2c)] to the Food Authority. Risk-based regulatory structures – Codex, EU and others- separate functional responsibilities between risk assessors (2: 14, 15, 16) and risk managers (2; 18.1b) to remain free and insulated from influence, interests, and interference. Assigning the risk assessment to the ICMR excludes the anomalous relationship between FSSAI and the Scientific Committee/ Panels.

The stepwise process defined in FSSA (u/s 3.1.zo) is shown in Table 1. The process begins when the Food Authority (4) - the risk manager - requests the risk assessor, ICMR, to conduct a risk assessment on the potential hazards that could cause harm as provided in terms of reference (3: Sch 1).

Table 1: Principles of risk assessment

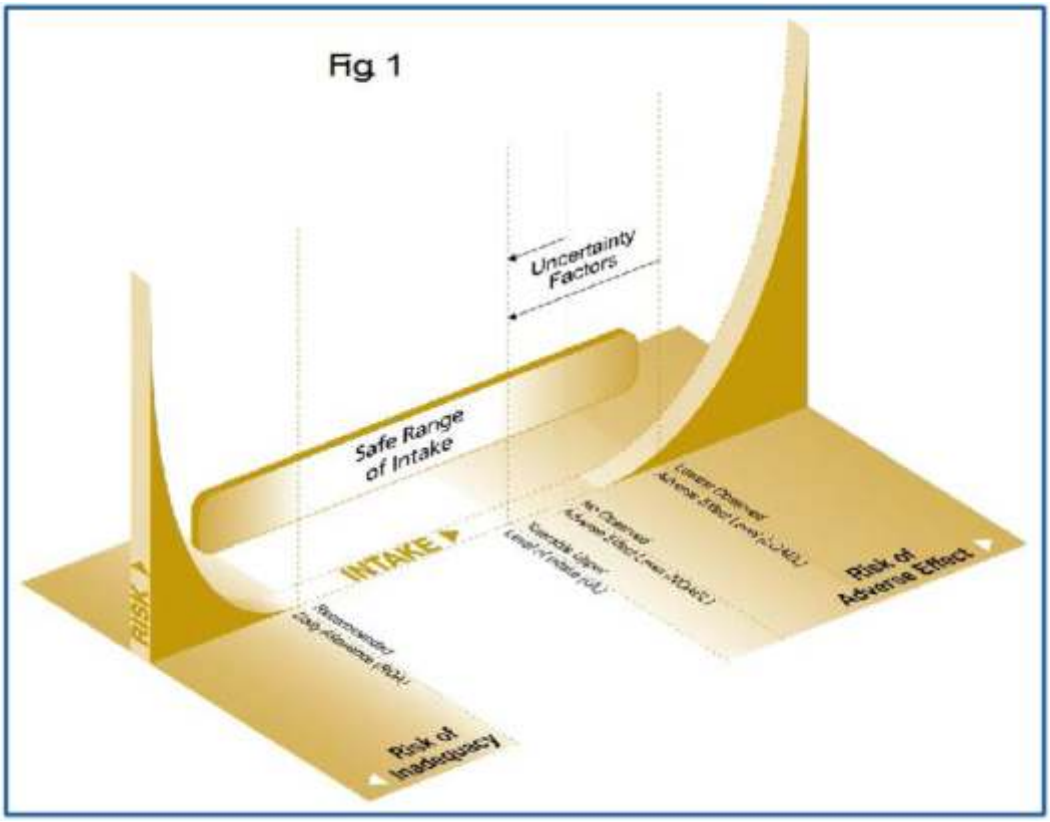
Step 1: Hazard Identification	**State the potential health hazard**
Step 2: Hazard Characterization	**Evaluate the level and threshold of adverse effects from available science**
Step 3: Exposure assessment	**Assess the magnitude of intakes.**
Step 4: Risk Characterization	**Evaluate potential risk, severity of harm**

The task assigned to ICMR (4) is to determine the tolerable upper limit for vitamins and minerals in health/dietary supplements and nutraceuticals above the Recommended Dietary Allowance (RDA), while considering various factors, including uncertainty and evidence of risk at different life stages (Step 1).

The points at which adverse health effects emerge are fundamental to risk assessment. To characterise hazards (Step 2), the available scientific evidence on intakes above RDA must be carefully evaluated and documented (4), (2: 18.2c).Several terms - low observed adverse effect level (LOAEL), no observed adverse effect level (NOAEL), highest observed intake (HOI), and uncertainty factors (UF) - are defined, evidence evaluated (study quality), scientifically reasoned, and applied in assessment protocols (Fig.1). Uncertainty in data is taken into account by applying UF to toxicological thresholds. Processand details of hazard characterisation are covered in the ICMR report (4) and the ILSI monograph (5). Where data from Indian population studies are unavailable, TUL values from other risk assessment institutions, such as the Institute of Medicine (IOM; USA), Scientific Committee on Food (SCF) and EFSA of the EC have been considered.

When there is insufficient evidence of harmful effects to establish toxicological thresholds, additional clarity on safety is required. An alternative approach proposed at the Technical Workshop on Nutrient Risk Assessment (FAO/WHO, 2006) involves establishing the Highest Observed Intake (HOI). The HOI is derived only when 'no adverse health effects' have been identified, and nutrients exhibit extremely low or non-existent toxicity, even at high intake levels. HOI is the highest level of intake observed (or administered, as reported in a study of acceptable quality), at the 90th or 95th percentile of estimated intakes in a population with no apparent adverse effects. However, the HOI must be clearly distinguished from the UL to prevent misinterpretation or misuse (5).Wordssuch as hazard, exposure, safety, risk, probability or likelihood, and uncertainty must be used unambiguously when communicating risk to align with published scientific opinion and definitions under food law.

Fig 1



On completing hazard characterisation, ICMR's conclusions are: (a) the Tolerable Upper Level is the maximum level of habitual intake– i.e., long-term average daily intake- of a nutrient or a related substance, which is judged 'unlikely' to lead to adverse health effects in humans. The term 'unlikely' in the context of risk assessment relates to satisfying the scientific criteria associated with the level of risk and, is not a value judgment intended to influence risk managers or prompt an unsubstantiated opinion; (b) the potential risk of adverse effects increases above the TUL; it is not a threshold level of safety but rather safe by a comfortable margin (Fig 1); (c) The range between the RDA and TUL is considered safe for total daily nutrient intake from multiple food sources, basic foods, fortified foods, and supplements.

ICMR established TUL for eleven vitamins and four minerals, given in Table 2, along with RDA 2010 and RDA 2020. Other publications noted TUL values of 1100 µg for iodine (5,6) and 350mg for magnesium (6), lower than 385mg (RDA 2020).

Nutrition advocacy relies upon reducing deficiencies irrespective of the time taken, while the gap continues. For decades, measures bound to RDA have restricted the potential to uplift the population's intake through safe higher intakes to sustain adequacy.

Table. 2: Vitamin and mineral levels

VITAMINS		ICMR [1,2] (RDA) 2010	ICMR 1,2,4 (RDA) 2020	ICMR [3,4] (TUL)	MINERALS		ICMR [1,2,3] (RDA) 2010	ICMR [1,2,4] (RDA) 2020	ICMR [3,4] (TUL)
Vitamin A (retinol) [b]	(µg)	600	1000	3000	Calcium	(mg)	600	1000	2500
Vitamin A (β – carotene)	(µg)	4800	NA	#	Chloride (AI) [5]	(mg)	1800-2300		#
Thiamine Vitamin B1	(mg)	1.2	1.4	100 @	Chromium (AI) [4]	(µg)	50	50 [4]	#
Riboflavin Vitamin B2	(mg)	1.4	2.0	40 @	Copper (AI (	mg)	1.7	2 [4]	#
Vitamin B6 (pyridoxine)	(mg)	2	1.9	100	Iron	(mg)	17	19	45
Vitamin B12 Cobalamins	(µg)	1	2.5	2000 @	Iodine	(µg)	150	150	900 (1100) [6]
Vitamin C (ascorbic acid)	(mg)	40	80	2000	Magnesium	(mg)	340	385	# (350) [6]
Vitamin D [c]	(µg)	10	15	100	Manganese (AI) [4]	(mg)	4	4 [4]	#
Vitamin E [d]	(mg)	7.5 – 10	7.5 -10	1000	Molybdenum [2]	(µg)	45		#
Vitamin K (K1), (K2)	(µg)	55	55	#	Phosphorus	(mg)	600	1000 [4]	#
Vitamin K3 (MK-4)		NA			Potassium	(mg)	3750	3500 [4]	#
Biotin [2]	(µg)	30		900 @	Selenium	(µg)	40	40 [4]	#
Dietary folate [a] B9	(µg)	100	300	1000	Sodium	(mg)	2100	2000 [4]	#
Niacin equivalent B3	(mg)	16	14	35	Zinc	(mg)	12	17	40
Pantothenic acid [2]	(mg)	5		#	Boron		NA		
TOTAL (TULs)				11/13	TOTAL (TULs)				4/14

1. Adult men sedentary (ICMR-NIN Report Expert Group 2009) 2. NRV; Codex CAC/GL 2-1985 3. ICMR Expert Committee Report (FSSAI; Sept 2018)
4. Expert Committee report (ICMR NIN 2020: pp 7) 6. ICMR NIN report of nutrient requirements 2023
Not considered @ No TUL found on data available: ICMR 2018
(a) Folic acid 1µg = 1.7 DFE (dietary folate equivalent); (b) Vitamin A: 1µg = 3.33IU. (c) Vitamin D: 1µg = 40 IU.
(d) Vitamin E 1mg = 1.5IU d-alpha-tocopherol, or 1.1IU dl-alpha-tocopherol

Hazard characterisation uses tools and principles of toxicology, which bring scientific certainty to policy discussions on time-targeted health goals.

Because vitamins and minerals, unlike other substances, are essential for a healthy life, adverse effects occur at suboptimal and excessive intakes. The risk assessment by ICMR is to overcome nutrient deficiencies through safe intakes from all sources: basic foods, fortified foods and health supplements. When surveys show deficiencies over four decades, raising prospects of overconsumption, though remote, delays the alleviation of inadequacy. Following ICMR's determination, published in 2018, exposure assessment and risk characterisation should have been done to complete the process. With every passing year, inflation and rising costs push the undernourished further away from an affordable, balanced and varied diet.

Micronutrient deficiencies significantly impact health and wellness, growth and development. Failure to change the trajectory of nutrient intakes despite supporting science and evidence requires urgent reflection on nutrition advocacy and policy.

References:

1. Guidelines for vitamin and mineral food supplements; CAC/GL 55 – 2005

2. Food Safety and Standards Act, FSSA 2006

3. FSS (Transaction of business and procedure for the Scientific Committee and Scientific Panels) Regulations2016.

4. Report of Expert Committee (ICMR): FSSAI Note 5th September 2018

5. Risk assessment of vitamins, minerals and bioactive compounds; K Bhaskarachary, V Sudershan Rao; ILSI 2023

6. Summary report of nutrient requirements for Indians. ICMR-NIN 2023.

RETHINKING HFSS FOODS: TOWARDS BALANCED NUTRITION AND INFORMED POLICY IN THE PROCESSED FOOD ERA

AUTHOR
Ms Subhaprada Nishtala,
Founder – Food Adroit

Introduction

The growing prevalence of obesity, diabetes, and other non-communicable diseases (NCDs) has intensified scrutiny of High Fat, Sugar, and Salt (HFSS) foods (NFHS-5, 2021; WHO, 2022). In both public health discourse and policy arenas, HFSS foods have become emblematic of unhealthy diets, especially as processed and ultra-processed foods become increasingly common in urban and rural India alike (Henningham et al., 2023).

However, the categorization of foods as HFSS often lacks nuance. Definitions vary widely across countries, and even within India, there is no single standardized framework. Here are a few of the definitions of HFSS foods from different regulatory frameworks and guidelines.

Source/Regulation	Definition of HFSS Foods
WHO (World Health Organization)	HFSS foods refer to foods with a high content of fat, sugar, or salt, which contribute to the global burden of obesity, diabetes, and other non-communicable diseases (NCDs).
FSSAI (Food Safety and Standards Authority of India)	HFSS foods are foods that are high in fat, sugar, or salt, exceeding the threshold levels specified for each nutrient, which can lead to adverse health outcomes when consumed in excess
Ministry of Women and Child Development (2017)	HFSS foods include processed foods that have high amounts of fat, sugar, and salt, often marketed as ready-to-eat or convenient foods but posing risks to children's health
National Institute of Nutrition (NIN, 2024)	HFSS foods are characterized by high concentrations of fat, sugar, or salt and are identified based on nutritional labeling and dietary impact on public health.

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While HFSS foods can be a significant contributor to poor dietary quality, equating them with all processed foods is misleading. The challenge lies not in the presence of fat, sugar, or salt—each of which plays an essential role in human metabolism—but in their excessive consumption, particularly in diets low in fiber, diversity, and nutrients (ICMR-NIN, 2024).

The Global HFSS Response: A Regulatory Snapshot

Given the rising consumption patterns and health burdens associated with HFSS foods, there emerges a critical need to systematically manage their production, marketing, and accessibility through evidence-based public health strategies. Over the last two decades, countries around the world have launched a variety of regulatory and fiscal policies aimed at reducing the population-level intake of HFSS foods (WHO, 2022).

- United Kingdom (2005): One of the earliest efforts was the restriction of HFSS food advertising during children's programming.
- Hungary (2011): Introduced the "Public Health Product Tax" on packaged foods high in sugar, salt, or caffeine (WHO, 2022).
- Mexico (2014): Became the first Latin American country to implement taxes on sugary beverages and junk food (WHO, 2022).
- Denmark (2011–2012): Briefly enforced a fat tax, repealed later due to implementation challenges (Thow et al., 2018).
- Portugal (2017): Introduced a sugar tax on soft drinks (WHO, 2022).
- England (2022): Advanced its HFSS strategy by restricting placement of HFSS items in retail outlets and proposing a watershed advertising ban before 9 PM (WHO, 2022).

These initiatives reflect the global momentum toward curbing HFSS food consumption through regulation and taxation. Yet, the effectiveness of such policies has been mixed. In many cases, these interventions failed to significantly shift dietary behaviors or reduce obesity rates in a sustained manner (Thow et al., 2018).

The Indian Context: Processed Foods, HFSS, and Policy Evolution

India's food landscape is at a crossroads. Urbanization, time scarcity, and rising disposable incomes have fueled the growth of processed food consumption (NFHS-5, 2021). While this brings convenience, it also increases the risk of over-reliance on energy-dense, nutrient-poor foods.

The Food Safety and Standards Authority of India (FSSAI) has responded through multiple strategic interventions:

- 2020: Issued guidelines restricting the sale of HFSS foods in and around schools.
- Front-of-Pack Labelling (FoPL): Draft regulations aim to inform consumers about nutrition profiles at a glance (FSSAI, 2022).
- "Eat Right India": A comprehensive public health movement that integrates food safety, sustainable diets, and nutritional literacy through programs like:
  - Eat Right Campus
  - Eat Right Mela
  - Safe and Nutritious Food at Workplace (FSSAI, n.d.)

These efforts represent a multi-pronged, systems-based approach, aligning with the global shift from

punitive to participatory strategies.

Why Vilifying Processed Foods as HFSS is Problematic

While well-meaning, the trend of labeling all processed foods as HFSS and framing them as "unhealthy" can have unintended consequences:

1. Not all processed foods are nutritionally poor. Fortified cereals, pasteurized milk, frozen vegetables, and packaged pulses can play a positive role in food security and nutrition.

2. Fat, sugar, and salt are not inherently harmful. They are essential nutrients required in appropriate quantities for energy metabolism, cellular function, and electrolyte balance.

3. Context matters. For physically active individuals or undernourished populations, moderate consumption of high-energy foods is not only acceptable—it can be beneficial (Henningham et al., 2023).

Instead of oversimplification, public health messaging should emphasize portion control, dietary diversity, and balanced meals that suit individual health needs, cultural preferences, and socioeconomic contexts.

The Whole-of-Diet and Food Systems Perspective

A more sustainable approach to public health nutrition requires a shift from a reductionist, nutrient-focused lens to a whole-of-diet perspective. This model recognizes the complex interplay between food, health, environment, and society. It promotes:

- Consumption of diverse, minimally processed, and nutrient-rich foods
- Inclusion of whole grains, seasonal fruits and vegetables, legumes, nuts, and healthy fats
- Cultural relevance in dietary guidelines
- Environmental sustainability, including plant-forward diets with a reduced ecological footprint (Raworth, 2012).

Equally important is food literacy—enabling people to understand not just what to eat, but why and how food choices impact health and sustainability. This includes reading nutrition labels, understanding ingredient lists, and developing critical thinking around food marketing.

Lessons from Global Failures of Over-Reliance on Taxes

Despite global enthusiasm for taxes on HFSS foods and sugary beverages, evidence of long-term effectiveness is limited:

- Mexico's soda tax initially reduced purchases but had a modest impact on obesity rates (Time, 2015).
- Hungary's product tax improved revenues but did not lead to major dietary shifts (World Health Organization,2015).
- Denmark's fat tax was repealed due to public opposition and cross-border shopping (BBC News, 2012).

These cases show that taxation alone cannot solve complex food system issues. Without complementary strategies—such as nutrition education, product reformulation, and improved access to healthy alternatives—taxation risks being regressive and ineffective.

India's Way Forward: Balanced, Inclusive, Informed

India's strength lies in its diverse food culture, multi-sectoral governance, and

active civil society. These assets must be leveraged to design policies that:

- Are inclusive and culturally contextualized
- Engage industry in product innovation and responsible marketing
- Empower consumers through education, not fear
- Promote access to affordable, healthy foods, especially for vulnerable populations

Through its programs and food regulations, FSSAI is charting a forward-looking path that integrates food safety, nutrition, and sustainability— a model other countries can learn from (FSSAI, n.d.).

Conclusion

Tackling the health risks associated with high-fat, sugar, and salt (HFSS) foods demands more than isolated interventions—it requires effective, evidence-based nutrition policies that are multidimensional, inclusive, and informed by robust research.

The increasing availability and marketing of HFSS foods call for vigilant, evidence-informed public health action. But it is important to avoid demonizing all processed foods or reducing nutrition policy to single-nutrient tax strategies.

Definitions of HFSS are still evolving, and their broad application risks oversimplification. Fat, sugar, and salt—when consumed judiciously—have legitimate roles in a balanced diet. The real issue lies in dietary imbalance, lifestyle shifts, and lack of awareness.

India's current direction—reflected in FSSAI's "Eat Right India" initiative—offers a powerful alternative. It emphasizes empowered decision-making, stakeholder partnerships, systemic thinking, and sustainable food environments.

As nations grapple with the dual burdens of undernutrition and overnutrition, India can become a model for low- and middle-income countries by demonstrating how responsible, inclusive nutrition policy can protect health while ensuring equitable access to wholesome and sustainable diets. The path to better nutrition and public health lies not through restriction alone, but through education, collaboration, and trust in the ability of informed citizens to make better food choices.

