

PFNDAI

FOOD, NUTRITION & SAFETY MAGAZINE

BULLETIN OCT 2025

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PFNDAI Bulletin FOOD, NUTRITION & SAFETY MAGAZINE

OCT 2025

Editor: Dr. J. S. Pai

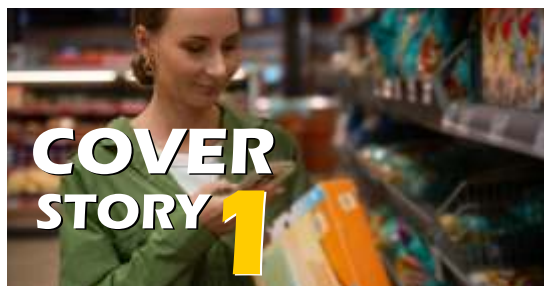
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THE HEALING PLATE: FOOD AS MEDICINE



Recently, Protein Foods & Nutrition Development Association of India held a seminar in which various health related aspects of foods and the supplements that we consume in a diet were discussed by experts in these fields. They told us that foods are not just to satisfy our hunger but work right from enjoyment to acting at physiological level to keep the body away from diseases.

Our ancestors found that what we eat may keep us well and categorised them into different types depending on their effects and advised us what to eat and what not to under different conditions and weather and developed the traditional science of Ayurveda that also included substances that would cure many of our diseases. After so many centuries we are now realising their wisdom when we find the physiological mechanism of many of the substances working in our body and modern supplements are being developed to keep us healthy.

There are many health benefits

of foods and supplements. These need to be properly studied and their benefits established and validated. There are protocols developed to conduct such trials that also estimates safety of such powerful substances that would work adversely if not used with caution.

Food, especially highly tasty food, needs to be consumed sensibly as overconsumption can invite undesirable effects, just as inadequacy causes deficiency diseases. As our lifestyle changes along with our work practices, the earlier practice of regular meals becomes difficult and we try to eat whenever and wherever possible through our busy schedule of several meetings and activities. Snacking is becoming very convenient for this. However, snacking can also create problems as it is difficult to keep a track of how much we have eaten unlike in meals.

Snacks are also evolving with so many different types with a variety of flavours and tastes, being also extremely

convenient to procure and consume. The occasions of snacking have also increased. Younger people would rather have snacks than meals as it relieves them of place, time and occasion restrictions.

Thus, foods that could work as medicine can also work against our health. Because of the enormity of assortment that is now available to choose from, we forget the basic purpose of food. It is very essential to remember that food is for sustenance and to keep us healthy. We should enjoy it but at the same time be sensible enough to avoid overconsumption.

So let us enjoy tasty foods for this festive occasion and enjoy it with our friends and families. Keep the physical activities and exercises also going together that helps keep us fit and also burn extra calories. Wishing you the season's greetings!

**Prof Jagadish Pai, Editor,
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THE IMPROPER USE OF THE RDA IN A SCIENCE-BASED FOOD LAW



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The Recommended Dietary Allowance is an index of micronutrient adequacy. Governments monitor dietary intakes through national surveys.

Past NNMB surveys (1975-2012 & 2017) have shown inadequacy persisting for several decades, with the gap widening from an upward RDA revision in 2020. Nutrition goals must be achieved in shorter time targets if populations are to enjoy the benefits of better health. Assured margins of safety above the RDA can reduce the gap in shorter timeframes, but are frustrated when the RDA is improperly used, delaying implementation of effective measures despite a risk-based food safety act in place since 2011.

Several countries limit or restrict levels above RDA, raising unsubstantiated safety concerns, though this has changed with scientific risk-based food legislations: EFSA (2002) and FSSA (2006) are noteworthy Acts. The Authority's approach to establishing the tolerable upper levels (TUL) by requesting ICMR to conduct a risk assessment was a

step in the right direction. The terms of reference to (a) review whether the allowance of vitamins and minerals could be above 1RDA with due safety considerations, and (b) to provide a research framework to fill existing gaps in information and knowledge to facilitate science-based decisions with both efficacy and safety aptly sums up the approach. The ICMR concluded the TULs represent a safe, long-term average daily nutrient intake from all dietary sources, namely basic foods, fortified foods and health supplements/nutraceuticals. It also defined 'unsupervised intake' to mean throughout the entire life or the required period of life for the general population.

As requested in (b), the risk management model uses the RDA and the TUL to characterize risk in setting maximum limits for health supplements/nutraceuticals on a case-by-case basis. To do so otherwise, by using fractions or multiples of RDA, would be considered arbitrary and lacking scientific validity. Requiring permissions outside the risk management model amounts to the same. It contradicts the statutes, which require risk assessment to precede the making of regulations and standards.

Several judgments under a similar food law, such as FSSA, 2006, have

rejected the use of RDA to determine levels of use in fortified foods as well as food supplements. In a case where a country's rule that vitamin and mineral preparations containing more than three times the RDA are to be classified as a medicinal product, the court ruled it presented a disproportionate and unjustified barrier to trade. A mere assumption of risk based on the RDA was insufficient to justify restricting the free movement of goods.

Instead of generalised, predetermined thresholds to classify products, a case-by-case assessment of each preparation based on the latest scientific evidence is required. The judgment affirmed the principle that public health measures must be proportionate and evidence-based, especially when restricting trade: a similar principle exists in FSSA. Secondly, the law does not allow rules to classify products as medicinal solely based on dosage: a determination of a product's pharmacological properties must be scientifically established.