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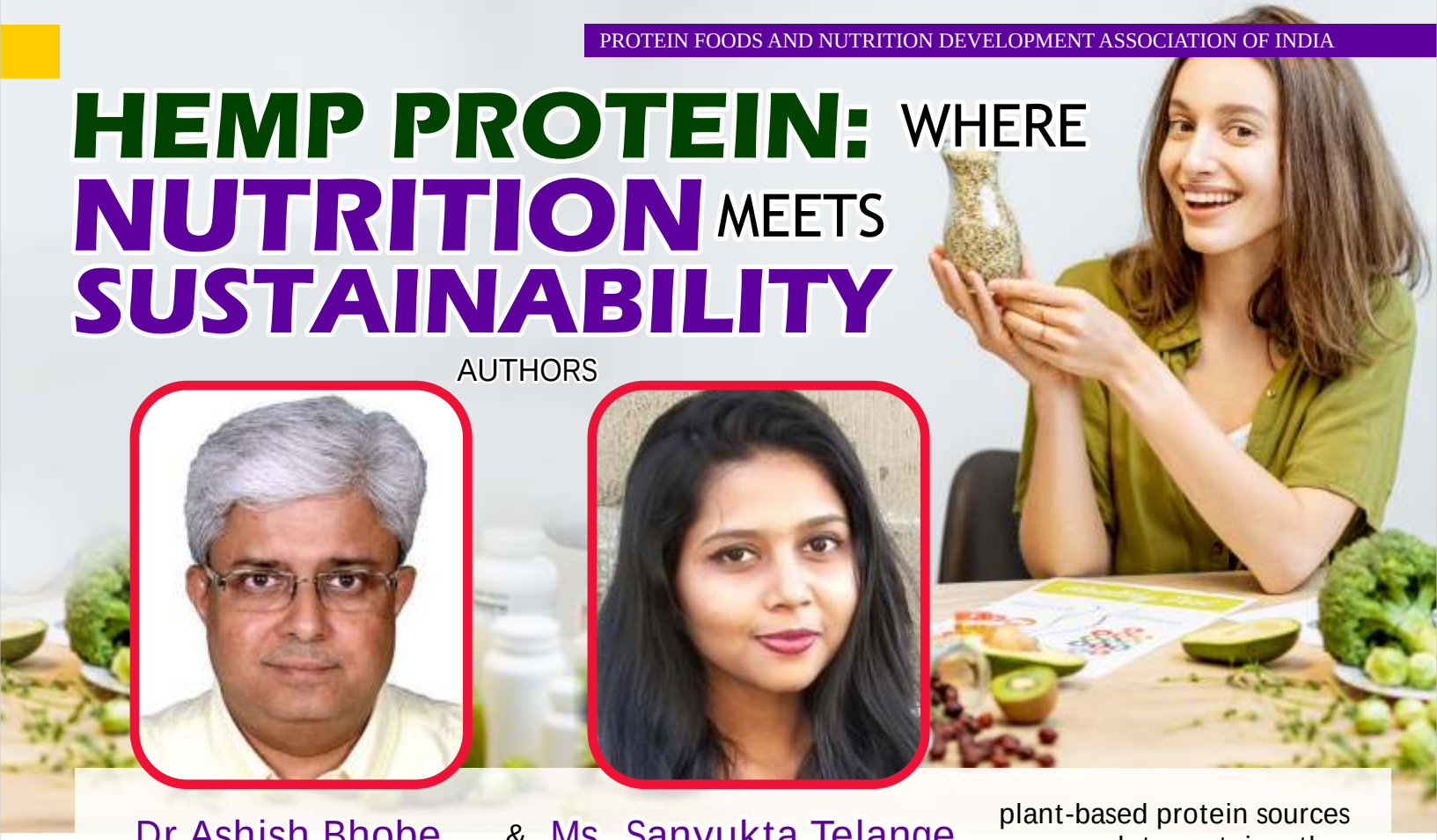
HEMP PROTEIN: WHERE NUTRITION MEETS SUSTAINABILITY



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Introduction

Protein is an essential part of a healthy diet, offering many benefits. With India facing a protein deficiency, adding protein sources to our diet is crucial. As more people shift toward plant-based and sustainable options, hemp protein stands out as an excellent choice. Derived from the Cannabis sativa plant, it provides numerous health benefits. It is a sustainable and nutrient-rich plant-based protein source. Hemp is different from the other varieties of cannabis plant as it typically has less than 0.3% THC (tetrahydrocannabinol), the principal psychoactive component. Hemp is one of the oldest plants cultivated around the world for its fibre, seeds, etc. Its cultivation requires minimal water, enriches soil health, and grows without the need for synthetic pesticides, making it an environmentally friendly crop.

Nutritional Profile of Hemp:

Hemp seeds are nutritious and great for a healthy diet. In 100 grams, they provide around 553 calories and are rich in protein (about 31.6 g). Relatively, very few plant-based protein sources are complete proteins, thus making hemp seed protein a valuable plant-based source of nutrition. Hemp seeds contain carbohydrates (around 8.7 g), fibre (4 g) and sugar (1.5 g), and they have a low glycemic index.

They also contain important minerals like magnesium, phosphorus, potassium, iron, and zinc, along with B vitamins such as B1, B2, B3, B6, folate, and vitamin E. Hemp seeds are high in arginine, an amino acid that helps support heart health. They also contain a high amount of healthy fats (about 48.8 g), especially omega-6 and omega-3 fatty acids with a favourable n-6 to n-3 ratio, which supports heart health, reduces inflammation, and promotes brain function.

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They also offer polyphenols and terpenoids. Hemp seeds stand out for their quality proteins, with around 181 identified proteins. The primary storage proteins, edestin (67–75%) and globular albumin (25–37%), are highly digestible, with edestin being superior to albumin due to its high sulphur amino acid content (methionine and cysteine). The PDCAAS score for dehulled hemp seeds is approximately 66%.Hemp protein supports muscle growth and repair and regulates immunity. Hemp seeds are highly nutritious, but they contain certain anti-nutritional factors like phytates, tannins, trypsin inhibitors, and saponins. However, these anti-nutritional compounds are common in many plant-based foods and can be minimized through processing methods like soaking, roasting, or enzymatic treatments, improving the overall digestibility and nutritional benefits of hemp seed products (1,2).

The table below represents the nutrients present in a 28g serving of some commonly consumed seeds. When we compare hemp seeds with others, they stand out for their high protein and PUFA content.

Table 1. Comparison of hemp with commonly consumed seeds(9)

28 g serving	Flaxseeds	Chia seeds	Hemp seeds	Sunflower seeds
Calories (Kcals)	152	137	155	164
Fiber (g)	7.8	10.6	1.1	2.4
Carbohydrates (g)	8.09	11.78	2.43	5.6
Protein (g)	5.2	4.4	8.8	5.8
MUFA (g)	2.1	0.6	1.5	5.2
Omega-3 fats (g)	6.5	4.9	2.24	negligible
Omega-6 fats (g)	1.7	1.6	7.84	6.4
Manganese(% RDI)	35	30	99	27
Thiamine (vitamin B1) (% RDI)	31	15	31	36
Magnesium(% RDI)	28	30	45	23

Processing of hemp protein:

The hemp seed protein concentrates can be produced at an industrial scale using dry or wet fractionation. Dry fractionation is a mechanical method involving grinding, milling, sieving, and isolating protein-rich fractions based on particle size or density. This cost-effective, solvent-free process is favoured for protein concentrates but does not achieve the purity of wet-extraction methods. The wet fractionation of hemp seed protein involves isolating and separating different protein fractions using water-based methods, resulting in protein concentrates or isolates with varying characteristics and functionalities. Protein is derived by cold-pressing hemp seeds and removing the oil, which leaves behind a protein-rich powder.

Hemp oil is extracted via screw pressing, leaving behind a protein-rich residue (cake or meal). The protein content in hemp seed cake can exceed 60% by removing the hull (through pearling and dry sieving) and further reducing oil content via pelletizing or organic solvents. Hemp protein isolates (HPI) with high protein content are commonly prepared using

alkaline extraction followed by acid or isoelectric precipitation, micellization, or reverse micellization. This involves defatting with supercritical CO2, Soxhlet extraction, or hexane, followed by alkaline solubilization and precipitation near the isoelectric point, typically pH 5, though recent studies suggest 5.8. Other recovery methods for isolation include enzyme, acid, and salt extraction. HPI provides essential amino acids, particularly arginine and glutamic acid, with moderate levels of sulphur-containing amino acids (3).

Hemp protein powders are generally safe for most individuals; however, some may experience mild side effects. Consuming large amounts frequently can lead to digestive discomfort, such as bloating and gas. Moreover, individuals with a hemp allergy should avoid consuming hemp protein products. According to a study, hemp seeds might inhibit platelet formation and could interact with blood-thinning medications. Therefore, individuals on such medications should consult a healthcare provider before consuming hemp.

Versatile applications:

Hemp seed protein is widely used in various food applications due to its high nutritional value and functional benefits. In meat products, adding hemp seed (8%), flour (0.2%), and oil (2%) to poultry roast improves fibre, protein, aspartic acid, and arginine content while reducing cooking losses. Meat analogues made using high moisture and high shear extrusion benefit from hemp proteins as they enhance their texture.

The demand for plant-based milk is rising due to lactose intolerance, milk allergy, and vegan diets. Hemp milk is a nutritious and low-allergen alternative to dairy, soy, and nut milk, with good nutrition and a mild nutty flavour. Research has shown that high-pressure homogenization improves its stability, preventing phase separation for at least three days at 4˚C. In other dairy products, like cheese, replacing 10–25% of milk with hemp seed protein in production increases cheese yield, improves protein content, and provides a balanced amino acid profile.

Hemp protein is also a promising natural emulsifier and plays a crucial role in stabilizing oil-water mixtures in food, pharmaceuticals, and cosmetics. It can be used for stabilizing oil-in-water emulsions in food products such as egg-free mayonnaise, non-dairy milk, probiotic encapsulation, and gluten-free rice bread. Studies show that salt-extracted hemp protein (HMI) forms small, stable droplets, while alkali-extracted hemp protein (AIH) provides better long-term stability and prevents separation. Additional processing, like ultrasonic treatment or combining hemp protein with pectin, further improves its emulsifying properties.

In bakery products, cookies made by replacing 10% wheat flour with hemp protein have higher protein and threonine content with a delicate texture. Bread fortified with 10% hemp seed cake flour maintains its texture while increasing protein levels and replacing 5–40% wheat flour with hemp seed cake flour, boosting the phenolic content and antioxidant activity.

For gluten-free bread, hemp protein significantly boosts nutritional value by adding protein and healthy fats. It improves the dough's structure, texture, and sensory appeal.

The addition of hemp flour in sourdough fermentation in gluten-free bread enhances its aroma, creating pleasant flavours like almond and caramel, along with a few undesirable flavour compounds. Researchers are exploring ways to balance these flavours to make hemp-based gluten-free bread more appealing. In pasta, replacing 5–20% wheat flour with hemp seed flour in gnocchi improves protein content, reduces stickiness and cooking loss, and enhances cooking resistance. Similarly, rigatoni pasta made with 5–20% hemp seed meal has higher phenolic content and antioxidant activity.

Hemp seed proteins (HSPs) are useful for making biodegradable films that can be used in food packaging and coatings. These films are safe to eat, break down naturally, and have good water resistance. However, they are not very strong and do not block moisture well, which limits their use in food packaging. To improve the strength and functionality of these films, scientists have experimented with different treatments and additives. For example, microbial transglutaminase helps make HSP films smoother, stronger, and more flexible with better heat-sealing properties. A composite film made from Deccan hemp seed protein, taro starch, and hemp leaf extract helped grapes stay fresh for longer. Edible films made with Sunnhemp protein, potato starch, and clove oil had better strength and moisture resistance. These films create a protective barrier around food, helping to maintain freshness and prevent dehydration. Additionally, HSP bodies (small protein structures in hemp seeds) can react to changes in pH levels, making them potential indicators for food quality monitoring.

Hemp seed proteins (HSPs) help protect food quality by encapsulating unstable bioactive compounds, enhancing stability, and extending shelf life. Encapsulated hemp seed oil retains its antioxidant properties, and HSP-alginate nano-emulsions remain stable in high-salt environments, making them valuable for food preservation. These applications highlight hemp protein's versatility as a sustainable and functional ingredient for improving the nutritional and sensory properties of various foods (4,5).

Is Hemp Legal in India?

Hemp legality in India is governed by strict regulations under the Narcotic Drugs and Psychotropic Substances (NDPS) Act, 1985. While the act generally classifies cannabis as illegal, it provides certain exceptions for industrial hemp, provided its THC (tetrahydrocannabinol) content remains below 0.3%. This distinction is important because THC is the psychoactive compound responsible for the "high" associated with marijuana, whereas industrial hemp has minimal THC and is primarily used for commercial and medicinal purposes.

Several states in India have recognized the potential of hemp for agriculture, medicine, and industry and have permitted its controlled cultivation. Uttarakhand became the first state to legalize industrial hemp farming, followed by Uttar Pradesh, Himachal Pradesh, and Jammu & Kashmir. These states allow farmers to cultivate hemp under government supervision, ensuring it adheres to the THC limit.

Apart from cultivation, hemp-based products like hemp seeds, hemp oil, hemp textiles, and other industrial derivatives are legal and widely available in India. Hemp seeds and oil are often a preferred choice in the health and wellness sector due to their rich nutritional composition (6).

Regulations by FSSAI

The FSSAI have set clear regulations under Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011 for Hemp seeds and seed products. It has defined hemp seeds and the requirement of cultivation compliance with the NDPS Act, 1985.

Hemp seed, oil, and flour can be used in food if they meet specific standards. Hemp seed flour, produced by milling seeds, should not exceed 5 mg/kg of THC, and if oil is extracted before flour production, it must be labelled as “Deoiled hemp seed flour.”

Beverages made from hemp seeds must maintain a THC level below 0.2 mg/kg, while any other food containing hemp seed products should not exceed 5 mg/kg of THC.

Cannabinoid regulations allow only naturally occurring cannabinoids in hemp seeds, with CBD levels not exceeding 75 mg/kg. The labelling of hemp food products must not contain images of the cannabis plant (including the leaf), the words “cannabis” or “marijuana,” or health claims about CBD. Any food products containing hemp seed or seed products should include the word ‘Hemp’ on the label.

Additionally, hemp-based food products cannot be manufactured, imported, or sold for infants under 24 months (7). These regulations ensure that hemp food products remain safe while preventing misleading claims or illegal drug-related associations.

Conclusion:

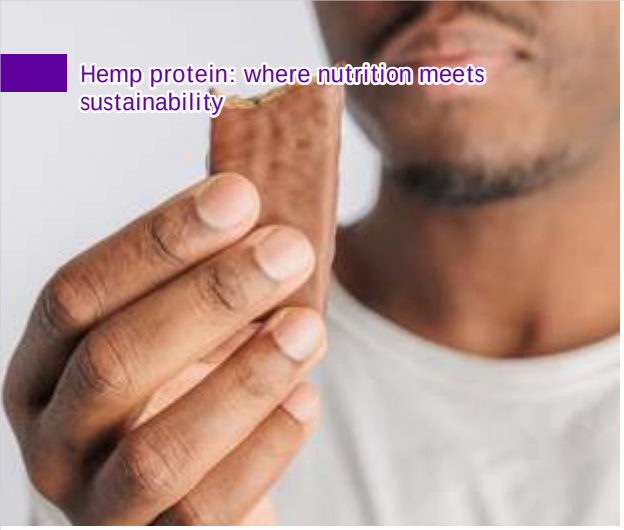
India's plant protein market is rapidly growing, which is expected to reach USD 1.35 billion by 2030, growing at a CAGR of 6.30%. Within this, hemp protein stands out as a dynamic segment, projected to grow at approximately 9% CAGR between 2024 and 2029 (8).

Its rise is fuelled by its health benefits and the growing adoption of veganism. It's gaining popularity in personal care products as well as sports nutrition for providing energy, protein, fibre, and omega-3 and 6 fats.

Common products in the Indian market include hemp seeds for use in salads, smoothies, and cereals. Hemp seed oil is another product often drizzled over salads. Hemp protein powder serves as a plant-based protein source for fitness enthusiasts and those seeking alternative protein options.

Additionally, hemp-based snacks, such as energy bars, granola, and protein bites, are available in stores. Hemp-infused beverages, including hemp milk and herbal teas, are also emerging in the market as dairy alternatives and wellness drinks.

Hemp-based food products not only provide significant nutritional benefits but also contribute to a more sustainable food system. With its nutritional advantages, versatility, and eco-friendly nature, hemp has the potential to play an important role in the future of sustainable food and nutrition.



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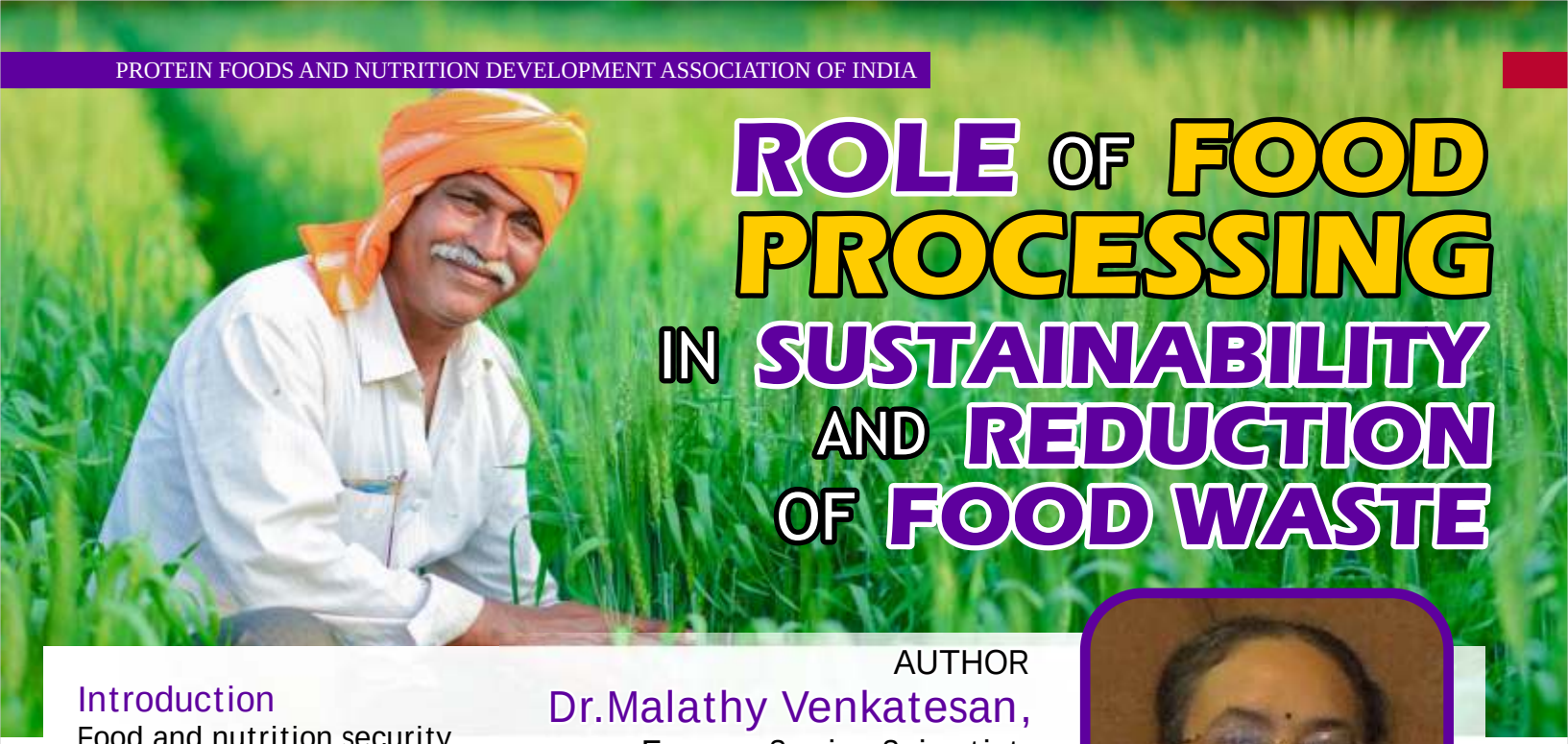

ROLE OF FOOD PROCESSING IN SUSTAINABILITY AND REDUCTION OF FOOD WASTE

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Introduction

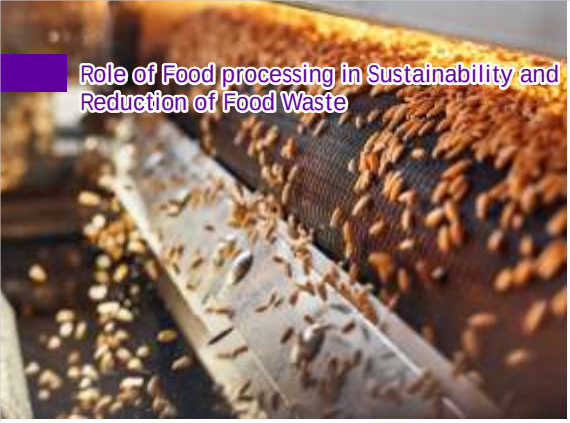
Food and nutrition security, a major global challenge, relies on the adequate supply of safe, affordable and nutritious fresh and processed foods to all people. Food security exists when “all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”.

Nutrition security “exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, in order to ensure a healthy and active life” (1). The world population is expected to increase to 9 billion in 2050. The food requirements can be addressed by reducing demand, lessening the current level of food waste or increasing food production.

Since prehistoric times, food processing has been a key aspect of the food production chain that links agricultural production with the provision of food to people in the form and at the time it is required. Processing of food is essential to increase useful life of foods, optimize nutrient availability and food quality, and reduce losses and waste.

Environmental sustainability is critical and both the agri-food production. The food processing sectors will be challenged to use less resources to produce greater quantities of existing foods and develop innovative new foods that are nutritionally appropriate for the promotion of health and well-being, have long shelf lives and are conveniently transportable.

Healthy diets which meet consumer expectations produced from resilient and sustainable agri-food systems need to be delivered in a changing world with diminishing natural resources. An integrated multi-sectoral approach across the whole food supply chain is required to address global food and nutrition insecurity(2). Apart from improving agricultural systems in order to close the nutrition gap, efficient storage and food processing technologies to prolong shelf-life are required.



If processing is poor, high food losses can cause food insecurity or increase the risk of producing unsafe and unhealthy food. In India, food storage and processing into products for year-round use has been traditionally carried out at the household level on a small scale. However, the gradual shift from joint families to nuclear households with increasing number of working women, increasing urbanization, change in lifestyle and food habits has resulted in the growth of food processing industry.

The willingness of young Indians to accept processed foods in recent times, coupled with robust regulations (FSSAI) and the innovative spirit of entrepreneurs to ensure safe and nutritious foods, is creating a path for the processing and marketing within and beyond the boundaries of the country. The Indian food industry has been successful in using innovations to manufacture traditional foods with machinery design, process development, raw material selection, end product packaging, and preservation for shelf-life extension. Some examples are the instant premixes of breakfast foods such as dhokla, idli, upma, and poha which are preferred by consumers due to greater convenience and instant cooking.

Processing can improve the nutritional quality of food. Processing can improve the bioavailability of essential nutrients – meaning more of the nutrient can be utilised by the human body. An example of this is processing legumes (via heat treatment, fermentation, germination or simply soaking) to increase the bioavailability of iron and zinc. Foods can also be fortified through addition of critical nutrients that may be limiting in some diets, as commonly performed for breakfast cereals. Processing therefore plays a key role in increasing nutrient availability to the growing global population.

In addition, many foods have a short shelf life. A variety of fruits and vegetables, as well as most animal-sourced foods, cannot be stored for long periods of time in their raw form. This can create potential food safety issues, or nutritional quality can decrease over time. Moreover, some regions do not produce sufficient food to meet the requirements or demands of their local population, meaning that it must be imported, taking time to reach those that need it. In addition, some food products are seasonal, where supply will exceed demand for some months of the year, and vice versa for the rest of the year.

It is essential to extend the useful life of nutrient-rich foods to avoid safety issues and preserve nutritional quality. This can be achieved through processing. For example, raw milk has a relatively short shelf life, but this can be extended by processing it into milk powder, cheese or yoghurt. Milk is a nutrient-rich food, and processing allows as much of this nutrition to reach consumers as safely as possible. Likewise, freezing or canning of fruit and vegetables can keep these foods stable for as long as they remain in this state. Pressing oil crops to produce vegetable oils allows the nutrients in these crops to be utilized in a wider variety of ways than the raw form allows. While some of these techniques are modern, such as freezing and canning, others, such as fermentation and pressing, have been instrumental in the human diet for millennia.

With one of the largest agricultural sectors in the world and a population exceeding 1.2 billion people, India's farming output has a meaningful impact on global food-security.

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INDIA'S NO. 1* MUESLI

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*As per Nielsen IQ Retail Intex data for period MAT Jul'24 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.

Role of Food processing in Sustainability and Reduction of Food Waste

Independent reports suggest that about 7%, or roughly 16-17 million tons of grain go to waste each year. While the processed foods industry is growing in India, both domestically and for export, it still plays a minor role compared to the fresh food industry.

While as much as 70-80% of food in developed countries is processed in some way, India currently processes only about 2%. Since food processing serves as a means of extending the shelf life of produce, this lack of food processing capacity contributes significantly toward food waste(3).

The government also owns a number of food processing and retailing companies, which manufacture and distribute food products through a range of brand names. These facilities provide a low-cost alternative to privately run markets in many cities, and generally offer a smaller selection of items. An Indian agricultural supply chain consulting firm indicated that 30% of the typical Indian household income is spent on staple vegetables - onions, tomatoes, and potatoes - with government-run markets helping supply these items for many families at more affordable prices.

With roughly 2% of food grown in India being processed, there is a great opportunity to extend the shelf life of products through drying, curing, juicing, packaging or other food processing techniques. This would be especially valuable in cases where there is a bumper crop and prices for a particular item plunge to the point where it is not economical to harvest or distribute (e.g., potato crops in 2011).Processing would allow for the crops to be stored until prices recover or to be exported to other parts of the world(3).

Food processing to reduce food waste

The amount of food that is wasted along the global supply chain from farm to consumer is about 1.6 Gtonnes (or about one third of the total produced based on weight) and 1.3 Gtonnes of this waste is edible. Food may be lost from the supply because of safety and quality considerations, and under-utilization of edible by-products and side streams of food processing. Food losses and waste can occur on farm, between farm to retail, at retail level and after it has reached the consumer. (4)

Food processing may be used to reduce the amount of food lost by using preservation processes, such as freezing, drying, fermentation, canning, pasteurization and sterilization, and packaging technologies to increasing the shelf-life of products.

There are many potential uses for underutilized edible products. For example, protein- based by-products of animal processing may be used for production of bioactive hydrolysates. India ranks either first or second in terms of production of cereals, fruits, and vegetables, pulses, milk, ghee. Food losses are significantly higher in case of fruits and vegetables followed by cereals, meat, and milk. Food processing is one of the many ways to minimize food wastage. The United Nations Environment Programme food wastage index report indicates that over 68 million tonnes of food is wasted annually in Indian homes, which is roughly 50 kilograms per person.

Pre-consumable food waste in India comes from surplus byproducts from food manufacturing supply chains, quality rejections, packaging damages, storage issues, transit losses and

pre-cut meats.India passed The Food Waste (Reduction) Bill 2018 to reduce food waste. However, a massive loss of food grains still needs to be addressed(5).

In addition to the two comprehensive surveys undertaken by the ICAR, there have been numerous food loss studies conducted on a more limited geographical or crop coverage scale. One example is the estimate of losses in the mango cultivation and processing chain.

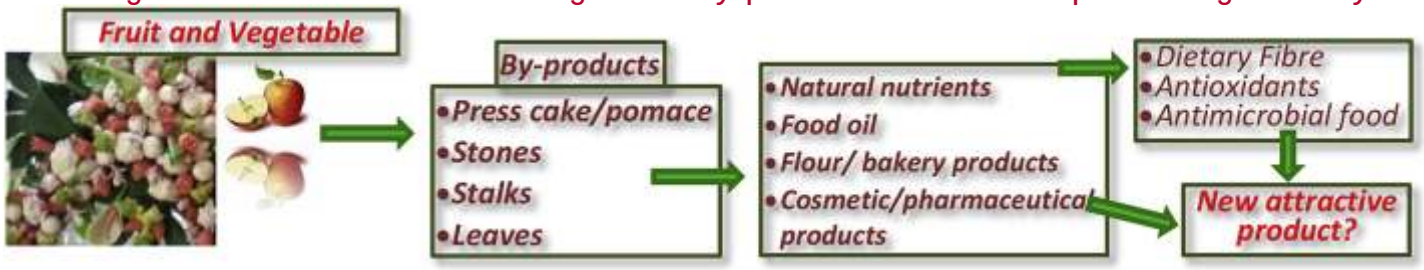
The lowest losses (9.2 percent) are reported in the ICAR-CIPHET study, which are the average losses from a large sample across eight agro-climatic zones (2012,2015). The highest losses (45 percent) are reported in the FAO (2018) study, which looked at two districts in Andhra Pradesh using a case study approach.These studies also estimated the losses at different stages of the supply chain. The FAO study (2018) finds the highest losses during harvesting and transport in the fresh fruit supply chain (15 percent for each),whereas the highest losses in the pulp supply chain occur in the traditional ripening process (19 percent).Processing would allow for the crops to be stored until prices recover or to be exported to other parts of the world. This would require low cost, small scale, mobile processing technologies which could be applied to particular crops or groups of crops.

In the food manufacturing sector, reducing waste is crucial as it can significantly impact the profitability and sustainability of the business. Extensive literature exists about the generation and characteristics of waste and effluents from the food processing industry with with regard to disposal

Table 1: Estimates of Losses in the Mango Supply Chain

State	Year of study	Supply chain stages covered	Estimated Loss %
AndhraPradesh	2018	Fresh fruit: harvesting, sorting, transport, retail	40.0–45.0
		Pulp: harvesting, sorting, grading, transport, ripening (traditionally or in chambers)	34.5–37.5
Uttar Pradesh, Karnataka, Haryana	2017	Harvest farm gate, post-harvest, handling, transport, wholesale level	18.0–31.0
All-India, eight agro-climatic zones	2012, 2015	Farm operations (harvesting, collection, sorting, packaging, transport); storage (farm, wholesale, retail, processing)	9.2 - 12.7
Karnataka	2017	Farm level, wholesale market, retailing, storage, consumer, processing unit	34.0
Andhra Pradesh	2009	Local marketing: field and assembly, wholesale, retail	29.7
Karnataka	1997	Farm level, transport, storage, storage (retail)	14.4–17.9

Fig 1: Potential of fruit and vegetable by-products in the food processing industry



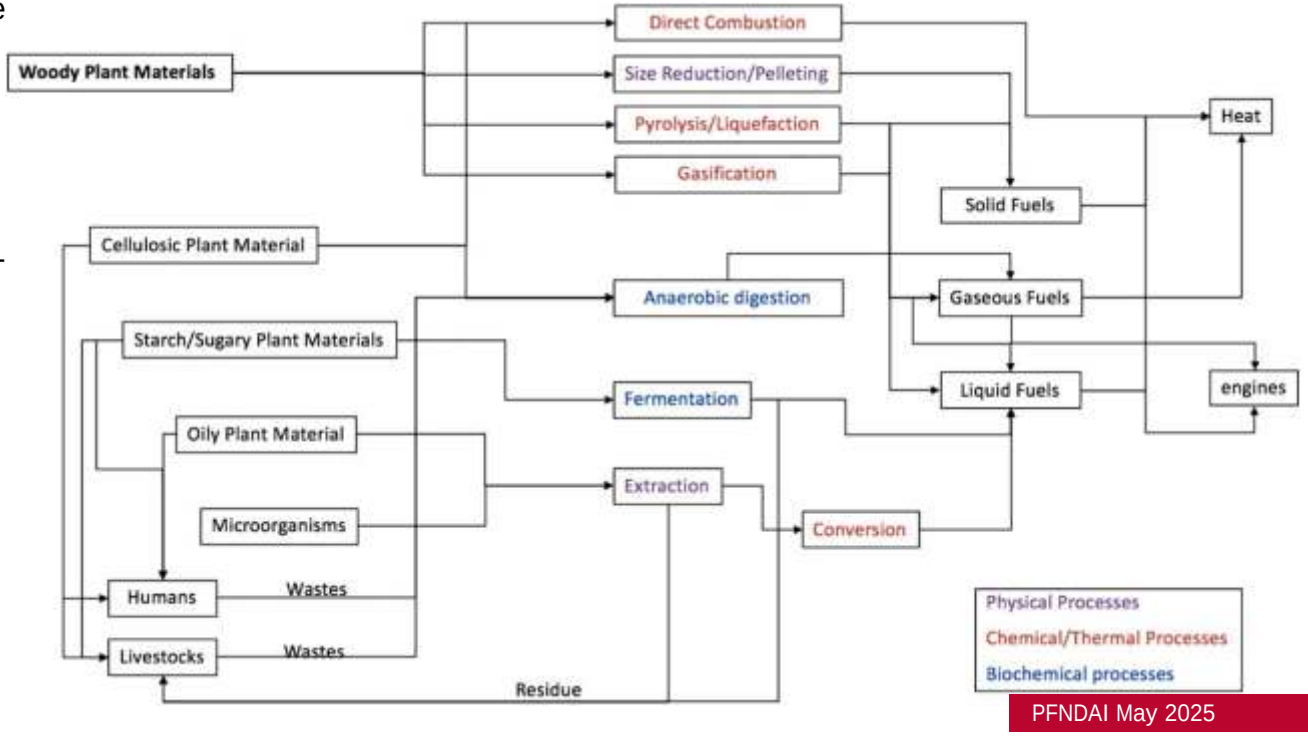
and environmental problems, and about technologies and strategies to reduce and avoid wastes. Fruitand vegetable residues, mostly thrown away in households, e.g. peels, seeds and unused flesh generated in the different steps of processing are a source of useful products including carbohydrates, polysaccharides and bioactive molecules, such as proteins, vitamins, minerals and antioxidants (6). Examples are pectin from apple pomace, colour from winery waste, xylo-oligosaccharide from corn cobs.

Meat forms the major product during industrial processing of meat while all other offal becomes by-products. These by-products constitute nearly 60% to 70% of the slaughtered carcass. The use of these by-products in feeds/ fertilizers after employing various technological processes—like rendering, dry reduction etc.—are technologically and economically viable, and growing market also exists for protein hydrolysates. These hydrolysates may be used as flavour enhancers, functional ingredients or simply as nutritional additives to foods of low protein quality (7). Table 2 summarizes the properties of Industrial food waste that are suitable for production of useful byproducts.

Table 2: Properties of potential food waste

Type of food waste	Potential materials	Products
Used cooking oil	Palm oil, rapeseed oil, soybean, sunflower seed	Biodiesel, Bioplastic
Animal by-products	Blood, fats, residues from intestines	Protein hydrolysate, animal feed
Organic crop residues	Straw, stover, peels, fruit pomace	Edible fibre, Food colour, Bioplastic
Milk industry waste	Cheese whey, lactose, proteins	Lactose, whey protein

There are recent reports on potential use of industrial food waste into bioplastic and biofuel.
Fig 2 provides an ideal and economic platform to optimize utilization of food industry waste and energy (fuels) recovery(8).



Summary

Sustainable practices in food manufacturing involve incorporating environmental, social, and economic considerations into the processes of producing, packaging, and distributing food.

Sustainable practices can also lead to cost savings for food manufacturers as well as improving efficiency and increase in productivity. Low cost, small scale, mobile processing technologies could be applied to particular crops or groups of crops towards optimization of utilization of agriculture produce.

Food processing industry is of enormous significance for India's development because of the vital linkages and synergies that it promotes between the two pillars of the economy; namely, industry and agriculture

Food waste is significantly under-researched in India.The data are largely limited to a few case studies on weddings. There are no household-level data on food waste. Achieving zero waste in India's food processing sector could result in circular economy for the industry.

India has the potential to become a leading producer of food in due course of time. Development of small- and medium-scale food processing industries in rural India, can contribute to improving the rural economy of the country as well as sustainability in food processing.

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FOOD PACKAGING: AN OVERVIEW

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Food packaging is essential and critical for food safety. It extends the shelf life and is vital for food security. Whether the food is fresh or processed, it needs protection from the environment. Food packaging is required throughout the supply chain from farm to fork. Apart from protecting food from physical, chemical, and biological damage, it makes the product tamperproof. Local regulations govern the information on the package label and protect the consumers by giving essential information about the product to make an informed choice.

Early humans used to immediately eat the food gathered from their surroundings and containers made from natural materials such as leaves; animal skin was the earliest packaging material. Baskets made from grass and bamboo were used to transport the food with an extended shelf life. With the progress of mankind and food processing, there was a need to preserve and transport food for a longer period. Glass and metal were the earliest packaging materials used for packaging food to keep it safe. In the last century, four types of packaging materials were mainly used for food packaging: glass, metal, paper, and plastics. (1)

Glass is one of the oldest packing materials and has references in Egyptian civilisation. It is the most inert material and therefore safe for any type of food. It is transparent and can reveal the contents to the consumer. It is recyclable. However, it is brittle and can easily break. Metal offers excellent physical protection as well as good barrier properties, consumer acceptance, and recyclability. Metal cans, containers, and boxes are common types of metal packaging. Tin has been used for more than two centuries for food packaging. It needs coating to make it resistant to corrosion. Aluminium is more popular in today's market. Metal packaging is also recyclable. Paper and paperboard packaging have their advantages. It has flexibility, printability, mechanical resistance, and recyclability. It can be used as primary packaging for dry products. It is mostly used as a secondary packing material.

Plastic material is widely used in food and beverage packaging. They have excellent tensile strength and effective barrier properties against oxygen,

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carbon dioxide, and water vapour. They also have adaptability (can be easily moulded in any shape), Versatility (endless options like pouches, bottles, films, trays, shells, and drums), are cost-effective, and lightweight. The most used polymers are LDPE, HDPE, PET, and PP.

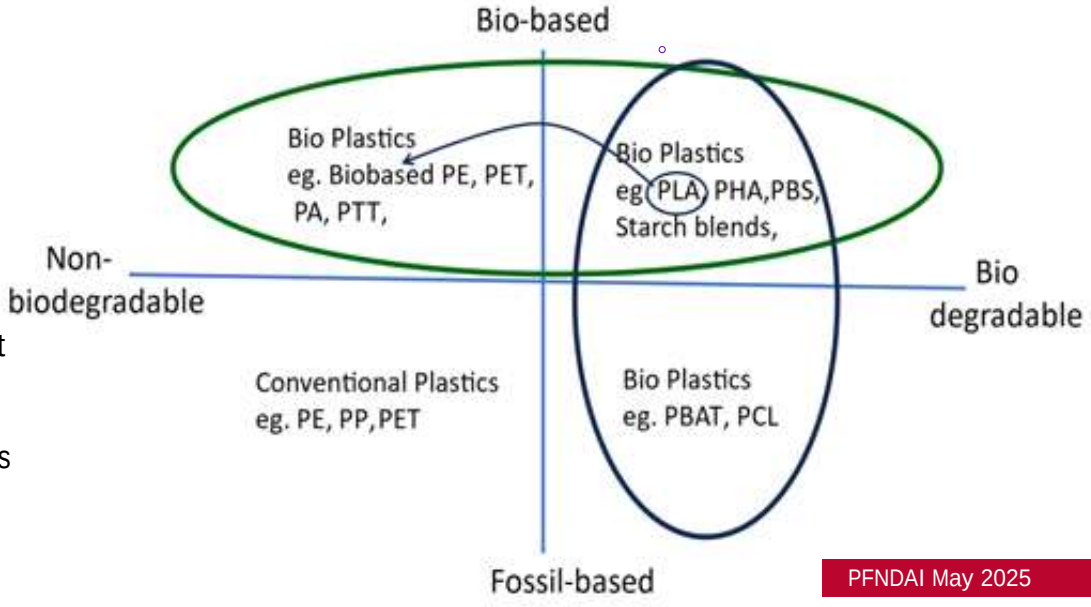
It is estimated that by 2050, there will be a 50% increase in global food supplies because of population growth. Because of their excellent barrier properties, plastic packaging materials are being widely used. They are derived from fossil fuels. In the packaging industry, food packaging accounts for 50% of plastics. When food material is thrown away, so is the plastic material which it was contained. The same is the case with single-use plastics, which are thrown away and become waste. The use of single-use plastic packaging is on the rise because of increased consumption of on-the-go snacks, and also due to ready-made meals and the rise in food delivery services.

They all will add to waste and therefore environmental concerns. Plastics remain in the environment as they take at least four hundred years to degrade. They are converted into microplastics and enter into the food supply chain. There is growing awareness about this, and several solutions are being suggested. An increase in reusable packaging like glass, recyclable packaging like paper, or biodegradable food packaging are some of the solutions.

Biopolymers and Bioplastics:

Biopolymers are produced by living microorganisms or derived from biomass. Once used, they can degrade within a reasonable period without causing environmental damage. They can be produced by using renewable biobased monomers e.g. Polylactic acid (PLA). By genetically modified bacteria e.g. Polyhydroxyalkonaoates (PHA). By chemical synthesis using both bio-derived monomers and, petroleum-based monomers e.g. Polybutylene succinate (PBA), Polybutylene adipate terephthalate (PBTA) OR entirely using fossil resources e.g. Polycaprolactone (PCL). Biodegradable materials can be broken down by microbes.

Some plastics from bio sources are non-degradable, and those from fossil sources are biodegradable. This is explained in the following figure. PLA is one polymer which can be an alternative to petrochemical plastics. It has the advantage of being compostable together with organic waste. However, its degradation can take place in 3 to 5 years. The time of degradation in soilalso depends upon various factors such as its crystallinity of polymer, molecular rate, water absorption, and the biodiversity of microorganisms in different conditions. It is marked with an arrow representing a shift from biodegradable to non-biodegradable status. This is because the rate of degradation of PLA in the marine environment is as slow as HDPE. It is therefore



challenge when the packaging waste enters water bodies where low temperature and high pressure are not conducive to its degradation. Hence, it is non-biodegradable or biodegradable depending on the environment.

Active and intelligent packaging: (3)

Traditional food packages are designed to be passive barriers that protect foods from the environment and help extend their shelf life. Modern food packages, like active and intelligent packaging, play a dynamic role in protecting the food throughout the food chain.