The Authority adopts the principled approach required under several statutes of the Act for setting maximum levels for vitamins and minerals, ensuring consumer safety and fair trade. Creating a distinction between health supplements/nutraceuticals and drugs, or that dosage forms require preapproval based on RDA, is an improper use that has no legal basis and lacks scientific validity.

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THE ROLE OF INFORMED CHOICE AND CONSUMER AWARENESS IN ACHIEVING NUTRITIONAL GOALS



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Nutrition is cornerstone of human health, influencing growth, immunity, cognitive function, and disease prevention.

Despite growing awareness about the importance of nutrition, many individuals continue to make poor dietary choices—not necessarily due to lack of knowledge, but due to an inability to interpret and apply nutritional information effectively.

This disconnect highlights the critical role of informed choice and consumer awareness in achieving nutritional goals.

Informed choice refers to decisions made based on accurate, accessible, and relevant information. In the context of nutrition, it involves selecting foods that align with one's health needs, lifestyle, and goals, guided by credible data.

Consumer awareness on the other hand encompasses the ability to understand food labels, ingredients, health claims etc. It empowers individuals to navigate the complex food environment,

understand the health benefits of the products and how best these could fit into their nutritional goals. Informed consumers are better equipped to make healthier choices, thereby contributing to improved public health outcomes.

India's current dietary landscape reveals significant nutritional imbalances that are contributing to a growing burden of metabolic disorders.

According to the What India Eats report by ICMR and NIN, there is a low consumption of fruits, vegetables, and dairy products, alongside an overreliance on carbohydrates—68% of individuals consume more than the recommended levels.

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Protein intake is also suboptimal, with nearly half sourced from cereals and millets, which offer lower biological value, and only 4.2 grams per day coming from milk and milk products.

These dietary patterns correlate with alarming health statistics: abdominal obesity affects 53.6% of the population, while 31.4% are overweight and 12.5% are classified as obese.

A recent study published in Nature Medicine by Anjana et al. 2025, reinforces these findings, showing that high carbohydrate intake among Indian adults is strongly associated with increased risk of metabolic issues, while substituting excess carbohydrates with high quality protein can significantly reduce this burden.

Given the widespread dietary imbalance, it is imperative to equip the consumers with tools that enable healthier choices – one of which is nutritional

labelling.

Nutritional labelling serves as a powerful tool to bridge this gap. Effective labelling must adhere to key principles:

- **Transparency:** ensures that information is clear and truthful
- **Standardization:** allows for uniform nutrient declarations (Per 100g or 100 ml basis)
- **Scientific basis:** requires that health claims be evidence-based
- **Relevance:** meaningful and

easy to interpret information

- **Consumer empowerment:** Ultimately, labels should empower consumers to make informed decisions about their diet and health.

The FSSAI's Labelling and Display Regulations (2020) has listed down clear labelling requirements to be followed such as: Name of Food, List of Ingredients, Nutritional Information per 100 g or per 100 ml or per single consumption pack, veg or non veg, food additives, name and complete address, License no., net quantity, lot no/ batch no, date of making, expiry date, Food allergens, Instructions for use etc.



These regulations are aimed to bridge the gap between awareness and informed decision making.

Campos et al. (2011) found that standardized nutrition labels significantly improve consumer understanding and can influence healthier purchasing behaviour. We need more put efforts towards ensuring that consumers understand these labels.

Interestingly, research shows that while 93% of consumers believe food affects health and recognize the harms of junk food, and 83% claim to be careful about their diet, 32% still do not check ingredient labels while shopping.



This paradox reveals that factors beyond awareness—such as convenience, peer influence, and emotional triggers—play a significant role in shaping behaviour.

Grunert et al. (2010) emphasized that even well-informed individuals may default to unhealthy choices due to environmental cues or habitual patterns.

Behavioural economics and psychology suggest that nudges and environmental design can be more effective than education alone in shifting consumer behaviour (Thaler & Sunstein, 2008).

To promote healthy eating interventions beyond education there is also a need to tackle motivation, environment and social influence as well.

To promote behavioural change, multi-dimensional strategies could be looked at:

- Emotional and social influence can be leveraged

by using role models and creating social buzz around nutritious trends, such as millet-based meals.

- Making healthy choices convenient is equally important—this includes improving access to affordable, tasty, and quick healthy options, and encouraging meal prepping through smart tools and apps.
- Behavioural nudges, such as placing fruits and vegetables at eye level in stores or offering larger packs of healthy snacks, can subtly guide consumers toward better choices.
- Communication strategies should also evolve, shifting from fear-based messaging to aspirational tones. Phrases like “Fuel your body, feed your potential” inspire confidence and pride in healthy decisions.
- Targeted messaging is essential for different demographics. For youth, the motivators are different than adults.





• Technology is transforming how consumers engage with nutrition. Digital innovations such as barcode scanning for instant nutrition facts, mobile apps for personalized dietary advice, AI-powered platforms for adaptive nutrition planning, and smart packaging for real-time freshness and nutrient data are making healthy choices more accessible and engaging.

These tools enhance convenience and confidence, turning food decisions from guesswork into informed action.

must be supported by behavioural strategies, and technological tools to translate knowledge into action.

Empowering consumers through education, accessibility, and emotional engagement can bridge the gap between intention and behaviour, fostering a healthier society.