Active packaging:

Active packaging increases product shelf life by interacting with food and the environment. This action is because active agents are added to the passive barrier, which act as absorbers, emitters, or releasers of the compounds which play a pivotal role in food preservation. Moisture absorbers prevent excess moisture inside the package. Excess moisture can be due to several reasons, like trapping during the packaging process, release due to temperature fluctuations, respiration of fresh products, poor water vapour permeability of the package, etc. This excess moisture will adversely affect shelf life because of microbial and mold growth, and undesired changes in the dry product quality. Moisture absorbers reduce water activity by using hygroscopic substrates or substances.

Commercially available systems use porous sachets where moisture-scavenger materials are enclosed. They can be in the form of pads, sheets, trays or in the form of adhesive desiccant labels. Desiccants such as bentonite, calcium chloride, calcium oxide, calcium sulphate, molecular sieves, silica gel, and natural clay could be inorganic. They can be organic bases like cellulose, fructose, modified starch, fructose, or sorbitol.

Ethylene is naturally produced by plants and acts as a hormone that plays an important role in their growth cycle. Climacteric fruits and vegetables produce high amounts of ethylene that reduce shelf life during post-harvest storage of fresh products. However, the acceleration of ripening and degradation of chlorophyll may cause deterioration of quality and reduction of shelf life during the storage of fresh products. The reduction of ethylene in the package atmosphere by active systems will slow down the undesirable changes. Ethylene absorbers include silica, zeolite, montmorillonite, activated carbon, and Japanese Oya clay. Potassium permanganate supported on inert materials like silica is widely used as an Ethylene scavenger.

Non-pasteurised or sterilised fermented foods like Kimchi, Yoghurt, Cheese, and soy paste release carbon dioxide in the package during storage, causing undesirable changes in the texture and flavour of the foods. The quality of potato, lettuce, onion, cucumber, cauliflower, artichoke, apricot, peach, apple, and carrot can deteriorate because of an excess of carbon dioxide in the package. Scavengers in the form of sachets were developed. Chemicals like Calcium oxide, sodium hydroxide, potassium oxide or silica gel can be used.

Food shelf life is affected by the presence of microorganisms. Carbon dioxide, with a well-known antimicrobial effect, can be used to modify the atmosphere to improve the shelf life. Sachets or pads with carbon dioxide emitters are generally employed.

Ethanol, an antimicrobial agent in the form of emitting sachets or film containing food-grade ethanol, are used. Chlorine dioxide and sulphur dioxide enclosed in sachets attached to an internal part of the sachets can have antimicrobial action.

Intelligent packaging

Intelligent packaging is defined as materials and articles that monitor the condition of packaged food or the environment surrounding the food. Here, the internal (metabolites) or external (e.g. temperature) environment is used as "information" to monitor the status of product quality, which improves product quality and can help traceability. Indicators do not react with food. They monitor the condition of the product to provide the information. Three technologies are used in the intelligent packaging system, viz. Indicators, sensors, and carriers.

Time-temperature indicators find applications in the perishable food industry, where temperature fluctuations during storage are a challenge. Time-temperature indicators are made up of small adhesive labels attached to containers or individual consumer packages to be visible and interpretable. There will be a physical change, like colour development or colour movement, related to the change in temperature. Freshness indicators allow monitoring the quality of food during storage and transport. In most cases, they are based on dyes sensitive to pH changes caused by the deterioration of the product. A typical example can be a nanolayer of silver that reacts with Hydrogen sulphide in the case of poultry, which turns from opaque in the beginning to transparent. Another example of a label turning red to orange to yellow because of ethylene in fruit storage. Gas indicators monitor the headspace gas environment. They help evaluate the effectiveness of the active packaging components (e.g. O2 and CO2 scavengers) or to detect the leaks in packaging, which is required for modified atmosphere packaging. For example, the oxygen indicator tablet in the sachets in meat storage is pink when there is no oxygen and turns blue when there is oxygen.

A sensor is a device that responds to chemical, biological, or physical properties by providing a quantifiable signal proportional to the measurement. The most popular are those that measure temperature, humidity, pH and light exposure. In chemical sensors, there is a receptor capable of detecting the concentration of specific chemical molecules such as volatile organic compounds and gas molecules (H2, CO, NO2, H2S, etc), which are responsible for food spoilage. Examples are meat, fish, fruit, and vegetable products. The marketing of these type of sensor in the food sector is delayed by high development costs. A typical electrochemical sensor consists of three main components: a working electrode, a counter electrode, and a reference electrode. Food spoilage processes are associated with the presence of certain odours. For example, biogenic amines in meat products. An electronic nose system can allow recognition of simple or complex flavours.

This has many applications, such as fermentation process monitoring, ripening and shelf-life investigation, quality evaluation of vacuum-packed beef. Optical sensors generate optical signals or cause a change in the optical properties of the system. The signal produced can be detected by the naked eye or a photo detector. Edible sensors are those where edible sensors are used for detecting food deterioration. For example, pectin matrix with red cabbage extract as colourimetric indicator. Anthocyanins in the red cabbage extract will change the colour as the pH changes.

Data carrier devices are intelligent packaging which play a different role than the other two classes described earlier. They do not provide information on the quality of products, but they are important for food safety as they are an important support for food traceability. They are generally placed on tertiary packaging. Bar code labels and QR codes, which have been used for a long time, have limited data storage and are important for inventory control and management. The RFID (Radio Frequency Identification Device) is the most advanced system. RFID tags can store a high number of different codes that transfer and communicate information over long distances, thus improving automatic product traceability and identification.

Edible packaging: (4)

This is a trending innovation in food packaging with great market potential, where packaging is made up of substances that can be consumed. This is sustainable as it does not require landfilling. Edible straws are made up of sugar, starch, and rice. They can be made in different flavours. Edible coffee cups can be great alternatives to paper cups. They are made from materials like cookies coated with chocolates or caramel. Edible spoons are made of wheat, sorghum, and rice. Starch-based cupcake wrappers are made up of wafer paper made from potato starch. Candy wrappers made from rice wafers are an option for edible packaging and can be eaten along with the candy or chocolate.

Nanotechnology and food packaging: (5)

Nanotechnology is still an unexplored but promising science that has applications in food packaging. Nanotechnology is transforming the food packaging industry by introducing innovative materials, techniques, and functionalities that improve food quality, safety and shelf life. Nanomaterials are used in three applications. (i) Improved packaging: Incorporating nanomaterials like clay and SiO_2 into packaging that improves physical performance, durability, barrier properties, biodegradation, and biocompatibility. (ii) Active packaging: incorporation of nanomaterials, Silver and TiO_2, with antimicrobial properties. (iii) Smart packaging: Incorporation of nano sensors to monitor and report on the condition of food.

Internet of Packaging (IoP): (6)
This technology brings a variety of benefits to manufacturers as well as consumers. By continuous exchange and analysis of information via smart devices, the IoP enables product traceability, drives supply chain efficiencies, optimises inventory management, reduces cost, and improves customer service.

Conclusion:

Food packaging was only restricted to being a barrier between the product and the environment to enhance the shelf life. With newer innovations like active and smart packaging and IoP, packaging now acts to further enhance, protect the product for its quality and safety. It gives customers better information about the product. With these kinds of developments and growing consumer awareness and demand for sustainable packaging, food packaging is poised for many challenging innovations.

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(6) IoT Packaging: Benefits, Examples, and Challenges

OMEGA-3 FATTY ACIDS: THE MISSING LINK IN INDIAN NUTRITION

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Introduction

Fatty acids play vital roles in the human body by contributing to energy production, cell membrane structure, signalling molecule synthesis, and development of the central nervous system. They influence lipoprotein metabolism and are closely linked to the risk of diet-related non-communicable diseases (DR-NCDs) such as coronary heart disease (CHD) (https://www.nin.res.in/RDA_Full_Report_2024.html).

There are three types of fatty acids in our diet, Saturated fatty acids (SFA), Monounsaturated fatty acids (MUFA) and Polyunsaturated fatty acids (PUFA). Our body can synthesise SFA and MUFA besides obtaining from diet while PUFA cannot be synthesised in the body. Hence, they are known as Essential fatty acids.

Essential fatty acids (EFAs) are polyunsaturated fatty acids that the human body cannot synthesize on its own, so they must be obtained from the diet.

There are two primary essential fatty acids: Linoleic acid (n-6 or Omega 6 fatty acid) and Alpha linolenic acids (n-3 or Omega 3 fatty acids)

Omega-3 polyunsaturated fatty acids (PUFAs) play a vital role in human health, particularly in brain development, cardiovascular wellness, and inflammation regulation. Omega-3 PUFAs are major structural components for cell membranes which are present in high concentrations in the central nervous system, including the brain. These are attributable to optimal nerve cell development, neurotransmission, cell signalling, neurogenesis, and neuroinflammation. These fatty acids have multiple benefits such as anti-inflammatory, antioxidant, anti-depression, and protective effect on cardiovascular health

Alpha-linolenic acid (ALA) is converted into eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA) in the body, but the process is quite inefficient. Both these fatty acids play an essential role in cognitive and behavioural changes among school children and despite their importance, the Indian population—especially children—consumes these essential nutrients in insufficient

quantities. A recent cross-sectional study sheds light on the current intake levels among Indian school children and the potential role of food fortification in addressing this nutritional gap.

Intake of these fatty acids, particularly long-chain PUFA (LC-PUFA) like DHA (C22:6 ω3) and EPA (C22:5 ω3) during infancy and in childhood bestows several benefits such as brain development and function, improved vision, cognition, behaviour and reduces the risk of cardiovascular disease (CVD) in later life. Studies have shown positive effect of supplementation of omega-3 PUFA on neuropsychological variables like attention, processing speed, visual-motor coordination, reading ability and verbal learning in children

A cross-sectional study conducted in Hyderabad purely observational in nature surveyed 625 children aged 7 to 13 years from local schools and used a Food Frequency Questionnaire (FFQ) to estimate dietary intake and analysed plasma fatty acid levels using gas chromatography.
The majority of the subjects in this study were non vegetarian. Even with Non vegetarian, their omega 3 requirements were not met mainly because their consumption was quite low, mostly inclined towards freshwater as the availability to marine fish is limited to coastal region. The recommendation is 100 to 200 g of marine fish per week while intake was only 100 g freshwater fish per week. The lower levels of DHA were directly linked to lower intake of DHA in diet. These findings highlight the concerningly low levels of omega-3 intake among Indian children, which could have long-term implications for cognitive health and development.

The study indicates that the intake of DHA and its concentration in plasma was positively and significantly correlated. These findings highlight the concerningly low levels of omega-3 intake among Indian children, which could have long-term implications for cognitive health and development. (Parasannanavar et al. https://www.researchgate.net/publication/351838292_Omega-3_polyunsaturated_fatty_acid_intake_and_plasma_fatty_acids_of_school_going_Indian_children_-_a_cross-sectional_study).

Food Fortification Strategies

To counter low omega-3 intake, fortification of staple foods such as dairy, bakery products, meat, and infant formulas offers a viable solution. Effective fortification methods include:

- Using fish oil, algae oil, or plant-based sources like flaxseed
- Microencapsulation to protect against oxidation and improve bioavailability

In the modern era, food fortification plays a pivotal role in addressing global nutritional deficiencies. Among the emerging bioactive compounds being studied, omega-3 fatty acids have attracted significant interest due to their wide-ranging health benefits.

Sources and Challenges

Traditionally, the primary sources of omega-3 fatty acids have been marine-based, particularly oily fishlike salmon, sardines, and mackerel. However, the sustainability of marine sources is under pressure due to overfishing and environmental concerns. Additionally, the strong odour and instability of omega-3s make their incorporation into food products technically challenging.

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To overcome these issues, recent research has focused on alternative sources, such as microalgae, which produce omega-3s naturally and offer a sustainable, vegetarian-friendly option (Patel et.al., 2021). Seed oils like flaxseed and chia also provide alpha-linolenic acid (ALA), though conversion to EPA and DHA in the human body is limited.

Techniques in Food Fortification

One of the major hurdles in food fortification is the susceptibility of omega-3 fatty acids to oxidation, leading to off-flavours and reduced shelf life. To counteract this, microencapsulation techniques are widely used. These involve encasing omega-3 oils in protective matrices like proteins, carbohydrates, or lipids to enhance stability and control release.

Recent innovations also include the use of nano emulsions, liposomes, and other advanced delivery systems to incorporate omega-3s into everyday food products without compromising taste, texture, or appearance. Omega-3 food fortification isn't just a nutritional enhancement—it's a public health imperative for India's next generation

Applications in Food Products

The scope of omega-3 fortification has expanded from health supplements to a wide range of functional foods. Bakery items, dairy products, infant formulas, beverages, and even meat products have been successfully fortified. The goal is to provide health-conscious consumers with easy access to these critical nutrients without the need for major dietary changes.

Regulatory and Consumer Perspectives

Regulatory frameworks vary globally but generally allow omega-3 fortification within specific limits to ensure safety and efficacy. Consumer acceptance remains a challenge, particularly with regard to flavour and odour, but continued advancements in encapsulation and processing technologies are helping bridge this gap.

The Future Outlook

With growing awareness of preventive healthcare and nutrition, omega-3 food fortification is poised for substantial growth. Advances in biotechnology, such as fermentation-based production of EPA and DHA, are likely to revolutionize the industry by offering scalable, sustainable solutions.

Ultimately, the integration of omega-3 fatty acids into mainstream diets via fortified foods represents a promising strategy to combat non-communicable diseases and support global health.

Omega-3 food fortification isn't just a nutritional enhancement—it's a public health imperative for India's next generation

UNDERUTILIZED SOURCES OF MICRONUTRIENTS:

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Micronutrients are essential for our health as they support various bodily functions, including immune response, cognitive function, and energy metabolism. According to estimates from the World Health Organisation (WHO), over 30% of the global population lacks certain vital micronutrients (1). This widespread deficiency can lead to severe health consequences, like weakened immune systems, developmental delays, and increased susceptibility to infections.

To counteract the effects of these deficiencies, it is important to promote healthy diets and nutrition. Along with this, evidence-based, affordable, and scalable alternatives like supplementation and bio-fortification can be effective interventions.Increasing the availability, accessibility, and consumption of nutritious food is crucial for enhancing micronutrient status. Traditional sources of these nutrients, such as fruits, vegetables, dairy, etc, have long been recognized. However, with growing concerns regarding food security, sustainability, and dietary diversity, researchers are investigating new sources of micronutrients. These foods may be an ethnic dish unfamiliar to others or a food that is traditionally enjoyed in specific regions (2). Below are some of the sources for micronutrients.

Indian mustard (Brassica juncea):

Mustard seeds, locally known as "Rai" or "Sarson," are commonly used in Indian cuisine and are typically served in small quantities due to their strong, pungent flavour, mainly used to enhance flavour in curries, dals, and pickles. In some parts of India, mustard is a staple food like ‘sarson ka saag,’ which is a popular and comforting Punjabi winter meal. Mustard greens,which are rich in micronutrients, specifically iron, phosphorus, calcium, and vitamins A, C, K,can be sautéed with garlic for use in soups. Yellow mustard seeds are widely used in ready-to-eat foods, typically found in jars or squeeze bottles as dips/sauces. Brown mustard seeds are generally spicier and are employed in Asian dishes to enhance flavour.

Mustard oil is another component that is widely used as a cooking medium, particularly in eastern India, as it is rich in essential fatty acids and trace minerals. It also serves as a natural preservative. Additionally, mustard meal, the byproduct of oil extraction, serves as a protein source and provides functional and antioxidant benefits. It can be primarily used in the livestock industry and has potential applications in the food industry for improving organoleptic characteristics, gelling, and emulsion-stabilising properties.

Indian mustard is highly valued for its culinary and medicinal uses, offering numerous health benefits due to its rich nutritional composition. It is an excellent source of essential vitamins and minerals. The approximate values for 100 grams of mustard seeds are as follows:

- Dietary fiber: 14.10 g
- Iron: 13.49 mg
- Folate: 95.9 mcg
- Zinc: 4.03 mg
- Calcium: 402 mg
- Phosphorus: 715 mg
- Magnesium: 266 mg
- Selenium: 71.5 mg

These nutrients play vital roles in maintaining good health. Mustard seeds also contain bioactive compounds that exhibit antioxidant and anti-inflammatory properties.

One such compound, sinigrin, is pungent and is broken down into allyl isothiocyanate (AITC) during digestion.AITC has antimicrobial properties, protecting against various bacterial strains. Sinalbin, another compound derived from glucosinolates, exhibits even stronger antimicrobial properties. AITC inhibits enzymes essential for bacterial metabolic activities, leading

to membrane damage and reducing harmful effects (3). While the antibacterial activity varies based on the type of mustard seed, all types demonstrate significant antimicrobial activity.

From a sustainability perspective, mustard is a hardy crop that requires relatively low inputs, making it an environmentally friendly food source. However, while mustard seeds contain beneficial phytochemicals such as sinigrin and sinalbin, their pungency may limit their widespread use. More research is needed to understand ways to make mustard-based products more palatable for broader consumption.

Green tea (Camellia sinensis):

Green tea is widely consumed as a refreshing beverage. But it contains more benefits than that. Green tea is a valuable source of essential micronutrients like vitamins, minerals, and trace elements that support various physiological functions. Its antioxidant properties can be attributed to the presence of vitamins C and E, which boost immunity. Green tea also contains B complex vitamins, fluoride, magnesium, zinc, manganese, and other trace elements. The concentration of these depends on the fermentation process, age, and size of the tea leaves. Green tea has high polyphenol content, which provides potent antioxidant properties. The main active ingredients in green tea extract are flavanol monomers known as catechins, which possess antioxidant properties. The unique flavour, colour, and aroma of green tea are also attributed to these polyphenols.

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One of the significant benefits of green tea extract is its ability to extend the shelf life of fat-containing foods by preventing lipid oxidation. This makes it a valuable ingredient for food manufacturers seeking natural preservatives. The finely powdered form of green tea leaves, known as green tea powder (GTP), has gained popularity for fully utilising the plant's active and beneficial components, including fibre, insoluble protein, and chlorophyll (4). In recent years, consumers have shown increased interest in products that contain green tea extract. New approaches, such as fortifying products with additional micronutrients or using green tea extracts in supplements and fortified foods, can enhance their role as a dietary source of essential nutrients. Green tea extract can be incorporated into a variety of food products, such as bread, biscuits, fat spreads, and meat products, serving both as a flavouring agent and a dietary supplement (5). It can also act as a natural substitute for synthetic preservatives, providing food manufacturers with a healthier option and potentially improving the overall nutritional value and health benefits of food products.

Despite its numerous benefits, green tea consumption should be moderated due to potential interactions. The bioavailability of the micronutrients present can vary due to the presence of tannins and polyphenols, which can either enhance or inhibit absorption. For example, polyphenols can enhance vitamin C stability, prolonging its antioxidant benefits, while tannins may reduce iron absorption, suggesting that green tea should be avoided with iron-rich meals. Further, R&D departments can focus on fortifying green tea with bioavailable iron sources to counteract this effect.

Spirulina (Arthrospira platensis):

Spirulina is a blue-green microalga that is gaining recognition as a rich source of micronutrients with significant nutritional potential. The U.S. Food and Drug Administration (FDA) has classified spirulina as "generally recognized as safe" (GRAS), making it a common ingredient in food and dietary supplements. Spirulina is commercially available in several forms, primarily as dry powder, pills, and capsules.

This microalga is notable for its high content of essential fatty acids and amino acids. It is rich in various minerals and vitamins. Spirulina is particularly abundant in provitamin A (beta-carotene), which supports vision, immune function, and skin health, as well as vitamin E. It also contains vitamin K, which is essential for blood clotting and bone health. The B vitamins (B1, B2, B3, B6) also contribute significantly to spirulina's vitamin content. Some strains of spirulina may contain bioavailable vitamin B12, although its reliability as a sole source of B12 is debated. Spirulina is an excellent source of minerals, particularly iron, providing about 2 mg of iron per 7 grams. This form of iron is more bioavailable than that from many plant-based sources, making it especially beneficial for individuals at risk of anaemia. Other important minerals in spirulina include magnesium (13.6 mg per 7 g), calcium (8.4 mg per 7 g), phosphorus (8.26 mg per 7 g), potassium (95.2 mg per 7 g), and selenium. These minerals play vital roles in various bodily functions, including muscle performance, immune support, and antioxidant protection.

In addition to its micronutrient profile, spirulina contains natural pigments, including phycocyanin (14-20%), which has strong antioxidant and anti-inflammatory properties, as well as carotenoids (0.5%) and chlorophyll (1%). The nutrients in spirulina are noted for their high bioavailability, meaning the body can absorb them quickly. It also provides gamma-linolenic acid (GLA), an omega-6 fatty acid linked to skin and heart health.