References

- Anjana et al. Dietary profiles and associated metabolic risk factors in

In conclusion, informed choice and consumer awareness are essential for achieving nutritional goals. While awareness is a necessary first step, it

India from the ICMR-INDIAB survey-21. *Nat Med* (2025). <https://doi.org/10.1038/s41591-025-03949-4>

- Campos et al. (2011). Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutrition*, 14(8), 1496-1506.
- FSSAI. (2020). Labelling and Display Regulations. Food Safety and Standards Authority of India.
- Grunert et al. (2010). Nutrition knowledge and use of nutrition information on food labels. *Appetite*, 55(2), 177-189.
- https://www.nin.res.in/nutrition2020/what_india_eats.pdf
- Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving Decisions About Health, Wealth, and Happiness*. Yale University Press.



AYURVEDA AND NUTRACEUTICALS: BRIDGING ANCIENT WISDOM WITH MODERN SCIENCE

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Ayurveda, the ancient Indian system of life and health science, has always placed immense emphasis on the relationship between food, health, and longevity.

Thousands of years before the “nutraceutical” concept was familiar to the Ayurveda system. Ayurvedic texts had already described the therapeutic potential of diet, herbs, and natural substances in maintaining health and preventing disease. Today, the nutraceutical industry stands at the intersection of nutrition and medicine, delivering products that are derived from foods but extend benefits beyond

basic nourishment. In this context, Ayurveda and nutraceuticals converge, offering a holistic yet scientifically valid framework for wellness.

The concept of nutraceuticals has been defined in multiple ways by leading global bodies. According to the American Nutraceutical Association, nutraceuticals are food or food-related products that offer physiological benefits beyond essential nutrition, aiding in the maintenance of good health.

The Food Safety and Standards Authority of India (FSSAI) describe nutraceuticals as extracts, isolates, and purified chemical compounds derived from foods that

confer physiological benefits. Meanwhile, the European Nutraceutical Association characterizes them as nutritional products with health-relevant effects, emphasizing that unlike pharmaceuticals, nutraceuticals are not synthetic drugs but food-based, often in concentrated form. Thus, nutraceuticals can be thought of as occupying a space between foods and medicines, offering preventive and therapeutic benefits without being categorized strictly as drugs. This middle ground has made them increasingly popular among health-conscious populations seeking natural interventions for lifestyle-related disorders.



Ayurveda's approach to food resonates closely with the nutraceutical philosophy. In the classical Ayurvedic text *Charaka Samhita*, the two core objectives of the science are clearly articulated: *Swasthasya Swasthya Rakshanam*; to preserve the health of the healthy, and *Aturasya Vikara Prashamanam*; to alleviate the ailments of the diseased, advising that one should adopt a diet that not only nourishes but also prevents the occurrence of diseases. This preventive orientation distinguishes Ayurveda from purely curative models of medicine. It suggests that food itself, when thoughtfully selected and consumed in accordance with nature and individual constitution, becomes medicine. This philosophy aligns seamlessly with the nutraceutical model of harnessing foods and natural compounds for health benefits.

In Ayurveda, Aahara (diet) is one of the three pillars of health, alongside Nidra (sleep) and Brahmacharya

(regulated lifestyle). Proper Aahara is considered essential for maintaining the equilibrium of doshas (Vata, Pitta, Kapha) which is an indicator of good health, nourishing the dhatus (tissues), and sustaining the agni (digestive fire). Ayurvedic texts classify foods not merely by calories or macronutrients, but by their rasa (taste), guna (qualities), virya (potency), vipaka (post-digestive effect), and prabhava (special effect). This comprehensive understanding makes Aahara both preventive and therapeutic.

Ayurveda classifies food into Sattvic (pure, nourishing, and harmonious), Rajasic (stimulating and energy-driven), and Tamasic (heavy and dulling), concepts that parallel modern nutraceutical categories where Sattvic aligns with functional foods and antioxidants for wellness, Rajasic with stimulants and performance enhancers, and Tamasic foods correspond to ultra-processed, low-nutrient diets linked with inflammation, lethargy, and disease risk, highlighting Ayurveda's timeless relevance in shaping today's nutraceutical approaches

that connect diet, health, and mental well-being.

To understand how Ayurveda conceptualizes nutraceuticals, one must turn to the doctrine of *Dravya*. Ayurvedic philosophy teaches that all matter in existence is structured from the five fundamental elements (*Panchamahabhutas*). A *dravya* or substance is therefore defined by two aspects: *Guna* (its inherent qualities) and *Karma* (the actions it performs). Dravyas are classified broadly into *Anna* (food) and *Aushadha* (medicine). However, when a dravya serves both roles simultaneously, nourishing like food yet healing like medicine, it is essentially what modern terminology recognizes as a nutraceutical. This indicates that the roots of nutraceutical theory are deeply embedded in Ayurvedic philosophy.

Several specific concepts in Ayurveda reflect principles remarkably similar to nutraceutical science. Among them, *Rasayana* is the most prominent. The term is derived from *Rasa* (essence or nutrition) and *Ayana* (pathways), together meaning "nutrition at the microcellular level." Rasayana therapies are designed to rejuvenate tissues, promote longevity, and enhance immunity.

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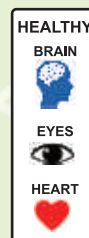
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Substances like ghee, milk, honey, barley, and Amalaki are classic Rasayanas, known to invigorate the body while preventing degeneration. The idea that nutrition can act at subtle levels to influence overall health directly mirrors the functional food approach of nutraceuticals.