As a sustainable food source, spirulina requires significantly less land, water, and resources compared to traditional crops and animal products, which ensures its use in future nutrition. Its high nutrient density has made it a key ingredient in programs designed to combat malnutrition. It can be used in food formulations, particularly in sports supplements, bakery products, beverages, dairy products, snacks, and confectioneries.

However, challenges such as potential heavy metal contamination, a strong taste, and concerns about the bioavailability of vitamin B12 need to be addressed to maximise spirulina's benefits. With further advancements, spirulina's micronutrient profile could be further optimized, making it an even more effective and sustainable solution for global health and nutrition.

Purple yam (Dioscorea alata):

There is a focus on purple yams as a source of vitamins, minerals, and bioactive compounds. They are particularly valued for their high anthocyanin content, which not only gives the yams their vibrant purple colour but also contributes to their antioxidant properties. The anthocyanins present exhibit strong anti-inflammatory and antioxidant qualities that may help reduce oxidative stress. Purple yams contain Vitamin B6 (0.3mg/100g), which is crucial for brain health and metabolism, and Vitamin C, which enhances iron absorption and supports immune function. They also provide essential minerals like magnesium (25mg/100g), which aids muscle and nerve function, and potassium (816 mg/100g), which helps regulate blood pressure.

In addition to this, purple yams are high in resistant starch and have around 4g of dietary fibre per 100g, both of which promote gut health by facilitating digestion and encouraging the growth of beneficial gut bacteria. Their complex carbohydrates help slow down glucose release, making them a useful food option for managing blood sugar levels (8).

Due to their nutrient density and functional advantages, purple yams are increasingly being incorporated into plant-based formulations, functional foods, and alternative protein sources. Apart from the yam itself, even its leaves are found to be beneficial for health. A study examining purple yam leaves found these leaves to be a potential new source of phenolic antioxidants and highlighted their role in mediating inflammatory responses, further expanding the potential applications of this crop (9).

Microgreens:

Microgreens are young edible seedlings of vegetables and herbs that have become recognized as powerful sources of essential nutrients and bioactive compounds. Harvested at the cotyledon or first true leaf stage, microgreens are typically ready within 7–21 days after germination. Despite their small size, they are packed with nutritional benefits and are rapidly gaining popularity.

A study examined six commonly consumed microgreens: broccoli, black radish, red beet, pea, sunflower, and bean. The findings revealed that each one of them had a unique nutritional profile. Among them, bean microgreens had the highest vitamin C content, measuring 80.45 mg per 100g of fresh weight. Broccoli microgreens were noted for their rich levels of phenolic compounds and iron, while red beet microgreens were rich in flavonoid content and organic acids, particularly citric acid, which supports strong antioxidant activity. Black radish microgreens exhibited the highest DPPH (2,2-diphenyl-1-picrylhydrazyl) antioxidant capacity, making them effective at neutralising free radicals. Sunflower microgreens showed high calcium content (148.63 mg per 100g of fresh weight) and fumaric acid levels, while pea microgreens showed the highest amounts of phosphorus and copper.

The diverse nutrient density and bioactive composition of microgreens mark their potential as functional foods. Additionally, they are well-suited to urban agriculture and controlled environment farming methods, such as vertical farms and hydroponic systems. They require minimal space, water, and time to grow, making them an environmentally friendly solution for enhancing nutrient security, particularly in urban and resource-constrained settings.

While many common greens are recognized for their nutritional benefits, several culturally familiar leafy vegetables remain underexplored for their nutritional value. Moringa leaves are exceptionally nutrient-dense. For instance, 100 g contains 2,300 mg of vitamin A, 65.9 mg of vitamin C, 1700 mg of Calcium, and 18 mg of iron, plus they retain nutrients even when dried. Fenugreek (methi) leaves offer high levels of iron (17.2 mg/100g), folate, vitamin C, and K, along with beneficial phytochemicals for metabolic health. Cauliflower greens, often discarded, are more nutritious than the cauliflower itself. The underuse can be due to cultural habits, food marketing, perception, and lack of awareness. Theyprovide significant amounts of calcium, iron, vitamin C, and beta-carotene.Colocasia (alu) leaves contain significant amounts of calcium (216 mg/100g), iron, and beta-carotene, though they need proper cooking to neutralize oxalates. Amaranth (both red and green) supplies iron, calcium, vitamins A and C, with red varieties offering antioxidants like anthocyanins.

In addition to these, a few lesser-known indigenous fruits also offer significant micronutrient value. Karonda (*Carissa carandas*) is particularly rich in vitamin C (135 mg/100 g) along with potassium (351 mg/100g), calcium (11 mg/100g), and potent antioxidants. It is a hardy, drought-resistant fruit that is often used in traditional medicine and eaten as a part of the diet, making it both culturally relevant and nutritionally powerful. Similarly, *Zizyphus jujuba* (commonly known as ber or Indian jujube) provides high levels of vitamin C (62 mg/100g), moderate amounts of beta-carotene, potassium, and B-complex vitamins. Rich in polyphenols and bioflavonoids, ber is another climate-resilient fruit ideal for promoting nutrition security in marginal environments (11).

Consciously including these greens and fruits in dietary practices and public nutrition programs can enhance micronutrient intake, especially for vulnerable groups. Promoting their use through education and innovation can help address micronutrient deficiencies sustainably. Though not microgreens, these are valuable and underutilized dietary resources.

Conclusion:

The acceptance of newer sources may benefit from increasing awareness of their sustainability and health benefits. For these foods to gain widespread consumer acceptance, they must be safe, nutritionally beneficial, and profitable for manufacturers. Addressing potential barriers such as taste, bioavailability, and regulatory approvals will be needed.

As the demand for functional foods and dietary supplements continues to grow, incorporating nutrient-dense and sustainable food sources can play a key role in addressing global micronutrient deficiencies. Research and technological advancements will be essential in optimising these food sources for better health and nutrition outcomes.

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REGULATORY ROUND UP

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

Food Safety and Standards (Packaging) First Amendment Regulations, 2025 related to use of recycled plastics in food packaging : The FSS (Packaging) Regulations (2018) is amended and is about the use of recycled PET. Recycled materials can be used for packing, storing, carrying, or dispensing food products if they comply with national standards or regulations applicable to such materials. This is a good step by the authorities for the sustainability of packing materials.

Reclassification of point related to 'Food grade Packaging material' as 'critical to food safety' under inspection checklist : An inspection checklist per schedule 4 of the FSS (Licensing and Registration of Food Business) Regulation 2011, published in order dated 02.11.2024. This checklist considers points related to packaging materials as Non-Critical. This order reclassifies the point related to packaging as "critical" in inspection because of the critical role of Food Packaging materials in these products. The packaging materials used, to be in sound condition. It should have a certificate of conformity from an NABL-accredited laboratory.

Notice dated 16.04.2025 for inviting public comments for consultation paper on compliance with the provisions of 'Analogue in Dairy Context' : FSSAI held a meeting in hybrid mode with all the stakeholders. It appears products that are "Analogue in dairy context" are being sold as dairy products. The meeting discussed the compliance with the provisions of "Analogue in dairy context" laid down under FSSAI. It was decided to publish a consultation paper on this matter on the FSSAI website, and comments/ suggestions are requestedfrom the stakeholders within sixty days from 16th April with justification/ rationale.

FSSAI has requested the stakeholders to provide their comments in the prescribed format, which can be accessed through the link provided below.

https://docs.google.com/forms/d/e/1FAIpQLSdFNX8oXlbhlj_PJ1CQIIpmsSmn-MP-ftbtWINrVnqRGOnnzQ/viewform?usp=header

Validity Order of FSSAI notified Food Testing laboratories dated 16.04.2025: This order provides a list of FSSAI-approved laboratories with validity of their accreditation as on16.04.2025. These can be used to carry out analysis of samples taken under the FSSA Act 2006 and regulations.

FSSAI Empowers Consumers to Report Misleading Claims on Food Products: By its press release dated 30/04/2025, FSSAI announced the development of the Food Safety Connect mobile application, which allows consumers to lodge complaints with the food authorities concerning misleading or false label claims on packaged foods. Complaints can also be submitted via FoSCoS. This tool enables users to easily provide details, such as front-of-pack images and misleading claims, etc. This will assist authorities in taking evidence-based action against non-compliant FBOs. This is a welcome step by food authorities to empower consumers.

RESEARCH IN HEALTH & NUTRITION

Biological clock plays critical role in driving teens' late-day eating habits

February 17, 2025

https://www.sciencedaily.com/releases/2025/02/250217160328.html

This study highlights the influence of the biological clock, or circadian rhythms, on adolescents' eating habits and its connection to weight management.

Researchers from Brown University's Warren Alpert Medical School and Mass General Brigham aimed to understand how the circadian system, which regulates biological processes, influences food intake and obesity in adolescents. The study involved 51 adolescents aged 12-18, divided into groups based on their body mass index (BMI): healthy weight, overweight, and obese.

Participants stayed in a lab for 11 days, with strict control over environmental and behavioural influences. Time cues like clocks and natural light were removed. A 28-hour sleep-wake cycle (longer than a standard day) was used to assess the impact of internal circadian rhythms on eating behaviour. Participants were given six chances to eat at fixed times daily, with access to a standardized menu. They could eat as much as they wanted during each session, and food intake was meticulously measured.

Food intake was highest in the late afternoon and evening for all participants. The lowest caloric consumption occurred in the morning, even when accounting for behavioural and environmental factors. Adolescents in the overweight or obese groups consumed significantly more calories during the circadian evening compared to those in the healthy weight group. Despite these differences, there was no variation in total sleep time among the groups. Researchers demonstrated that the circadian system directly regulates food intake, independent of external factors like light exposure, activity, or sleep cycles.

Adolescence is a critical period for establishing lifelong health patterns. The findings underscore the importance of considering the timing of food intake when addressing weight management.Potential interventions could include adjusting circadian rhythms through controlled light exposure (e.g., minimizing light at night, promoting bright light in the morning) and incorporating morning exercise.

This study reveals that the circadian system not only affects hunger and metabolism but also directly influences food intake, particularly among adolescents at risk for obesity. By addressing these findings, clinicians and researchers can better support adolescents in achieving and maintaining healthy eating habits.

Scientists call for targeted fibre diets to boost health

March 19, 2025

https://www.sciencedaily.com/releases/2025/03/250319143417.htm

This study from RMIT University introduces a new classification system for dietary fibres, aiming to better guide nutritional decisions and develop targeted health food products.

Dietary fibres, found in fruits, vegetables, beans, and whole grains, are essential for digestion, weight management, blood sugar control, heart health, and cancer prevention.The current classification of fibres into "soluble" and "insoluble" is overly simplistic and does not capture the diverse structures and mechanisms through which fibres impact human health.

Researchers propose a nuanced classification system based on

five key features: Backbone structure, Water-holding capacity, Structural charge, Fiber matrix and Fermentation rate. This "bottom-up approach" links specific fibre properties to their health impacts, enabling more precise dietary recommendations.

Different fibres target different health outcomes, much like medicines for specific conditions. For example, fibres in apples and bananas, though both rich in dietary fibre, function differently in promoting health.The team studied 20 types of fibres and their interactions with gut microbiota, providing insights into how specific fibres influence gut health. Most populations, including those in Europe and the USA, consume far less fibre than the recommended 28–42 grams per day.

The new framework can guide consumers, dieticians, and food technologists in selecting fibres for specific health benefits, such as promoting colonic health or reducing glucose absorption.It also highlights the urgent need to address the global fibre gap to improve overall health. Researchers plan to investigate how specific fibres, as classified by this new system, modulate the gut microbiota and how this knowledge can be applied to health interventions.

AI food scanner turns phone photos into nutritional analysis

March 18, 2025

www.sciencedaily.com/releases/2025/03/250318141833.htm

This study from NYU Tandon School of Engineering introduces an AI-powered food scanner that analyses meal photos to provide detailed nutritional information.

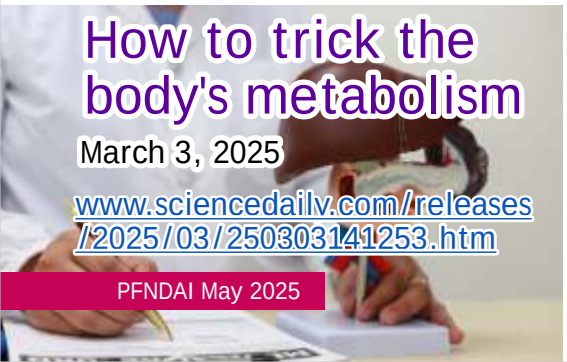
The AI system calculates calorie count, fat content, and nutritional value (e.g., protein, carbohydrates) from food images.It aims to assist individuals managing weight, diabetes, and other diet-related health conditions by eliminating the need for manual food tracking.

It uses deep-learning algorithms to recognize food items and calculate their nutritional content.Incorporates a volumetric computation function to estimate portion sizes by measuring the area occupied by food on a plate.

The system accounts for variations in food appearance across different preparations and cuisines.Accurate volumetric analysis ensures precise nutritional assessments. Runs on a web application, avoiding the need for heavy computational power or cloud processing.Achieved a mean Average Precision (mAP) score of 0.7941, indicating high accuracy in identifying food items, even when overlapping or partially obscured.Successfully analysed diverse dishes, such as pizza, idli sambhar, hot dogs, and baklava, with nutritional values closely matching reference standards.

The system is accessible via a smartphone web browser, making it user-friendly and widely available.It serves as a "proof-of-concept" with potential for broader healthcare applications, including personalized diet management. Traditional food tracking methods rely on self-reporting, which is prone to errors. This AI system removes human error, offering a reliable alternative.It addresses the health challenges faced by specific groups, such as firefighters, who have high rates of obesity and related health risks.

Researchers plan to refine and expand the system for more comprehensive healthcare applications.This innovation represents a significant leap in dietary tracking and personalized nutrition.



How to trick the body's metabolism

March 3, 2025

www.sciencedaily.com/releases/2025/03/250303141253.htm

Researchers have discovered a new way in which the liver regulates its consumption of sugar and fat. This could potentially increase the effectiveness of weight-loss and diabetes medication.

Many people who have tried to lose weight by cutting calories are familiar with this frustrating reality: at some point, the body stops shedding pounds. It senses the reduced calorie intake and responds by

slowing down metabolism, causing it to burn fewer calories than before the diet.

This happens because the body perceives a potential starvation threat and adapts by conserving energy while still carrying out essential functions. It may seem incredibly unfair that the body doesn't recognize the goal of weight loss and instead works against it by holding on to calories.

This study from the University of Southern Denmark explores a newly discovered way in which the liver regulates its metabolism, potentially improving the effectiveness of weight-loss and diabetes medications.
The body slows metabolism when calorie intake is reduced, making weight loss harder.Researchers identified a gene called Plvap, which enables the body to switch from burning sugar to fat during fasting.When Plvap was turned off in mice, their livers continued burning sugar, preventing the usual metabolic slowdown.This discovery could lead to new treatments that help maintain calorie burning even during weight loss.

Many people using weight-loss drugs like Wegovy and Ozempic experience a plateau after losing 20-25% of their body weight.If scientists can control the liver's metabolism, it could extend the effectiveness of these treatments.The study also found that fat was redirected to muscles instead of the liver, improving insulin sensitivity and lowering blood sugar levels.

The findings are based on mouse models, meaning human trials are still far off.Researchers aim to develop medications that regulate fat and sugar burning in the liver.This could lead to new treatments for obesity, type 2 diabetes, and metabolic diseases.

Chickpeas and lentils provide superior zinc and iron absorption compared to oats and wheat, study finds

19 Mar 2025

https://www.nutritioninsight.com/news/chickpeas-lentils-zinc-iron-bioavailability.html

Researchers from the University of Adelaide, Australia, say that pulse products, particularly chickpea and lentil flours, are a rich source of micronutrients, specifically zinc and iron.

They believe the study findings can help improve dietary recommendations and fortification strategies to address global micronutrient deficiencies.The research, published in Food Composition and Analysis, aimed to explore ways to increase the bioavailability of nutrients in crops from public supermarket shelves. Chickpeas and lentils are nutritious in whole and flour form.

This study highlights the superior nutritional benefits of chickpeas and lentils compared to cereal grains like oats and wheat. Researchers from the University of Adelaide found that pulse products—especially chickpea and lentil flours—are rich sources of micronutrients, particularly zinc and iron. These findings could help improve dietary recommendations and fortification strategies to address global micronutrient deficiencies.

This study highlights the superior nutritional benefits of chickpeas and lentils compared to cereal grains like oats and wheat. Researchers found that pulse products, particularly chickpea and lentil flours, are rich sources of micronutrients, specifically zinc and iron. The findings could help improve dietary recommendations and fortification strategies to address global micronutrient deficiencies.

Scientists are exploring ways to reduce phytates naturally, such as:Optimizing cooking or processing methods.Developing low-phytate, high-nutrient crops.Investigating how other micronutrients interact with phytates in cereals and pulses.

Exploring African botanicals and medicinal plants for new nutrition solutions

20 Mar 2025

https://www.nutritioninsight.com/news/african-botanicals-sustainability-baobab-gut-health.html

The nutrition industry continuously explores new plants and compounds for various health benefits.

Suppliers of African botanicals

bring attention to the continent's wide range of native species, many of which are not well known on international markets.

Companies like Baobab Exports, Blue Sky Botanics, and Baobab des Saveurs are working to bring attention to Africa's rich biodiversity, particularly lesser-known plant species that have potential applications in food, beverages, and wellness products.

The baobab tree (Adansonia digitata), endemic to Africa, has seen significant growth in its commercial applications. Traditionally used in powder form, baobab is now available as an organic purée, developed by Baobab Exports and Blue Sky Botanics. The baobab purée is pasteurized and designed for beverages and dairy applications, including smoothies, juices, ice creams, and yogurts. It has a sherbet, grapefruit, and mango-like flavour, making it suitable for both flavour and functional health benefits.
Nutritional benefits: Baobab contains 11 grams of fibre per 100 grams, allowing products to make high fibre claims.

Baobab's Health Benefits: Gut health: Baobab has prebiotic effects, polyphenols, and phytosterols that support microbial diversity.Blood pressure benefits: Research suggests Hibiscus sabdariffa tea has anti-hypertensive effects.Prebiotic comparison: A study from the University of Ghent in Belgium found that baobab has the same prebiotic effect as inulin but at half the dosage.Dairy applications: Baobab purée is being tested in kefir, a fermented dairy product known for gut health benefits.Glycemic index: Adding 2% baobab fruit powder to bread significantly lowers its glycemic index.Nutrient profile: Baobab is a rich source of vitamin C, potassium, and antioxidants.

https://www.nutritioninsight.com/news/healthy-aging-plant-based-cognitive-health.html

This study provides valuable insights into dietary patterns that promote healthy aging, emphasizing plant-based foods, moderate consumption of healthy animal-based foods, and lower intake of ultra-processed foods.

Researchers analysed the midlife diets and health outcomes of 105,015 participants aged 39–69 over 30 years, defining healthy aging as reaching age 70 free of major chronic diseases while maintaining cognitive, physical, and mental health.

Eight dietary patterns were linked to healthy aging, including: Alternative Healthy Eating Index (AHEI), Alternative Mediterranean Index, Dietary Approaches to Stop Hypertension (DASH), Mediterranean-DASH Intervention for Neuro-degenerative Delay (MIND), Healthful Plant-Based Diet, Planetary Health Diet Index, Empirically Inflammatory Dietary Pattern & Empirical Dietary Index for Hyperinsulinemia

These diets emphasize fruits, vegetables, whole grains, unsaturated fats, nuts, and legumes, with low to moderate intake of fish and dairy. Higher intake of ultra-processed foods, particularly processed meat and sugary beverages, was associated with lower chances of healthy aging.

No one-size-fits-all diet: Healthy diets can be adapted to individual needs and preferences. Public health impact: Research on healthy aging is crucial for promoting independence and quality of life.Researchers suggest replicating the study among diverse socioeconomic and ancestral populations to generalize findings.

https://www.nutritioninsight.com/news/fish-oil-omega3-fatty-acid-inflammation-insulin-resistance-glucose-intolerance-immune-system-immunity-obesity-diabetes.html

New research suggests fish oil can weaken insulin resistance and reduce glucose intolerance by modulating the body's inflammatory response.

The study, published in the journal Nutrients, involved experiments with rats, which were not obese but exhibited a condition similar to type 2 diabetes.

The disease is characterized by elevated blood sugar due to reduced action of the hormone insulin. The authors explain supplementation with omega-3 fatty acids — such as those present in fish oil — is commonly prescribed for individuals with cardiovascular problems and type 2 diabetes. However, the effects of these nutrients on insulin resistance without obesity are poorly understood.

This study explores how fish oil supplementation can help reduce insulin resistance and glucose intolerance by modulating inflammation. Researchers found that omega-3 fatty acids, particularly EPA and DHA, shift immune system cells from a pro-inflammatory state to an anti-inflammatory state, improving blood sugar levels, cholesterol, and triglycerides.

Fish oil supplementation (2 g per kg of body weight, three times per week for eight weeks) reduced insulin resistance in non-obese rats. Lymphocytes, key immune cells, shifted from pro-inflammatory to anti-inflammatory, triggering a cascade effect that improved metabolic health. Blood sugar, inflammatory markers, and lipid profiles (total cholesterol, LDL, triglycerides) showed improvement.Non-obese type 2 diabetes patients (10–20% of global cases) may benefit from omega-3 supplementation.

Obesity is a major risk factor for diabetes, but systemic inflammation can also contribute to insulin resistance in non-obese individuals.Delayed intestinal transit may play a role in non-obese diabetes, as observed in previous studies.Early inflammatory changes in lymph nodes of young rats suggest inflammation is a key factor in diabetes, even without obesity.

Fish oil supplementation reversed pro-inflammatory immune responses, increasing regulatory T-cells (Tregs) that help inhibit inflammation.More research is needed to confirm findings in human trials and determine optimal omega-3 dosage.

https://www.nutritioninsight.com/news/unicef-urges-action-to-break-gender-barriers-in-adolescent-nutrition.html

Adolescent girls in South Asia are facing a high burden of nutrition imbalance, warns UNICEF.

Nutrition Insight speaks with an expert from the humanitarian organization, who underscores the need for gender-responsive strategies based on the latest research across Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Zivai Murira, regional adviser of Nutrition at UNICEF South Asia tells us girls in these countries face a dual burden of malnutrition and rising obesity, which are driven by gender norms, weak food regulations, and the unchecked influence of food advertising.

This article highlights UNICEF's urgent call for gender-responsive strategies to address adolescent nutrition challenges in South Asia. The region faces a dual burden of malnutrition and rising obesity, driven by gender norms, weak food regulations, and aggressive marketing of ultra-processed foods. South Asia has the largest cohort of adolescent girls globally, with 172 million affected by malnutrition, micronutrient deficiencies, and obesity. Obesity rates among adolescent girls are rising, fuelled by unhealthy food environments and weak regulations.

UNICEF supports 12 evidence-based interventions, including: Fortified, nutritious meals, Micronutrient supplementation and deworming, Nutrition and lifestyle education, Advertising, labelling, and taxation policies to reduce unhealthy food consumption & Periodic nutrition screening and social safety net services
Gender inequalities and systemic barriers hinder adolescent girls' access to nutrition and healthcare. Food industry influence and aggressive marketing make unhealthy foods widely available. Weak enforcement of policies due to insufficient resources and training.India and Sri Lanka are the only countries with nationwide bans on junk food marketing in schools.

Governments must implement stronger regulations to protect adolescent girls from ultra-processed foods.Multi-sector collaboration is needed to overcome political challenges and fragmented decision-making.Foreign aid cuts threaten nutrition programs, but UNICEF remains committed to supporting adolescent girls.

Mango consumption improves heart health and insulin sensitivity

17 Mar 2025

https://www.nutritioninsight.com/news/mango-consumption-improves-heart-health-and-insulin-sensitivity-study-suggests.html

Eating two cups of mango daily may help obese adults with chronic low-grade inflammation, according to a recent study.

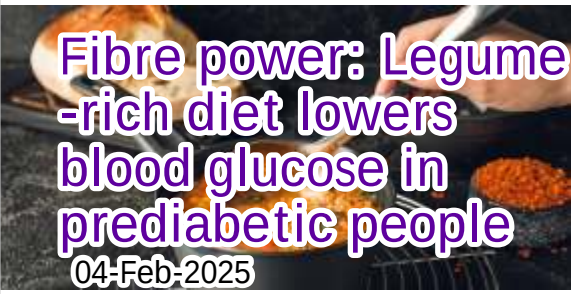
Moreover, eating mangoes does not increase weight and may help improve antioxidant status, which the research states may mediate blood glucose levels. The paper published in Nutrients says 100 calories worth of daily mango consumption can lower insulin concentration levels and improve insulin sensitivity. The Illinois Institute of Technology researchers suggest this finding can help reduce the risk of chronic conditions like type 2 diabetes, which is also linked to heart health.

"Managing blood glucose isn't just about monitoring blood sugar levels — it's about improving insulin sensitivity," says Indika Edirisinghe, PhD, Professor of Food Science and Nutrition. "Our study suggests that adding fresh mangoes to the diet can be a simple, enjoyable way for people who are overweight or have obesity to support better insulin function and reduce type 2 diabetes risk."

This study suggests that mango consumption may improve heart health and insulin sensitivity, particularly in obese adults with chronic low-grade inflammation. Researchers at the Illinois Institute of Technology found that eating two cups of mango daily (about 100 calories) can lower insulin concentration levels and enhance insulin sensitivity, potentially reducing the risk of type 2 diabetes.

Mango consumption does not lead to weight gain and may improve antioxidant status, which could help regulate blood glucose levels.Participants consuming mangoes showed a significant drop in insulin resistance, measured using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR).Beta-cell function (the pancreas's ability to produce and release insulin) significantly improved among mango consumers.No significant differences were observed in glucose levels or inflammatory markers between the mango and control groups.No variations in fasting triglycerides, HDL, LDL, or total cholesterol were found between interventions.

Mangoes may be a heart-healthy alternative to sweets with similar caloric content.Improved insulin sensitivity without weight gain challenges misconceptions about mangoes' natural sugar content.Further research is needed to understand the exact mechanisms behind mangoes' impact on blood glucose control.



Fibre power: Legume-rich diet lowers blood glucose in prediabetic people

04-Feb-2025

https://www.foodnavigator-asia.com/Article/2025/02/04/legume-rich-diet-lowers-blood-glucose-in-prediabetic-people/

A 16-week clinical trial conducted by researchers from the National University of Singapore, SIFBI, ASTAR, and Wilmar International* explored how a legume-rich diet could improve metabolic health in prediabetic individuals.

Participants: 127 Chinese prediabetic individuals in Singapore. Groups: Two randomized groups: Intervention Group: Consumed 100g of cooked legumes per meal (including mixed beans, red kidney beans, and chickpeas) alongside a lower-calorie diet. Control Group: Followed a similar lower-calorie diet but without additional legumes.

Measured Health Parameters: Blood sugar levels (HbA1c, fasting blood glucose, insulin resistance). Cholesterol levels (LDL, HDL, and total cholesterol). Body composition (weight, BMI, waist and hip circumference, fat and lean mass). Gut microbiota composition (presence of beneficial and harmful bacteria).

Blood Sugar and Insulin Regulation: HbA1c levels decreased more significantly in the intervention group: Intervention group: Nearly 4% lower HbA1c by week 16.Control group: About 2.5% lower HbA1c by week 16.Other markers like insulin levels and insulin resistance also decreased.

Cholesterol Levels: Both groups showed reductions in cholesterol, but the intervention group had greater improvements: LDL ("bad" cholesterol) and total cholesterol dropped significantly in the intervention group. HDL ("good" cholesterol) initially decreased after week 4, then gradually increased over time.

Weight & Body Composition: Both groups lost weight, but the intervention group had greater reductions: Intervention group lost an average of 3.23kg. Control group lost an average of 2.7kg.The fat mass decreased more compared to lean mass, improving body composition.

Gut Microbiota Changes: The legume-rich diet increased beneficial gut bacteria linked to better cholesterol and glucose metabolism, such as: Eubacterium rectale, Roseburiafaecis, Roseburia hominis & Bifidobacterium genus. These bacteria were negatively correlated with LDL and total cholesterol.

At the same time, harmful bacteria associated with low-fibre diets decreased, including: Ruminococcusgnavus, Ruminococcus torques, Bacteroides massiliensis & Bilophilawadsworthia.

The study suggests that food-based dietary interventions—especially a legume-enriched diet—can significantly improve blood sugar control, cholesterol levels, weight loss, and gut health in prediabetic individuals. These findings reinforce the idea that fibre-rich diets may reduce the risk of type II diabetes and cardiovascular diseases. Researchers also noted that gut microbiota composition plays a crucial role in these metabolic improvements, though further validation in independent studies is required.

Prebiotic infant formula aids gut, immunity - Danone-funded meta-analysis

10-Feb-2025

https://www.nutraingredients-asia.com/Article/2025/02/10/prebiotic-infant-formula-aids-gut-immunity-danone-funded-study/

This meta-analysis explores how prebiotic-enriched infant formulas impact gut health and immunity in infants.

Researchers examined formulas containing a 9:1 mixture of short-chain galacto-oligosaccharides (scGOS) and long-chain fructo-oligosaccharides (lcFOS), aiming to mimic human milk composition.

Gut health benefits: Infants consuming these formulas exhibited higher levels of beneficial gut bacteria (Bifidobacteria and Lactobacilli), similar to breastfed infants. Additionally, stool pH was lowered, stool frequency increased, and stool consistency improved, supporting a healthier gastrointestinal environment.

Immune health effects: The formulas led to increased levels of faecal immunoglobulin A (IgA), an antibody crucial for mucosal immunity. However, systemic immunity markers in the blood were not significantly affected.

Pathogen reduction: The presence of harmful bacteria such as Clostridium species and E. coli was notably lower among infants consuming prebiotic-enriched formulas.

This systematic review and meta-analysis sought to evaluate the benefits of infant formulas containing a 9:1 mixture of short-chain galacto-oligosaccharides (scGOS) and long-chain fructo-oligosaccharides (lcFOS). The blend was designed to mimic the composition of human milk, aiming to enhance gut microbiota and immune function in formula-fed infants.

FOOD SCIENCE & INDUSTRY NEWS

How supplements are evolving to meet consumer demand

06 Mar 2025

https://www.nutritioninsight.com/news/self-care-supplements-wellness-health-market-research-nutrition-women-gut-microbiome-energy-brain-mood-cognition-glp1-weight-fat-obesity.html

The supplement industry is transforming as self-care emerges as a dominant consumer priority.

According to Innova Market Insights, self-care extends beyond traditional health care to encompass feeling well, looking good, and protecting long-term health. This positioning is driving new supplement innovation across key areas, including energy, holistic women's wellness, weight management, trending flavours, innovative delivery formats, and mood and mental health boosts.

Notably, one in five consumers has increased their supplement use over the past year, moving from a reactive, treatment-based approach to a more proactive, preventive mindset. Innova Market Insights data highlights that while a nutritious diet and regular exercise remain essential strategies, supplement use is becoming a core component of self-care, with 29% of consumers turning to supplements for daily wellness.

This article explores the evolving self-care supplement industry, highlighting innovations in flavours, formats, weight management, women's wellness, and energy support. The shift toward preventive health has led to increased consumer interest in non-pill formats, personalized solutions, and scientifically backed formulations.

Non-pill formats now dominate 65% of the market, including gummies, lozenges, lollipops, and oral strips. Trending flavours include tropical fruits (lychee, mangosteen, pi pa) and botanical flavours (ginger, hawthorn, lime). Popular global flavours: Orange, strawberry, red raspberry, lemon. GLP-1 weight loss therapies are influencing supplement innovation. Nutrilinq Genesis supports muscle loss and nutritional gaps in GLP-1 therapy patients. Supergut GLP-1 booster provides prebiotic fibre to aid digestion and metabolism.

Brain-mood health is the top claim in new women's supplements. Ingredients like vitamin B12, theanine, and tryptophan are gaining consumer trust. URO Whole Body Probiotic supports gut, skin, and oral microbiome health.Consumers seek clean energy without crashes. Peak Energy supplement combines Peak ATP (muscle endurance) and Enfinity Paraxanthine (steady mental clarity).

Newly discovered β-galactosidase enzyme offers prebiotic science and food tech advances

11 Mar 2025

https://www.nutritioninsight.com/news/prebiotics-oligosaccharides-gut-health-digestion-supplements-microbiome-food-technology-science-nutrition-wellness-glycans-galactosides.html

A team of Japanese researchers led by Associate Professor Masahiro Nakajima from the Tokyo University of Science (TUS) has identified a new β-galactosidase enzyme in the gut bacterium Bacteroides xylanisolvens. They believe this discovery could pave the way for prebiotic science and food technology advancements.

Carbohydrate chains, or glycans, are essential sugar-like compounds that contribute to various biological functions in humans, plants, and microorganisms. Among them, galactosides — found in plant cell walls and prebiotic oligosaccharides — play a crucial role in gut health. Due to their potential health benefits, many of these glycans are also incorporated into processed foods like juice and powdered milk.

β-Galactosidases are enzymes that break down galactosides by releasing galactose, a simple sugar. While these enzymes are commonly found in human gut

bacteria such as Bifidobacterium, little has been known about their role in B. xylanisolvens.

A team of Japanese researchers from the Tokyo University of Science (TUS), led by Associate Professor Masahiro Nakajima, has identified a new β-galactosidase enzyme in the gut bacterium Bacteroides xylanisolvens. This discovery could lead to advancements in prebiotic science and functional food development.

β-Galactosidases are enzymes that break down galactosides, releasing galactose, a simple sugar. The newly discovered enzyme, Bxy_22780, specifically targets unique galactose-containing glycans, which may have prebiotic properties. Galactooligosaccharides (GOS), complex sugars often used as prebiotics, were found to be broken down efficiently by this enzyme. The enzyme works only on GOS with a β-1,2-galactosidic bond, particularly β-1,2-galactobiose and β-1,2-galactotriose. X-ray diffraction analysis revealed that the enzyme has a special binding site (subsite +1), making it highly selective.

The enzyme could be used to synthesize large amounts of unique glycans with prebiotic benefits. It may help improve gut microbiome health by supporting beneficial bacteria. The enzyme's ability to break down specific sugars could lead to new food formulations. It may be incorporated into health supplements and fortified foods. The enzyme could contribute to new drug development, particularly for Chagas disease, which is caused by a parasite that produces glycans containing these structures.

Cheese from peas: Danish researchers develop pea protein-based paneer with same taste and texture

20 Mar 2025

https://www.foodingredientsfirst.com/news/cheese-from-peas-danish-researchers-develop-pea-protein-based-paneer-with-same-taste-and-texture.html

Researchers from the University of Copenhagen in Denmark have demonstrated how a significant amount of the milk used in paneer, a popular South Asian cheese, can be substituted with plants while maintaining its taste and texture.

The researchers developed a hybrid version of paneer with 25% pea protein, which they hail as a "solid step toward more sustainable dairy products with nutritional benefits" as well as eco-friendly benefits.

Danish researchers at the University of Copenhagen have developed a hybrid paneer made with 25% pea protein, aiming to create a more sustainable dairy product while maintaining the taste and texture of traditional paneer. Paneer, a staple in South Asian cuisine, is typically made from casein, a milk protein. However, dairy production has a significant environmental impact, prompting researchers to explore plant-based alternatives. The team used EU-grown pea protein, which is considered more sustainable than soy-based alternatives.

One of the biggest hurdles in plant-based cheese innovation is replicating the texture and taste of traditional dairy products. The researchers found that at least 25% of milk proteins could be replaced with pea protein while still maintaining the firmness, shape, and taste of paneer. Since pea proteins retain more water than milk proteins, the team applied higher pressure during the cheese-making process to ensure the paneer remained solid. This technique helped the hybrid cheese maintain its structure despite its higher plant-based content.

The researchers believe that further studies could allow for an even greater reduction in milk content while still producing a consumer-friendly product. This innovation could significantly reduce the climate footprint of dairy products while offering a nutritionally beneficial alternative.

Why big food companies are obsessed with India

29-Jan-2025

https://www.foodnavigator.com/Article/2025/01/29/obsessive-unilever-and-mondelez-target-growth-in-india/

Its mix of youth, a booming middleclass and rising disposable incomes is an especially delicious recipe irresistible to FMCG corporates hellbent on growing revenues and profits.

Their largest similarity now, however, is an eagle-eye focus on the vast growth potential in the Indian market. And that's not to say it's a new market to the big players. On the contrary, they each hold various interests in India and reap vast rewards from them already. What is noticeable, however, is the growing importance of India in companies' financial forecasts.

The country's combination of a large, youthful population, a booming middle class, and rising disposable incomes has made it an attractive market for Western FMCG (fast-moving consumer goods) corporations seeking revenue expansion.

Key Drivers of Growth in India: Demographics & Economy: With a population exceeding 1.4 billion and an expanding middle class, India offers one of the largest consumer markets globally. Rising disposable incomes and shifting consumption patterns, influenced by Western brands, are driving demand for packaged food and beverages.

Urbanization & Lifestyle Changes: Increased urbanization has led to a preference for Westernized food habits among time-constrained consumers. The adoption of convenience foods, snacks, and ready-to-eat meals has surged. E-commerce & Technology: The rapid rise of e-commerce, smartphone penetration, and online food deliveries has made international brands more accessible, even in rural areas. Government Policies: Favourable regulations aimed at easing foreign investment restrictions have further encouraged global FMCG players to expand in India.

Snacking Revolution in India: India has emerged as a leader in the global snacking trend, with 18% of adults replacing meals with snacks in 2024. The bakery and snack markets are experiencing rapid growth, driven by: Strong cultural ties to snacks like namkeen and meetha. Major brands leveraging traditional flavours. Some holding 24% of the Western snacks market while expanding into ethnic snacks.

Localized Product Development: Western brands must customize offerings for India's diverse culinary landscape, incorporating traditional ingredients like turmeric and ginger. Affordable & Premium Offerings: A balance between mass-market affordability and aspirational premium products is crucial. Regional Adaptations: Companies must cater to specific tastes and dietary preferences across different regions. Sustainability & Health-Focused Products: Increasing demand for healthier snacks, organic products, and sustainable food options.

India's rapidly evolving consumer market, technological advancements, and business-friendly environment make it a prime destination for global food manufacturers. Western FMCG brands must focus on localization, affordability, and innovation to maximize their presence in this lucrative space.

Why 'food as medicine' will dominate 2025

21-Jan-2025

https://www.foodnavigator.com/Article/2025/01/21/food-as-medicine-trend-set-to-dominate-2025/

Growth of the 'food as medicine' trend is having a major impact on food and beverage, with 2025 set to take its success to a whole new level.

Interest in the food as medicine movement has been gradually trending upwards over the past decade. But the recent rise in popularity of all things, health and wellness, has led to a surge in sales for food and beverage products promoting wellbeing.

Worth a "healthy" $25bn, the food as medicine market is projected to grow at a CAGR of 4.3%, reaching $36.6bn by 2034, according to Prophecy Market Insights. Now, that rise looks set to revolutionise the food and beverage industry as manufacturers step up innovation and new product development to meet mounting consumer demand. "The global expansion of functional foods is expected to outstrip that of traditional foods in both developed and emerging countries," says a spokesperson for Prophecy Market Insights.

The "food as medicine" trend is set to dominate 2025, driven by increasing consumer interest in health and wellness. The market, currently valued at $25 billion, is projected to grow at a CAGR of 4.3%, reaching $36.6 billion by 2034.

Key Drivers of Growth: Rising Health Consciousness – Consumers are shifting towards foods rich in vitamins and minerals to support overall well-being. Gut Health Focus – Functional foods targeting gut health are gaining popularity, with manufacturers responding to demand. Energy-Boosting Foods – Stress levels are pushing consumers to seek dietary solutions for energy, though product offerings remain limited. Sleep-Enhancing Beverages – The demand for drinks promoting better sleep is expected to rise in the coming months.

Manufacturers are stepping up innovation to meet growing consumer demand. Functional foods are expanding beyond gut health to support energy levels and sleep.

The trend is not limited to those avoiding medications—it is also being explored as a complementary aid for weight loss.

The food and beverage industry is expected to capitalize on nutrient-dense products, with clear messaging on health benefits. Snack bars and cereals are currently leading the way, but there is huge potential for ready meals, drinks, and snacks.

Multi-sensorial innovation, affordability and health key drivers in Asian confectionery

03-Feb-2025

https://www.foodnavigator-asia.com/Article/2025/02/03/multi-sensorial-innovation-affordability-and-health-key-drivers-in-asian-confectionery/

Consumers in Asia are increasingly looking for multi-sensorial experiences in their confectionery purchases while also prioritizing affordability and health.

Experts emphasize the need for advanced innovations to appeal to a more discerning market. Taste is king, texture is queen—consumers seek exciting textures in confectionery. Examples of multi-sensorial products: Cookies with large chocolate chunks or chocolate enrobing. Soft cakes with chocolate coating. Wafer sticks filled with chocolate or caramel.