Another parallel concept is *Ritucharya*, which prescribes dietary and lifestyle practices according to seasonal changes. Ayurveda recognizes that the body's metabolism and resilience vary across seasons, requiring specific foods to maintain balance. For instance, during winter, digestive strength is enhanced, so nourishing foods like cereals, pulses, wheat, corn, milk, and milk products are recommended to sustain internal warmth and vigour. This seasonal adjustment resembles the modern recognition that nutritional needs are dynamic, influenced by environmental and biological rhythms.

A third relevant Ayurvedic notion is *Pathya*, which denotes food that is

wholesome, mind-calming, and beneficial to the body. The opposite, *Apathya*, refers to foods that harm health. *Pathya* is further categorized into foods beneficial

for healthy individuals, foods that should be avoided to prevent disease, foods suitable for patients, and foods contraindicated for patients. The first category aligns closely with nutraceuticals, as it consists of foods that proactively sustain wellness and resilience.

While Ayurveda provides the philosophical foundation, modern nutraceuticals are being developed with advanced technologies to maximize efficacy and convenience. Several innovations illustrate how ancient formulations are being translated into contemporary consumer products. For example, Affron®, a standardized saffron extract containing 3.5% Lepticrosalides®, is marketed for its mood-enhancing benefits. Similarly, curcuminoids from turmeric, known for their poor bioavailability, are now delivered through patented phytosome technologies to enhance absorption and therapeutic action.

Traditional combinations like turmeric and black pepper, once consumed in

household remedies to improve digestion and manage inflammation, are now encapsulated in oil-based nutraceuticals for broader reach. Another innovative blend combines Ashwagandha with L-Theanine to alleviate stress, fatigue, and irritability, while promoting restful sleep and relaxation. These examples demonstrate how Ayurvedic knowledge is being modernized into consumer-friendly nutraceuticals and functional foods. This integrative model reflects a maturing industry that not only draws inspiration from Ayurveda but also validates and optimizes it through scientific methods.

More such combinations can be explored, including pediatric nutraceuticals formulated with well-documented herbs such as Brahmi and Shankhpushpi to support cognitive development, and diabetic nutraceuticals enriched with Jamun, Yashtimadhu, Madhunashini (Gudmar), and Fenugreek to aid in the holistic regulation and management of blood glucose levels.

Ayurveda food preparations might have a limitation with the modern taste preferences but their palatability can be optimized through the traditional and natural approaches.

The use of natural sweeteners can help balance the bitterness or astringency often associated with certain Ayurvedic herbs. Combining neutral or mild-flavoured herbs with stronger formulations can enhance acceptability without affecting their integrity.

Traditionally, people were accustomed to herbal tastes through teas and decoctions and adopting modern forms can further improve consumer appeal while preserving authenticity and health benefits.

Recognizing the importance of Ayurveda in the nutraceutical sector, the Food Safety and Standards Authority of India (FSSAI), in collaboration with the Ministry of Ayush, introduced the Food Safety and Standards (Ayurveda Aahara) Regulations, 2022. This regulation formally establishes a category for Ayurvedic food preparations, referred to as Ayurveda Aahara.

These preparations are characterized by balance, seasonal appropriateness, and reliance on natural herbs with therapeutic value. Traditional recipes, once confined to classical texts, are now standardized and recognized under this framework.

In July 2025, FSSAI issued a



definitive order placing Ayurveda Aahara under Category A of its regulatory system, giving official recognition and clarity to such products in the market for promoting Ayurveda-inspired nutraceuticals globally.

Claims related to Ayurveda-based foods and nutraceuticals fall under the same regulatory framework governed by the Food Safety and Standards Authority of India (FSSAI). According to the Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Foods, and Novel Foods) Regulations, 2016, these products cannot make prophylactic, therapeutic, or curative claims.

However, they may make general wellness claims if such claims are scientifically substantiated or supported by traditional

evidence and are not misleading or exaggerated. For Ayurveda-inspired foods, claims may refer classical Ayurvedic texts to substantiate traditional benefits.

In cases where a product introduces a new recipe or ingredient under Ayurveda Aahar, it must include references from authoritative Ayurvedic sources and published scientific literature, and any health benefit claims require prior approval from FSSAI. For example, *Kulatha Soopa*, a soup made with horse gram, black gram, turmeric, and asafoetida, is recommended for anorexia.

Similarly, *Mridvikadi Panaka*, a drink made with grapes, nagakesara (Iron wood Tree), and chavya (Javanese long pepper), is advised in fevers of the *Pittaja* type (fevers arising due to digestive disturbances) according to the classical indications.



Rasayana, Ritucharya, and Pathya reflects this; in nutraceutical science, the emphasis is on clinical validation, standardization, and bioavailability.

Together, they complement each other.

The significance of merging these two perspectives is relevant. In a world facing rising chronic diseases, lifestyle disorders, and mental health challenges, the need for preventive healthcare has never been greater. Nutraceuticals inspired by Ayurveda can reduce reliance on synthetic pharmaceuticals, minimize side effects, and empower individuals to take charge of their wellness.

They also represent a cultural bridge, showcasing India's Ayurvedic heritage on the global stage while aligning with contemporary

scientific expectations. Moreover, the integration of Ayurveda into nutraceutical frameworks creates opportunities for innovation, research, and economic growth, positioning India as a leader in the natural health products market.

In conclusion, the convergence of Ayurveda and nutraceuticals represents a transformative shift in healthcare. Both systems, though articulated differently, rest on the shared belief that food can be medicine. Together, they pave the way for a holistic, integrative model of nutrition and wellness.

By harmonizing tradition with innovation, Ayurveda and nutraceuticals can together foster a healthier society, offering preventive, personalized, and natural solutions to the health challenges of our time.