40% of consumers prefer interesting textures when making purchases. Companies must proactively innovate to meet these expectations. The economic climate has reinforced affordability as a major purchasing factor. In Indonesia, affordability is a basic necessity, while healthier products are an emerging category.

Bite-sized products are a successful strategy: They provide affordable indulgence. They also serve as portion-controlled healthier options.

Healthier Innovation & Sugar Reduction: Sugar reduction is gaining traction but requires more education and initiatives. Singapore leads in healthier innovation, while Indonesia is still developing awareness. Governments are pushing for sugar-reduced products, driving manufacturers to reformulate.

Synbiotic-fortified milk shows promise for toddler gut health and iron status

Kacey Culliney, Freelance Multimedia Journalist January 27, 2025

https://www.vitafoodsinsights.com/childrens-health/synbiotic-fortified-milk-shows-promise-for-toddler-gut-health-and-iron-status

Fortified milk containing synbiotics, micronutrients, and with reduced protein content holds promise for elevating iron status and improving overall gut health in toddlers, according to an industry-funded study.

Published in Frontiers in Pediatrics, the study – part of a series of Child Health and Residence Microbes (CHaRM) studies from the University of Queensland, Australia, on gut health in toddlers – investigated the impact of fortified milk versus unfortified cow's milk on the gut microbiota of children aged one to two years.The double-blind, randomised control trial took place over a 12-month period in a small cohort of children.

A 12-month randomized control trial conducted by the University of Queensland, Australia, investigated the effects of fortified milk on gut health and iron status in toddlers aged one to two years. Participants: A small cohort of clinically healthy toddlers. Active Group: Consumed fortified milk with reduced protein content, synbiotics, and micronutrients.

Control Group: Consumed unfortified cow's milk.

Synbiotic Blend: Bifidobacterium breve M-16V. Short-chain galactooligo-saccharides (scGOS). Long-chain fructooligosaccharides (lcFOS). Additional Nutrients: Iron, vitamin D, and vitamin C.

Toddlers in the active group showed higher levels of serum iron, transferrin, and hemoglobin at month 12 compared to baseline. Iron absorption was enhanced due to Bifidobacterium's ability to: Lower colonic luminal pH. Convert Fe3+ to Fe2+ (making iron more bioavailable). Prevent pathogenic bacteria from utilizing iron.

Higher abundance of Bifidobacterium in the active group. Bifidobacteria may reduce opportunistic pathogenic bacteria by: Competitive exclusion. Binding Fe2+ to their extracellular membranes, limiting access for harmful microbes.

Iron intake in toddlers is often sub-optimal, despite their higher nutritional needs. Iron-fortified foods and supplements can cause diarrhea and increase pathogenic bacteria. Synbiotic-fortified milk offers a potential alternative with fewer side effects.

Study Strengths & Limitations: Provides a working hypothesis on synbiotics' role in gut microbiota composition. Confirms iron absorption improvements through gut acidification. Limitations: Conducted on a small cohort of clinically healthy children. Findings may not be generalizable to broader populations.

The study highlights the critical role of diet in early gut microbiota development and suggests that fortified milk could positively impact nutritional status and gut microbiome composition in toddlers. Further research is needed to validate these findings in larger populations.

Early Intervention in Food Innovation

https://www.ift.org/news-and-publications/blog/2025/early-intervention

Hear from a firm that helps companies succeed at innovation and minimize risk by evaluating product ideas in their initial stages.

As consumer preferences fluctuate, food and beverage companies typically strive to develop new products that will meet these shifting demands. For example, today's consumers increasingly look for products that are healthier and more sustainable. But products making claims like "supports digestive health" or "made with recycled materials" must meet specific compliance regulations—and those regulations can vary by market.

Rather than spending time and resources to develop products that may not qualify to make desired claims, many companies are opting to test their product ideas in advance through regulatory concept reviews. This audit framework helps businesses determine, early on, whether their product ideas will be permissible in their target markets and whether they can make the nutrition and health claims they wish to make.

As consumer preferences evolve, food and beverage companies must develop new products that align with trends like health and sustainability. However, regulatory compliance can be complex and market-specific, making early regulatory concept reviews a valuable tool for minimizing risk and ensuring product success.

Regulatory Concept Reviews: Purpose: Helps businesses determine early on whether their product ideas will be permissible in target markets. Key Benefit: Ensures that nutrition and health claims meet compliance regulations, avoiding costly delays or redesigns. Expert Insight: Mariko Kubo, Head of Global Regulatory at Leatherhead Food Research, emphasizes that early regulatory engagement helps companies align with key requirements before development begins.

Major Risks in Food & Beverage Innovation

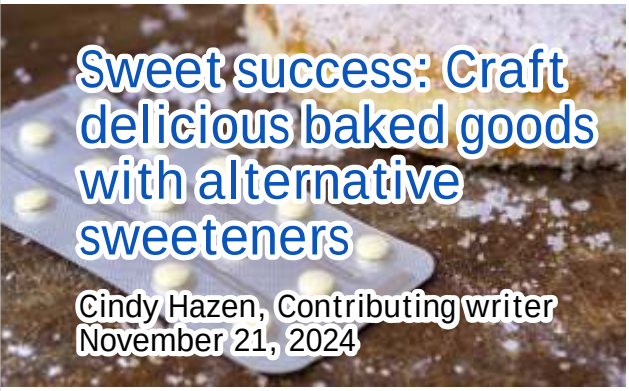
New License Requirements: Some products require additional licensing (e.g., soft drinks transitioning into alcoholic beverages). Failure to comply can lead to high costs and delays.

Authorization Challenges: Certain ingredients and claims need official approval before marketing. This process can be expensive and time-consuming (sometimes taking years). Registration Requirements: Some fortified foods require

Benefits of Early Concept Reviews: Initial feedback helps shape development plans to meet regulatory standards. Potential risks are identified early, allowing proactive solutions. Collaboration with regulators fosters smoother approval processes. Regulatory experts provide guidance on leveraging new technologies.

Leatherhead's Front-End Innovation Principle applies a regulatory lens at the beginning of product development. Key steps in the process: Checking ideas against global regulatory frameworks. Ensuring substantiation of desired claims through unbiased dossiers. Recommending alternatives to reinforce compliance. Conducting risk assessments to determine market readiness. De-risking product concepts by analysing competitor strategies.

Early regulatory concept reviews reduce risks, streamline innovation, and enhance compliance. By integrating regulatory insights at the ideation stage, companies can avoid costly setbacks and accelerate product success.



Sweet success: Craft delicious baked goods with alternative sweeteners

Cindy Hazen, Contributing writer
November 21, 2024

https://www.supplysidefbj.com/sweeteners/sweet-success-craft-delicious-baked-goods-with-alternative-sweeteners

Replacing sugar with nonnutritive sweeteners in baked goods requires precise formulations to balance sweetness, bulk and functionality while addressing challenges like texture, browning and digestion.

This is often achieved by combining complementary ingredients like stevia, monk fruit, allulose and fibres.This article explores the challenges and solutions of replacing sugar with alternative sweeteners in baked goods. Since sugar contributes sweetness, bulk, texture, and browning, formulators must carefully balance these properties when using nonnutritive sweeteners.

Key Challenges in Sugar Replacement: Loss of Bulk: High-intensity sweeteners like stevia and monk fruit provide sweetness but lack bulk, requiring additional ingredients. Heat Sensitivity: Some sweeteners break down at high temperatures, losing their sweetness. Browning Issues: Many alternative sweeteners do not participate in Maillard browning, affecting crust colour and flavour. Texture Changes: Differences in water-binding properties impact moisture retention and structure.

Solutions for Better Baking: Combining multiple sweeteners to balance sweetness and bulk. Adding proteins or reducing sugars (e.g., dextrose, fructose, allulose, fructo-oligosaccharides (FOS)) to improve browning. Using soluble fibres to simulate sugar's bulk in dough. Adjusting batter viscosity with clean-label starches. Using enzymes to soften crumb, increase loaf volume, and extend shelf life.

Sweetener Profiles: Stevia: Varies in flavour based on growing conditions and extraction methods. Works well in chocolate cakes but requires premium versions for vanilla-based products. Monk Fruit: Heat-tolerant but needs a bulking agent. Erythritol: Often combined with allulose, stevia, and monk fruit. Has a cooling effect but works well at lower levels. Allulose: 70% as sweet as sugar, contributes bulk and browning, but burns at lower temperatures. Requires longer bake times and lower temperatures.

Optimizing Formulations: Pairing stevia and allulose for synergistic sweetness. Using monk fruit and stevia together to mask off-notes. Adding soluble tapioca fibre to retain moisture. Using baking powder or egg whites to improve leavening. To craft delicious baked goods with alternative sweeteners, formulators must strategically combine ingredients to replicate sugar's functionality while maintaining taste, texture, and appearance.

Gut Health: What Consumers Want in 2025

https://www.foodnavigator.com/Article/2025/02/03/gut-health-what-consumers-want-in-2025/

The article explores the gut health trend, which continues to drive innovation in food and beverage products. The global digestive health market is valued at $51.62 billion, with a projected 8.3% CAGR.

Key Trends in Gut Health for 2025: The Four Ks: Kimchi, Kefir, Kombucha, and Kraut. These fermented foods remain hugely popular, with brands like Biotiful, Lifeway Foods, Danone Activia, and Yeo Valley expanding their offerings.

Market growth rates: Kefir: $1.26 billion, 5.0% CAGR, Kimchi: $4.9 billion, 4.9% CAGR, Kombucha: $2.64 billion, 15.6% CAGR, Sauerkraut: $10.5 billion, 5.3% CAGR

Fortification of Foods: Manufacturers are adding gut-friendly ingredients (e.g., turmeric, cinnamon, ginger) to existing products. The functional food market is valued at $281 billion.

Gut-Friendly Sweets & Chocolates: Savvy Sweets and NeatSweets are launching high-fibre gummy bears. Lil' Goodness and OhSo offer prebiotic dark chocolate. Dark chocolate (70% cocoa) is gaining popularity for its gut health benefits.

Gut-Boosting Snacks: Bio&Me launched flapjack bars with gut-friendly ingredients. Boundless introduced smoky-bacon crisps with high fibre content.

Mediterranean Diet & Gut Health: Olive oil, fruits, vegetables, lean proteins, and high-fibre foods are seeing increased demand. The diet supports beneficial gut bacteria like lactobacillus and bifidobacteria.

AI in Food Gains Consumer Acceptance

https://www.foodnavigator.com/Article/2025/01/31/ai-in-food-gains-consumer-acceptance/

The article explores consumer attitudes toward AI in food production, revealing a mix of optimism and caution.

A survey conducted in the UK and US found that 42% of consumers view AI positively in food design and production, while 27% hold a negative perspective.

Key Findings on Consumer Sentiment: Younger consumers (18-27) are the most optimistic, with 65% supporting AI in food. Higher-income groups ($100,000+ annual income) are more positive (65%) than lower-income groups (42%). Food safety applications of AI receive strong support (53% positive, 19% negative). AI-assisted diets are gaining traction, with 48% willing to let AI analyse their genetic makeup for nutrition recommendations.

Major Companies Using AI in Food: Danone & Microsoft: AI for supply chain efficiency. Bel Group & Coca-Cola: AI-driven recipe development. Nestlé: AI-powered customer service. KitKat & Hershey's: AI-enhanced marketing campaigns.

Consumer Concerns & Regulations: 83% believe AI-created food should be labelled as such. 65% think AI-assisted food should not be marketed as "natural." 78% support government regulation of AI in food production. 79% expect AI-driven cost savings to result in lower food prices.

Lingering Resistance: 29% of consumers say AI involvement would make them less likely to buy a product. 26% say they'd be more likely to purchase AI-assisted food. Younger consumers (52%) are more open to AI-made food than older demographics.

India Budget 2025: Food industry lauds cold chain, organic production funding but bemoans lack of excise support

11-Feb-2025

https://www.foodnavigator-asia.com/Article/2025/02/11/india-budget-2025-food-industry-lauds-cold-chain-and-organic-production-funding-but-bemoans-lack-of-excise-support/

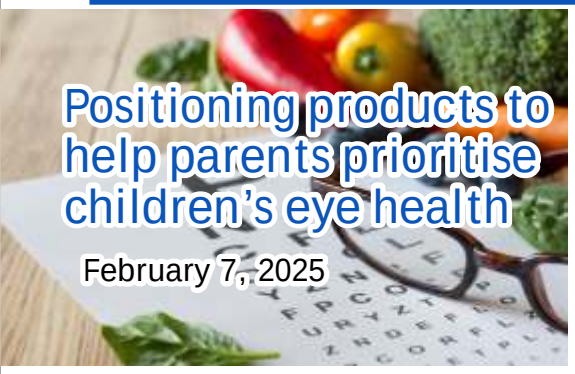
India's Budget 2025 has received mixed reactions from the food industry.

While the sector appreciates the funding for cold chain infrastructure and organic production, concerns remain over the lack of excise support and tariff reductions for food ingredients.

Key Highlights of Budget 2025 for the Food Industry: Cold Chain & Logistics Improvements: The budget allocates funds to enhance cold storage facilities, aiming to reduce post-harvest losses and improve food quality. Organic Farming Support: The government's emphasis on sustainable agriculture could encourage dry fruit growers to

adopt eco-friendly practices, potentially boosting exports. Tariff Concerns: The dry fruits sector is disappointed by the absence of tax reductions on imported commodities like apples and kiwis, which are widely consumed as dried snacks. Sector-Specific Tax Benefits: While mobile phone batteries and shipping-related goods received direct tax measures, the food industry did not see similar fiscal relief. Pulses Development Mission: A six-year plan aims to improve climate-resilient variants, protein content, and post-harvest management. Support for MSMEs & Food Processing: The government plans to establish the National Institute of Food Technology to assist farmers and entrepreneurs.

Industry Response: The FMCG sector welcomes the focus on agriculture and infrastructure, but dry fruit manufacturers feel their challenges were overlooked. While cold chain improvements may indirectly benefit the industry, stakeholders argue that targeted policies are needed to boost global competitiveness.



Positioning products to help parents prioritise children's eye health

February 7, 2025

Positioning products to help parents prioritise children's eye health

Childhood myopia is on the rise worldwide, creating opportunities for supplement brands to help parents seeking to prioritise their children's eye health, says Mintel.

This report highlights the growing concern of childhood myopia and how supplement brands can help parents prioritize their children's eye health.

Key Findings: Rising Myopia Rates: The prevalence of myopia has increased from 24% (1990-2000) to 36% (2020-23), with prolonged screen time, limited outdoor activity, and poor nutrition identified as major contributing factors. Low Awareness Among Parents: Only 9% of British parents express concern about their children's eye health, indicating a gap in awareness. APAC Leading Innovations: The Asia-Pacific (APAC) region accounts for 59% of global launches of food, drink, and supplements targeting children's eye health, with Vietnam leading the market. Nutrient-Rich Foods for Eye Health: Ingredients like lutein, zeaxanthin, blackcurrant, and bilberry are being explored for their vision-support benefits. Picky Eating Challenges: Many children avoid foods rich in vitamin A, lutein, and omega-3 fatty acids, which are essential for healthy vision. Brands like Easy Peasie offer Veggie Powder Blends to help parents introduce these nutrients.

Opportunities for Brands: Fortified Eye Health Products: Supplements and snacks enriched with essential nutrients can help bridge the gap. Educational Campaigns: Raising awareness about screen time management and outdoor play can encourage healthier habits. Innovative Formats: Discreetly adding nutrient-rich powders to meals can help picky eaters get the vitamins they need.

Tax sugar and salt in food to improve health?

March 17, 2025

www.sciencedaily.com/releases/2025/03/250317164500.htm

Introducing a new salt levy is another proposal put forward in a comprehensive set of recommended regulations for the food sector.

The UK government should extend its sugar tax beyond soft drinks to cover all types of foods, according to a major new report published. The Transforming UK Food Systems Programme (TUKFS) report, entitled "Regulatory Tools for a Healthy and Sustainable Diet," highlights how the existing soft drinks levy has reduced sugar content in beverages by 44%, and suggests a similar approach expanded across all food types could help tackle the UK's obesity crisis.

Introducing a new salt levy, similar to the sugar tax, is another proposal put forward in a comprehensive set of recommended regulations, which are suggested not only to transform public health in the UK, but also to deliver nationwide environmental benefits.

This report from the University of Reading proposes extending the UK's sugar tax to all processed foods and introducing a salt levy to improve public health and tackle the obesity crisis. The report, titled "Regulatory Tools for a Healthy and Sustainable Diet," highlights the success of the existing soft drinks levy, which reduced sugar content in beverages by 44%.It suggests expanding the sugar tax to cover processed foods like milkshakes, biscuits, yogurts, and breakfast cereals. A salt levy is also proposed to further enhance public health and deliver environmental benefits.

Stronger Regulations move away from voluntary measures, which have failed to address environmental damage and poor health outcomes. Implement mandatory measures, such as taxes on sugar and salt in processed foods. Setting targets to reduce red and processed meat consumption could lower the UK's climate impact and cancer risk. Adding dairy and beef farms to environmental permitting schemes to ensure sustainable practices. Stronger regulations would support long-term economic goals by fostering a healthy environment and workforce.

Additional Measures require large food businesses to report sales of unhealthy products. Make front-of-pack traffic light food labelling mandatory on all products. The report emphasizes that voluntary approaches have not worked, and stronger regulations are needed to transform the UK's food landscape.It argues that healthier diets and sustainable practices are essential for national security and economic stability.

The government is expected to unveil its food strategy and 25-year farming roadmap later this year, which may incorporate these recommendations. This comprehensive approach aims to address the UK's obesity crisis while promoting environmental sustainability and economic growth.

Crunch time on salt and sugar: Popular UK snacks flunk “healthy” government criteria ahead of junk food ad ban

18 Mar 2025

https://www.nutritioninsight.com/news/junk-food-diet-nutrition-salt-sugar-sodium-healthy-eating-calories-diabetes-obesity-uk-advertisement.html

A new UK report exposes excessive salt and sugar in popular snacks, raising alarm with less than eight months to go before national advertising restrictions roll out in October.

It flags that the majority of snack products fail to meet the government’s criteria for “healthier” — underscoring a missed opportunity for food brands that have not complied with salt and sugar reduction targets.

Often regarded as a healthier snack, many ready-to-eat popcorn products contain excessive levels of salt and sugar.With the upcoming restrictions set to impact companies that fail to reformulate, report publisher Action on Salt and Sugar calls for the government to “get tough” on the food industry and set new, stricter, mandatory salt and sugar reduction targets.

A recent UK report exposes excessive salt and sugar in popular snacks, raising concerns with just months to go before national advertising restrictions take effect in October 2025. The findings reveal that a majority of snack products fail to meet the government’s criteria for being "healthier," highlighting a missed opportunity for brands that have not complied with voluntary salt and sugar reduction targets.

Ready-to-eat popcorn—often perceived as a healthier snack—is found to contain excessive levels of salt and sugar. Action on Salt and Sugar, the report's publisher, urges the government to enforce stricter mandatory reduction targets, arguing that voluntary efforts have largely failed. In an analysis of over 1,200 snacks, the following percentages were flagged as "less healthy" under UK guidelines: 77% of chips, 56% of nuts, 88% of popcorn. These products could soon be restricted from advertising on TV and online before 9 PM due to their unhealthy profiles.

Health experts warn that excessive salt and sugar consumption significantly increases risks for high blood pressure, heart disease, kidney disease, and strokes. Dr. Pauline Swift (Blood Pressure UK) stresses that cutting salt is a lifesaving necessity as excess sodium intake is directly linked to dangerous health conditions. Kate Howard (Recipe for Change) argues that food companies are harming public health by failing to improve their products, stating that most are not incentivized to reformulate without government regulation.

Companies failing to reduce salt and sugar levels will lose advertising opportunities under the upcoming UK regulations. Brands that proactively reformulate will be better positioned as consumer awareness and regulatory pressure continue to rise.

Scientists examine fingerprinting techniques to curb olive oil and pine nut fraud

28 Mar 2025

https://www.foodingredientsfirst.com/news/olive-oil-fraud-detection-sesquiterpene-fingerprinting.html

Researchers at the University of Barcelona (UB) in Spain have investigated fingerprinting methods to prevent fraud in olive oil and pine nuts by verifying their geographical origins.

The study aims to protect consumers and producers from fraudulent practices when such products reach the market and pose risks to consumer health in extreme cases. Food fraud is an ongoing concern for the F&B industry, which is ramping up technological efforts to combat the rampant adulteration of various products. The olive oil supply chain, in particular, persistently ranks among foods with the highest fraud incidence, according to the EU Agri-Food Fraud Network, 2021.