Despite differences in orientation, Ayurveda and modern nutraceutical science display a clear conceptual overlap. Modern nutraceuticals focus on isolating bioactive compounds, quantifying their effects, and packaging them in consumer-friendly forms. Ayurveda, on the other hand, embraces a holistic approach, emphasizing the interconnectedness of body, mind, season, and environment.

Yet, both traditions converge on the principle that foods and herbs can serve therapeutic purposes. In Ayurveda, the language of



BUILDING CONSUMER TRUST THROUGH PRODUCT CLAIMS SUBSTANTIATION

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Introduction

Establishing consumer trust is fundamental to the success of any product in the market. Substantiating product claims is essential, not only to assure customers of the product's efficacy and safety, but also to ensure compliance with regulatory requirements, prevent misleading advertising, and foster long-term loyalty among consumers.

By providing clear evidence and transparent communication about product attributes, companies demonstrate their commitment to honesty and integrity. This approach minimises the risk of disputes or regulatory actions and empowers consumers to make informed choices, thereby strengthening brand reputation in the marketplace.

Importance in the Indian Context

In India, consumers are increasingly discerning, and regulatory bodies such as the Advertising Standards Council of India (ASCI) and Food Safety and Standards Authority of India (FSSAI) play a pivotal role in overseeing product claims. Robust substantiation becomes even more critical in this environment. Brands must ensure that all advertised product benefits are supported by scientific data and communicated in a manner that resonates with local consumer expectations while complying with prevailing guidelines. This not only safeguards the brand from potential legal challenges but also establishes credibility and trust with Indian consumers.

Challenging the product claims

Product claims can be

challenged by competitors, regulatory authorities, or consumers. Disputes may arise if the evidence is deemed insufficient, outdated, or not relevant to the specific claims.

Brands must therefore ensure that their substantiation is robust, scientific, and clearly linked to the advertised benefits to withstand scrutiny and protect their reputation in the marketplace. Marketers must back challenged claims with scientific evidence, such as lab results or clinical studies. Keeping this data ready helps brands defend their products quickly and maintain credibility.



Generating Scientific Data

Scientific data can be generated through controlled laboratory experiments, clinical trials, consumer acceptance studies, and rigorous analytical testing.

Engaging independent third-party organisations for assessments or validating results through peer-reviewed studies further strengthens data credibility. These methods ensure that evidence supporting product claims is both reliable and recognised within the scientific community.

Recognised methods for generating scientific data to substantiate product claims include:

- In vitro studies: Testing in controlled laboratory settings, often using cell cultures or biochemical assays to assess specific product properties.
- In vivo human trials: Testing with actual participants to evaluate the product's effects in real-world scenarios, providing robust and directly relevant evidence.

- Expert panel tests: Utilising qualified professionals to assess the product based on established criteria.
- Consumer panel tests: Gathering feedback from target consumers under controlled conditions to gauge perceived efficacy and acceptance.

Employing a combination of these methods enhances the comprehensiveness of substantiation, ensuring the evidence is scientifically sound and reflective of consumer experience.

Guidelines

Depending on the nature of the product claim, the study should be meticulously designed and conducted in accordance with relevant guidelines such as those from the Indian Council of Medical Research (ICMR) or the International Council for Harmonisation – Good Clinical Practice (ICH-GCP). Adhering to these standards ensures the research methodology is scientifically robust, ethically sound, and globally recognised, enhancing the credibility and acceptability of

substantiation data among regulators and consumers.

Regulators have provided detailed guidelines regarding product labelling, and strict adherence to these standards reduces the likelihood of claim rejection. For nutraceuticals intended for health promotion or disease risk reduction, regulatory authorities demand submission of robust scientific studies as part of the approval process.

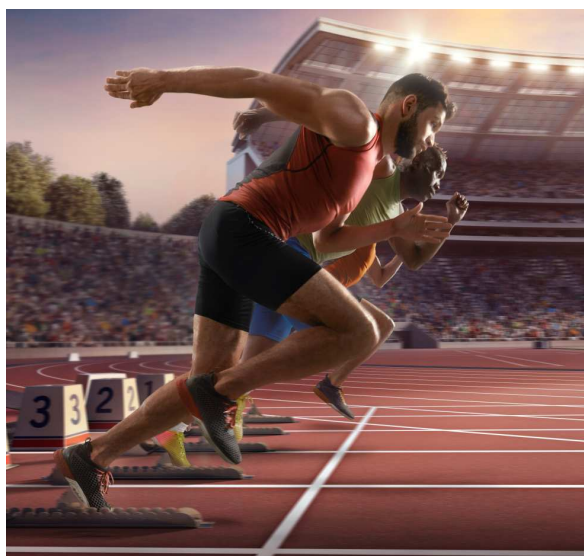
These studies must demonstrate the validity of claimed benefits, ensuring consumers receive accurate and reliable information. Compliance with these requirements improves the chances of claim approval and reinforces consumer confidence.

If a food product is designed to promote health or reduce disease risk, it approaches regulatory boundaries of a drug-like product. Indian regulators have set clear guidelines on claims that cannot be made on product labels, such as statements implying diagnosis, cure, mitigation, treatment, or prevention of specific diseases unless expressly permitted. Claims suggesting medicinal properties or those that could mislead consumers about intended use are strictly prohibited.



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Only approved and substantiated claims, supported by robust scientific evidence, may be used on food product labels, as outlined by FSSAI and other regulatory bodies. Brands must ensure full compliance with these standards, avoiding unsubstantiated or prohibited claims to prevent regulatory action and uphold consumer trust.

Randomised Controlled Trials: The Gold Standard Randomised Controlled Trials (RCTs) are regarded as the gold standard for demonstrating product efficacy. By randomly assigning participants to intervention or control groups, RCTs eliminate bias and provide robust, statistically significant data about actual benefits for the target consumer population. This approach validates claims with high scientific rigour and enhances product credibility and acceptance among regulators and consumers.

The first step is to define the product label claim for which data is required. Based on the claim, study objectives and outcome

measures are defined, helping to establish a robust scientific protocol, considering the study population, age group, and relevant conditions.

Clear articulation of the claim ensures focused and relevant research, guides methodology and endpoints, and facilitates transparent communication with regulatory authorities and stakeholders, reducing ambiguity and strengthening substantiation.

Study Investigator, Protocol Development, and Ethics Compliance

A qualified Investigator, preferably a medical doctor with specialisation in the relevant field of research, should assume overall responsibility for leading the study. To ensure the scientific rigour and comprehensiveness of the study protocol, it is advisable to involve a nutritionist in the planning and designing process. This collaborative approach enhances the robustness and relevance of the research methodology.

Once the study protocol is drafted and consensus among all stakeholders is achieved, the next critical step is to obtain approval from an Institutional / Independent Ethics Committee (IEC). This approval must be sought in accordance with the

prevailing ethical and regulatory guidelines. It is essential that the Ethics Committee be registered with the Central Regulatory authorities, as this ensures both regulatory compliance and the upholding of high ethical standards throughout the study.

Following receipt of Ethics Committee approval, the study should be registered on the Clinical Trials Registry-India (CTRI) website. Registration on this platform further contributes to the credibility and transparency of the study, reinforcing its acceptance among regulatory authorities and the scientific community.

Evaluation Components within Study Protocols

A comprehensive protocol for product claim substantiation typically incorporates three distinct evaluation components. These elements are essential to ensure a rigorous and multi-faceted assessment of product efficacy, thereby enhancing the reliability of study outcomes.





1. Clinical Examination

The clinical examination is conducted by the Investigator, who uses established clinical scales tailored to the specific benefits claimed for the product. Examples of assessment tools include measurement of vital parameters, anthropometric indices, psychometric scales, Satiety Index, and Quality of Life (QOL) questionnaires and many more such validated scales. These instruments are chosen to offer objective, clinically relevant insights into the claimed effects.

2. Objective Assessments

Objective assessments involve the use of specialised instruments or laboratory tests to generate quantifiable physiological data. Typical examples include non-invasive devices for body composition or skin analysis, as well as measurement of physiological markers in blood samples. These objective measures are critical for demonstrating the efficacy of the product in a scientifically robust manner.

3. Participant Feedback

In addition to clinical and objective evaluations, participant feedback is captured through structured questionnaires. This approach is designed to collect subjective experiences and perceptions

directly from study participants, offering valuable insights into the real-world impact of the product from the consumer's perspective.

Integrating these components ensures a holistic, scientifically robust evaluation and reliable study outcomes.

Statistical Analysis and Interpretation of Study Data

A rigorous statistical analysis is a critical component in substantiating study outcomes or product claims. It is imperative that the study is adequately powered from a statistical standpoint; insufficient statistical power may result in the data being rejected by regulatory authorities. To ensure validity and reliability, careful statistical planning must be undertaken at the outset, which includes precise calculation of the required sample size and the selection of appropriate statistical tests tailored to the study design and endpoints.

The presentation of results should include confidence intervals and p-values, which are essential for demonstrating the statistical significance and reproducibility of the findings. Employing this comprehensive and methodical statistical

approach not only enhances the credibility of the study but also increases its acceptance by regulatory bodies.

Common Reasons for Claim Rejection

Claims may be rejected by regulatory authorities if critical aspects of the research process are overlooked. An incorrect trial design or mismatch between trial design and claim wording can render endpoints insufficient for regulatory approval. If outcomes measured do not closely align with the claim statement, the evidence may be considered inadequate.

Using a non-standardised or variable product formulation during the trial undermines result validity. Regulators require that the tested product matches the marketed product exactly; any variation can raise doubts about reproducibility and reliability. Another common reason for rejection is an underpowered study design, where too few participants yield unreliable or inconclusive results, regardless of observed trends.



approval processes and helps avoid wasted resources and post-study rejections.

One key recommendation is for regulatory authorities to offer a pre-vetting mechanism for claim

substantiation protocols. Early feedback on study design, endpoints, and methodology enables industry stakeholders to refine protocols before trials commence. Pre-vetting fosters transparency, reduces ambiguity, and enhances the quality and acceptance of scientific evidence for product claims. This collaborative model builds trust, accelerates innovation, and ensures consumer protection in the marketplace.

Key Takeaways

For Industry: Invest in robust, scientifically designed studies that adhere to regulatory standards and best practices. Ensure scientific findings are translated into clear, consumer-friendly, and responsible communication to enhance

product credibility and consumer trust.

For Regulators: Provide clear, accessible pre-submission guidance to streamline the approval process. Foster collaboration with industry stakeholders to minimise post-study claim rejections and support the development of reliable, evidence-based products.

For Consumers: Critically read product labels and proactively demand products with evidence-backed claims. Making informed choices helps protect consumer interests and encourages higher standards across the industry.