The first study, published in Food Chemistry, highlights the potential of a method called “sesquiterpene fingerprinting” to verify the geographical authentication of virgin olive oil. The scientists say it is “emblematic” of the Mediterranean diet but particularly vulnerable to fraud. Falsification of the declaration of origin is especially difficult to detect. The second, published in the same journal, uses the same analytical strategy to ensure the authenticity of pine nuts’ geographical and botanical origin.

Researchers at the University of Barcelona (UB) have developed fingerprinting techniques to help curb fraud in olive oil and pine nuts by verifying their geographical origins. Fraud in the food industry is an ongoing issue, particularly in the olive oil supply chain, which ranks among the most commonly adulterated products.

Their first study focuses on sesquiterpene fingerprinting, a biochemical method to authenticate virgin olive oil, a staple of the Mediterranean diet. Fraudulent declarations of origin are especially tricky to detect, but analysing sesquiterpenes—naturally occurring compounds in olive oil—can help differentiate

genuine products from counterfeits.

The second study applies the same approach to pine nuts, which are often mislabelled due to price variations. Mediterranean pine nuts command higher prices than Asian pine nuts, making them a target for counterfeiting. The research demonstrated that sesquiterpene fingerprinting is more reliable than traditional isotope analysis in detecting authenticity.

Additionally, chemometric techniques combined with gas chromatography-mass spectrometry provided near-perfect accuracy in identifying pine nuts' origins. This breakthrough could significantly improve fraud detection in food products globally.

https://www.pbs.org/newshour/health/are-seed-oils-toxic-the-answer-is-complicated-according-to-research

The debate on seed oils and their health effects has gained attention, with figures like Robert F. Kennedy Jr., set to become the U.S. health secretary, and health influencers labelling them as toxic.

His campaign promotes reverting to cooking with beef tallow instead of seed oils, which have become central to the American diet due to their unsaturated fats that lower cholesterol levels, in contrast to saturated fats in tallow that raise cholesterol.

Seed Oils and Their Rise in Consumption: Seed oils—often called "vegetable oils"—are extracted from seeds, unlike fruit-based oils such as olive or coconut oil. The most commonly criticized seed oils, dubbed the "hateful eight," include canola, corn, soybean, cottonseed, grapeseed, sunflower, safflower, and rice bran oil. Their mass consumption escalated after the mechanical screw press was invented in 1888, enabling large-scale extraction. Between 1909 and 1999, soybean oil consumption in the U.S. rose dramatically, altering the biological composition of the population by increasing omega-6 fatty acids stored in body fat by 136%.

Omega-6 to Omega-3 Ratio and Health Impacts: Omega-6 and omega-3 fatty acids regulate inflammation, with omega-6 promoting inflammation and omega-3 reducing it. Historically, people consumed these fats in equal amounts, but modern diets favour omega-6 fats at a 15:1 ratio, mainly due to increased seed oil intake. High omega-6 levels and an imbalanced omega-6 to omega-3 ratio are linked to health conditions such as mood disorders, chronic pain, menstrual issues, and even colon cancer.

However, the omega-6 to omega-3 ratio varies among seed oils:High ratios (potentially harmful): Safflower (125:1), Sunflower (91:1), Corn (50:1)Lower ratios (potentially beneficial): Soybean (8:1), Canola (2:1). Genetic modification has produced seed oils with improved ratios, though their health benefits are still under study.

Inflammation, Genetics, and Disease Risk: Research has produced mixed findings on seed oils' inflammatory effects. While one study showed no significant effects on 11 inflammatory markers, another indicated that high omega-6 intake may increase inflammation. Genetics also plays a role—individuals of African, Indigenous, and Latino descent metabolize omega-6 faster, which may amplify inflammation.

Heart Disease and Seed Oils: Seven randomized trials assessed the relationship between seed oils and heart disease. Findings suggest that swapping saturated fats (like beef tallow) for seed oils with lower omega-6 to omega-3 ratios (such as soybean oil) reduces the risk of heart attacks. Conversely, replacing saturated fats with seed oils that have higher omega-6 ratios (such as corn oil) may increase the risk of heart disease. Soybean oil, widely used in the U.S., has a favourable omega-6 ratio (8:1) and has been shown to lower heart disease risk.

Seed Oils, Processed Foods, and Migraines: Many processed foods—chips, frozen meals, and packaged desserts—contain seed oils with unfavourable omega-6 ratios, though these foods are unhealthy for additional reasons. A randomized trial found that reducing omega-6 intake while boosting omega-3 intake

(e.g., eating more fatty fish and replacing corn oil with olive oil) significantly reduced migraine frequency, outperforming some migraine medications.

Seed oils have fundamentally altered human biology due to their widespread consumption. While they offer benefits like lowering cholesterol, their effects on inflammation and disease risk vary by type and individual genetics. Simplifying seed oils as "bad" or "good" is misleading, and a nuanced approach to their health impact is necessary.

New AI instantly analyses a meal's nutritional content through image recognition

20 Mar 2025

https://www.foodingredientsfirst.com/news/snap-and-track-new-ai-instantly-analyzes-a-meals-nutritional-content-through-image-recognition.html

As concerns about weight management and diabetes continue to rise, an AI system developed by NYU Tandon School of Engineering researchers introduces a promising new AI-based tool in the fight against diet-related health conditions.

Users snap a photo of their meals and are instantly presented with an estimation of its calorie count, fat content, and nutritional value, which the researchers say means "no more food diaries or guesswork."

This futuristic scenario is now much closer to reality, say the authors who pitched the concept at the sixth International Conference on Mobile Computing and Sustainable Informatics hosted by the Institute of Electrical and Electronics Engineers.The tool uses advanced deep-learning algorithms to recognize food items in images and calculate their nutritional content, including calories, protein, carbohydrates, and fat.

The system employs deep-learning algorithms to recognize food items and calculate their nutritional values. Unlike traditional self-reporting methods, which are often inaccurate, this AI removes human error from dietary tracking. It has been deployed as a web application, allowing users to access it via their phone's browser without needing to download an app.

Developing reliable food recognition AI has been difficult due to three major hurdles: Visual Diversity of Food – The same dish can look vastly different depending on preparation style, making recognition complex. Portion Size Estimation – The AI uses volumetric computation to measure the exact area each food occupies on a plate, ensuring precise nutritional assessments. Computational Efficiency – Previous models required excessive processing power, but this system leverages YOLOv8 with ONNX Runtime to run efficiently on mobile devices.

The AI was tested on various foods, including: Pizza slice – 317 calories, 10g protein, 40g carbohydrates, 13g fat. Idli sambhar – 221 calories, 7g protein, 46g carbohydrates, 1g fat. Hot dog – 280 calories. Baklava – 310 calories, 18g fat.

Initially designed to address firefighter health concerns, the system could soon expand to broader healthcare applications. Researchers believe it will help combat weight management issues, diabetes, and cardiovascular risks by providing instant, accurate dietary insights.

South Korea to Prioritise Food Safety Information & Visibility in New e-Labelling Regulations

By Pearly Neo 08-Jan-2025

https://www.foodnavigator-asia.com/Article/2025/02/10/south-korea-to-prioritise-food-safety-information-and-visibility-in-new-e-labelling-regulations

South Korea is making significant changes to its food labelling regulations to enhance consumer convenience and visibility of essential information while promoting sustainability.

The Ministry of Food and Drug Safety (MFDS) has announced that non-essential details will be moved from printed labels to electronic labels (e-labels), accessible via QR codes.

Key Changes in Labelling Regulations: Printed labels will prioritize essential information such as product name, expiration date, allergens, and storage methods.

Font size on printed labels will increase from size 10 to size 12 for better readability. Only select nutritional details (calories, sodium, sugar, and trans fats) and the top three ingredients by content ratio will remain on printed labels. Other details (full nutritional information, ingredients, business address, packaging material, etc.) will be available via QR codes.

Benefits of the New System: Improved consumer access to crucial food safety information. Reduced industry costs by eliminating the need to reprint packaging due to errors. Environmental benefits by supporting carbon neutrality initiatives.

Food QR Platform: MFDS has launched Food QR, a real-time food information service where consumers can scan QR codes to access: Food safety updates (recalls, allergen warnings, etc.). Health information (ingredients, nutritional data). Lifestyle details (cooking methods, recipes). Future plans include sign language videos and foreign language translations.

These changes aim to modernize food labelling, making it more accessible and environmentally friendly.

Thailand revises Healthy Choice logo eligibility criteria for multiple food products

11-Feb-2025

https://www.foodnavigator-asia.com/Article/2025/02/11/thailand-revises-healthy-choice-logo-eligibility-criteria-for-multiple-food-products/

Thailand's Food and Drug Administration (FDA) has revised the eligibility criteria for its Healthier Choice logo (THCL), tightening standards for beverages, seasonings, packaged soup bases, and plant-based dairy alternatives.

Key Changes in THCL Criteria: Soup Bases: Must contain ≤200mg sodium per 100g of prepared soup and ≤ 5.4g total fat per 300g of soup. Plant-Based Dairy Alternatives: Must have ≤ 5.5g sugar and ≤3.3g saturated fat per 100ml, and ≤4,100mg sodium per 300g of the final product. Instant Coffee: Sugar content reduced to ≤5g per 100ml (previously 6g) and ≤15g per package (previously 18g). Seasonings & Beverages: Stricter limits on sodium and sugar to align with healthier consumption patterns.

Implementation & Industry Response: The new criteria take effect immediately ,but manufacturers have two years to clear products that still carry the logo under previous standards .The voluntary nature of the THCL program has led to low adoption rates ,with a study showing that only 10%of manufacturers launched products displaying the logo between 2017 and 2021 .While these revisions aim to improve public health ,concerns remain about limited industry participation .

Despite the stricter criteria , Thailand faces a bigger challenge—low industry participation .A 2023 Mahidol University study found that THCL adoption remains limited and inconsistent ,restricting its impact on public health.

Despite self-affirmed GRAS, plant-based products may require additional safety measures in a crowded multibillion-dollar market

Scott Miller, Senior staff writer
February 5, 2025

https://www.supplysidefbj.com/food-beverage-regulations/despite-self-affirmed-gras-plant-based-products-may-require-additional-safety-measures-in-a-crowded-multibillion-dollar-market

Plant-based foods often promise a healthier lifestyle, but gaps in the research, along with processing risks and regulatory challenges, reveal that safety requires a robust, holistic approach.

This article examines the safety challenges surrounding plant-based foods, despite their self-affirmed GRAS (Generally Recognized as Safe) status. While these products are often marketed as healthier alternatives, they face pathogen risks, regulatory gaps, and processing concerns that require a more holistic safety approach.

Key Safety Concerns: Pathogen Risks: Plant-based foods can harbour Listeria and other

bacteria just as easily as animal products—sometimes even more so.

Contamination can occur during processing, allowing bacteria to spread throughout facilities.GRAS Limitations: The self-affirmed GRAS system allows new plant-based ingredients to enter the market without long-term safety studies, raising concerns about potential allergens and unknown health effects. Processing Challenges: Many plant-based products contain high protein, high moisture, and near-neutral pH, creating an ideal environment for microbial growth and spoilage.

Experts argue that plant-based foods require the same stringent safety measures as animal products. The FDA and USDA regulate these products, but gaps remain in long-term research on novel ingredients. Some scientists worry that self-affirmed GRAS status allows companies to introduce new ingredients without sufficient safety data.

To mimic meat-like texture, mouthfeel, and flavour, plant-based products often rely on specialty ingredients processed under unique conditions. These ingredients may alter microbial structures, potentially increasing foodborne illness risks.
el, and flavour, plant-based products often rely on specialty ingredients processed under unique conditions. These ingredients may alter microbial structures, potentially increasing foodborne illness risks.

Experts recommend a multi-hurdle approach to ensure plant-based food safety: Raw Material Control: Ensuring ingredient quality and safety. Processing Standards: Implementing strict microbial control measures. Environmental Monitoring: Preventing contamination in facilities. Finished Product Testing: Verifying safety before distribution.

While plant-based foods are a booming $10 billion market, their safety challenges must be addressed. Companies must prioritize rigorous testing, transparency, and quality control to ensure consumer trust.

Study Explores Viable Alternatives to Methylcellulose in Meat Substitutes

February 18, 2025

https://vegconomist.com/studies-and-numbers/study-explores-viable-alternatives-methylcellulose-meat-substitutes/

A recent study conducted by French ingredient developer MANE and higher education and research institution ONIRIS VetAgroBio, has examined alternative ingredients that could replicate the textural properties of methylcellulose in plant-based meat products.

The research focused on developing a formulation that maintains the structural integrity of soy-based burgers without relying on this common additive.

This study explores alternatives to methylcellulose, a common additive in plant-based meat products used for its gelling and binding properties.

Conducted by French ingredient developer MANE and ONIRIS VetAgroBio, the research aims to find cleaner-label solutions that maintain the structural integrity of soy-based burgers.

The study examined a combination of faba bean protein, the enzyme laccase, and sugar beet pectin to replicate methylcellulose's functionality. The enzyme facilitates protein cross-linking, while the pectin supports protein bond formation, helping to maintain texture.

A panel tested 17 soy-based burger formulations, assessing firmness, juiciness, and stickiness compared to a control product containing methylcellulose.

The alternative formulation achieved a high desirability score of 0.94, indicating strong potential as a replacement.

While progress has been made, researchers have not yet found a fully clean-label substitute that matches methylcellulose's performance without compromise.

The findings provide valuable insights into alternative structuring systems for plant-based meat products. Further refinement is needed to improve formulation and scalability, but this research lays the groundwork for future innovations in cleaner-label meat substitutes.

India launches a series of food safety measures, but experts warn gaps remain

19-Feb-2025

https://www.foodnavigator-asia.com/Article/2025/02/19/india-launches-a-series-of-food-safety-measures-but-experts-warn-gaps-remain/

India has launched a series of food safety measures to improve quality, nutrition, and regulatory oversight, but experts warn that significant gaps remain in the country's food and nutraceutical industries.

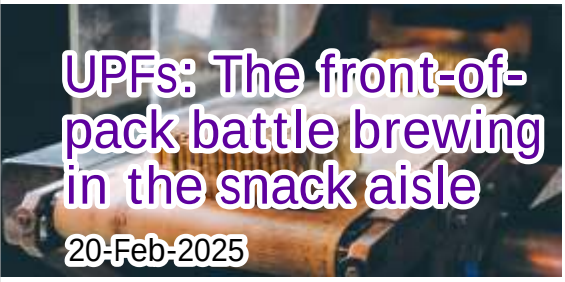
There is a thin line between food and drugs, especially for health supplements and nutraceuticals, leading to confusion in classification and approval processes.

Unlike pharmaceuticals, nutraceuticals do not require clinical trials, creating uncertainty in safety and efficacy standards. New products must have 30 years of global market history and 15 years in India, which hinders innovation and discourages new entrants.

India's Recommended Dietary Allowance (RDA) levels differ from USFDA and EFSA standards, leading to trade restrictions and product rejections. Approvals for ingredients and formulations are often granted in isolation, causing duplication and inefficiency.

The Food Safety and Standards Authority of India (FSSAI) has grown from six regulations in 2011 to 29 today, but more reforms are needed. Digital Food Import Rejection Alert (FIRA) Portal: Launched in November 2024, this system helps monitor and manage health risks from imported food products. Joint Parliamentary Standing Committee: Established to assess FSSAI's functioning and recommend updates to food safety laws.

Experts emphasize the need for harmonizing Indian regulations with global standards, improving transparency in approvals, and encouraging innovation to help the nutraceutical industry grow from $8.5 billion to $100 billion by 2030.



UPFs: The front-of-pack battle brewing in the snack aisle

20-Feb-2025

https://www.foodnavigator-usa.com/Article/2025/02/20/ultra-processed-foods-the-labelling-battle-in-the-snack-aisle/

Ultra-processed foods (UPFs) are facing increasing scrutiny from regulators, health experts, and consumers due to their potential health risks.

In response, a major shift is occurring in food regulation, particularly regarding front-of-pack (FOP) labelling. The Non-GMO Project has introduced the Non-UPF Verified certification, aiming to help consumers differentiate between ultra-processed and minimally processed foods. The project hopes to reshape purchasing habits, similar to how non-GMO labels influenced decisions in the past.

The FDA has proposed a standardized FOP nutrition labelling system, which would indicate the levels of saturated fat, sodium, and added sugars in food products as Low (=5% DV), Medium (6%-19% DV), or High (=20% DV). Large manufacturers would have three years to comply, while smaller businesses would have an additional year.

Research has linked UPFs to health problems such as depression ,disrupted sleep , hormonal imbalances ,heart disease ,obesity ,diabetes ,and cancer .According to a study by Innova Market Insights ,85%of consumers want to avoid UPFs , but 44%associate them mainly with fast food ,demonstrating confusion about what qualifies as ultra processed .Experts note that many consumers struggle to consistently identify UPFs , making clear labelling crucial for informed decision making .

Major food companies are facing lawsuits over claims that UPFs are intentionally designed to be addictive .A lawsuit filed by Morgan& Morgan argues that food corporations used strategies similar to Big Tobacco to market unhealthy products , especially to children .

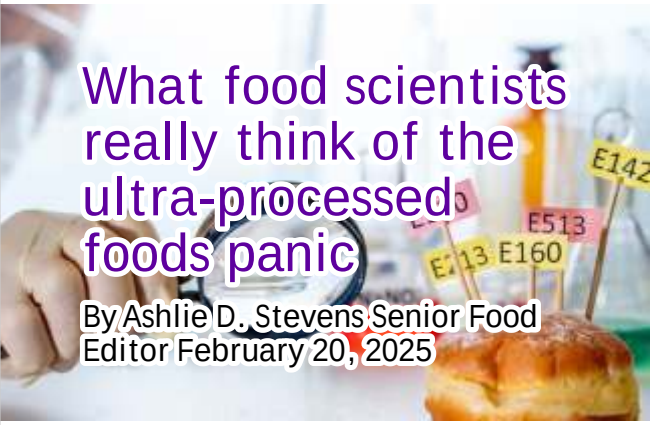
Another potential lawsuit against the FDA challenges its GRAS (Generally Recognized as Safe)designation ,arguing that it has failed to properly

Countries like Chile and Mexico introduced strict warning labels, leading to reduced purchases of sugary and high-fat foods, yet obesity rates still increased. Canada's Health Star Rating system has had limited impact, while the UK's traffic light labelling has helped consumers make healthier choices but hasn't significantly curbed obesity.

Policymakers may need complementary strategies, such as education campaigns and reformulation incentives, to ensure real public health improvements. Truefoods.com, developed by Mass General Brigham, offers consumers a database rating 50,000+ food items based on processing levels.

The movement against UPFs is gaining traction with Robert F Kennedy Jr's appointment as Secretary of Health and Human Services, who advocates diet-based health solutions. Debate continues over whether NOVA classification should shape policy, as not all UPFs are nutritionally equal—for instance, bread vs. candy. Consumers are increasingly aware of UPF risks, yet lack a clear definition of what qualifies as ultra-processed. Labelling efforts could shift consumer habits, but education and policy reforms may be needed to make real health improvements.

The food industry is facing growing legal challenges, potentially setting new precedents for accountability. Portion control strategies, rather than outright bans, might be a more effective solution.



What food scientists really think of the ultra-processed foods panic

By Ashlie D. Stevens Senior Food Editor February 20, 2025

https://www.salon.com/2025/02/20/what-scientists-really-think-of-the-ultra-processed-foods-panic/

This article challenges the widespread panic surrounding ultra-processed foods (UPFs), arguing that the NOVA classification system oversimplifies food processing and nutrition.

Dr. Matt Teegarden and Dr. Susanne Bügel argue that the NOVA system treats vastly different foods as nutritionally equivalent simply because they undergo similar processing.

Whole wheat bread, yogurt, and canned beans can be classified differently based on minor additives, despite being nutritionally similar. Epidemiological studies linking UPFs to health risks often rely on dietary recall data, which is not always reliable.

Randomized controlled trials suggest UPFs may encourage overeating, but they fail to isolate processing as the cause.

Some UPFs, like fortified cereals and plant-based milks, provide essential nutrients and should not be universally demonized.

Bügel's team is working on a new classification system that integrates processing methods with nutritional content to provide a more holistic view of food health impacts. The article suggests that public health officials should refine dietary guidance rather than fuelling broad-strokes panic.

This article critiques the widespread panic surrounding ultra-processed foods (UPFs), arguing that the NOVA classification system oversimplifies food processing and nutrition.