Ultimately, claim substantiation is not only a compliance exercise but also a trust-building mechanism for the Indian food industry. By aligning science, regulation, and communication, stakeholders can create a transparent ecosystem that benefits consumers and brands alike.

To avoid rejection, trial design, endpoints, and product formulation must be tailored to the claim, and the study must be sufficiently powered to detect meaningful effects.

Rigorous planning and alignment with regulatory expectations are vital for successful claim substantiation and approval.

Collaboration between Industrial bodies and Regulators

Going forward, regulators and industry should adopt a collaborative and proactive approach to align trial designs with regulatory expectations. Early and continuous engagement can pre-empt pitfalls, ensuring studies generate data that meets scientific and regulatory standards. This alignment streamlines



FOOD BEYOND NUTRITION:

A NARRATIVE REVIEW OF ITS PSYCHOLOGICAL, CULTURAL, AND HOLISTIC DIMENSIONS IN INDIA

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Abstract

Food is more than biological fuel—it is a cultural, psychological, and spiritual construct. In India, food plays a celebratory, ritualistic, and symbolic role while also shaping health outcomes in the context of rising non-communicable diseases. This narrative review explores food through a multidimensional lens, integrating the psychology of eating, Indian philosophy of the five koshas, food safety and reformulation concerns, and strategies for behavior change.

Using the samosa as a case study, we illustrate how foods can be examined through nutritional, safety, behavioral, and mindful-eating perspectives. Multi-stakeholder action—from government, food industry,

clinicians, and households—is essential to enable healthier food environments while respecting cultural traditions.

Introduction

Food is not only a biological necessity but also a cultural, psychological, and spiritual experience. In India, the meaning of food extends beyond nutrients to embody identity, memory, and tradition. Every festival has its associated foods, every region its culinary identity, and every household its inherited recipes. Food is also offered as prasadam — a sacred act linking nutrition to spirituality.

Globally, nutrition research increasingly acknowledges that

food choices are shaped not just by nutrient composition but by psychology, social context, and culture (Rozin, 2020; Higgs & Spetter, 2022).

In this review, we explore food through four perspectives: (1) psychology and memory of eating, (2) the Indian philosophical lens of the five koshas, (3) safety, reformulation, and portion control in modern food systems, and (4) mindful approaches such as add-pair-swap strategies.





Food and Memory: The Psychology of Eating

Food evokes memory. Childhood foods, school canteen snacks, and festive meals become deeply encoded in autobiographical memory. Studies show that emotionally significant food memories are more vivid and enduring than neutral ones (Herz, 2021; Rangel, 2021). Comfort foods, such as sweets or fried snacks, act as emotional anchors because they are associated with family care, celebrations, or belonging.

Food preferences are also a learned response. Repeated exposure, cultural learning, and reinforcement shape taste acquisition (Birch & Anzman-Frasca, 2020). Dopaminergic reward pathways further explain why favorite foods often involve high-fat, high-sugar profiles (Small & DiFeliceantonio, 2019). Thus, food preference is an interplay of biology, psychology, and culture.

The Five Koshas and Food in Indian Philosophy

Indian philosophy conceptualizes human

experience through five koshas (layers of existence):

1. **Annamaya Kosha (physical body)** – sustained by food, aligning with modern nutrition science.

2. **Pranamaya Kosha (energy body)** – vitality influenced by dietary quality and metabolic health (Mozaffarian, 2022).

3. **Manomaya Kosha (mental-emotional body)** – diet influences mental health; recent evidence links dietary quality to depression and anxiety risk (Marx et al., 2021).

4. **Vijnanamaya Kosha (wisdom body)** – ethical, mindful food choices reflecting sustainability and wisdom.

5. **Anandamaya Kosha (bliss body)** – spiritual fulfillment through food, e.g., prasadam.

This framework provides a holistic lens: food is not only for sustenance but also for energy, emotion, ethics, and spirituality.

Food is everyone's Responsibility

Food Through Different Lenses: The Case of the Samosa

The samosa, a popular Indian snack, exemplifies how food can be assessed differently depending on the lens applied

This table illustrates how a familiar Indian food

item—the samosa—can be analyzed through nutritional, safety, behavioral, and mindful-eating lenses. Multi-stakeholder responsibility is emphasized:

(1) Food industry plays a key role in reformulating HFSS foods, reducing portion sizes, and offering healthier alternatives,

(2) Government supports informed labeling and food safety regulations.

(3) Clinicians, particularly qualified clinical dietitians, build individual awareness around portion control, mindful eating, and swaps not only for home-cooked meals but also for packaged foods, cloud kitchen orders, and restaurant meals.

(4) Households require education and behavioral nudges, as portion control at home remains difficult to regulate. Collaborative strategies like the Add-Pair-Swap model—adding healthy ingredients, pairing indulgent foods with nutrient-dense accompaniments, and swapping unhealthy options for healthier ones—represent actionable pathways for improving population-level dietary behavior while respecting cultural food preferences.

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The “Samosa” Through Multiple Lenses: A Case for Multi-Stakeholder Action

Lens	Key Considerations	Implications for Public Health and Industry
Nutritional	High fat and carbohydrate content; moderate protein; micronutrient profile varies with fillings.	Reformulation by industry to reduce fat, salt and sugar (HFSS); incorporation of nutrient-dense fillings (e.g., sprouts, vegetables, legumes).
Food Safety	Concerns with reused oil, acrylamide formation, and microbial contamination in street foods; preservatives and stabilizers in packaged versions.	Enforcement of hygiene and labeling standards; clean oil policies; consumer education on safe preparation methods.
Cooking Methods	Deep-frying increases fat and acrylamide; baking and pan-roasting reduce oil use; air-frying is a modern option.	Industry can diversify ready-to-eat options (baked/air-fried samosas) to provide healthier alternatives; cloud kitchens can adopt lower-oil techniques.
Portion Size	Oversized samosas encourage over-consumption; mini/bite-sized versions lower caloric load and improve satiety management.	Industry-led resizing of packaged portions; policy-led nudges on standard serving sizes; clinicians can guide households in portion control strategies, especially for food delivery and restaurant meals.
Mindfulness /Swaps	Whole-wheat wrappers, sprout-based or protein-rich fillings; pairing samosas with fiber-rich foods like chickpeas; mindful apps help track calories and swaps.	Application of the Add-Pair-Swap approach: Add healthy ingredients, Pair with balanced accompaniments, Swap deep-fried/refined options with baked or whole-grain variants. Industry and clinicians can jointly drive consumer awareness of these options.

Food, Behavior, and Modern Tools

Digital health apps are increasingly used for calorie tracking, portion estimation, and behavior change. Evidence shows that linking food intake to “physical activity equivalents” (e.g., walking minutes required to burn calories) can improve accountability and reduce consumption of high-calorie foods (Michie et al., 2021;

Horne et al., 2023).

In India, where the ICMR–INDIAB study (2023) reported that 92% of adults are physically inactive, integrating mindful swaps with increased physical activity is particularly relevant.

Multi-Stakeholder Roles in Food Awareness

Addressing unhealthy diets requires collaboration:

- Government: Policies on labeling, advertising, and portion size nudges. Initiatives like Eat Right India are examples of regulatory efforts.
- Food Industry: Reformulation of HFSS foods, resizing packaged portions, and providing healthier alternatives (baked/air-fried options).



• Clinicians (Dietitians): Crucial in counseling patients on portion control, swaps, and pairing strategies for both home-cooked and restaurant foods.

• Households: Require sustained education, as portion control at home remains a challenge. Awareness campaigns and clinician-guided interventions are critical.

The **Add-Pair-Swap** strategy offers a culturally sensitive, behaviorally practical approach to dietary modification. Rather

than eliminating favorite foods, individuals can add healthier ingredients, pair indulgent foods with nutrient-rich accompaniments, and swap unhealthy versions with healthier alternatives. Multi-stakeholder action is critical:

- (1) Food industry reformulates and resizes packaged food
- (2) Government enforces HFSS labeling and portion norms
- (3) Clinicians/dietitians build awareness on portion control and swaps for both home and out-of-home foods

(4) Households adopt add-pair-swap strategies in cooking and eating out. This integrated approach supports long-term behavior change, reduces HFSS consumption, and promotes public health while respecting cultural food traditions.

The Add-Pair-Swap Strategy: A Multi-Stakeholder Framework for Healthier Eating using example of popular samosa

Strategy	Description	Practical Example (Samosa)	Stakeholder Role	Public Health Impact
Add	Introduce nutrient-dense ingredients or healthier cooking methods.	Add sprouts, legumes, or vegetables into filling; add whole-wheat/millet wrapper; add baking/air-frying as options.	Food Industry: reformulate products; Clinicians: guide patients; Households: incorporate in daily cooking.	Improves nutrient density, increases fiber/protein, reduces fat load.
Pair	Combine indulgent foods with healthier accompaniments to balance meals.	Pair samosas with chickpeas, yogurt dip, or salad instead of fried snacks or sugary chutneys.	Clinicians: educate on balanced meal design; Households: practice pairing at meals; Restaurants/Cloud kitchens: offer healthier combos.	Enhances satiety, reduces glycemic load, promotes balanced eating.
Swap	Replace HFSS (high-fat, salt, sugar) options with healthier alternatives.	Swap deep-fried samosa for baked/air-fried version; swap refined flour for whole-grain wrapper.	Food Industry: scale up baked/whole-grain variants; Government: mandate HFSS labeling; Clinicians: provide swaps in counseling.	Reduces exposure to HFSS foods, lowers obesity and NCD risk.



Conclusion

Food in India transcends nutrition. It carries memory, emotion, cultural meaning, and spiritual value while also being a determinant of health in the modern landscape of rising obesity and non-communicable diseases. By integrating ancient frameworks like the koshas with contemporary behavioral science, food can be understood as a holistic construct. Using case studies such as the samosa, we see how nutrition, safety, portion size, and mindfulness intersect—and how multi-stakeholder collaboration can shape healthier dietary behaviors without dismissing cultural preferences.

References

- Birch, L. L., & Anzman-Frasca, S. (2020). Learning to prefer healthy foods: From innate processes to cultural learning. *Annual Review of Nutrition*, 40, 249–272.
- EFSA. (2023). Acrylamide in food: Updated scientific opinion. *EFSA Journal*, 21(6), e07891.
- FSSAI. (2022). State of food safety in India: Annual report. Food Safety and Standards Authority of India.
- Herz, R. S. (2021). The role of odor-evoked memory in psychological and physiological health. *Brain Sciences*, 11(9), 1196.
- Higgs, S., & Spetter, M. S. (2022). Cognitive control of eating: The role of memory and attention. *Annual Review of Nutrition*, 42, 109–128.
- Hollands, G. J., et al. (2022). Reducing portion sizes to change behavior: Evidence and implications. *Nature Human Behaviour*, 6(6), 738–749.
- Horne, P. J., et al. (2023). Physical activity calorie equivalent (PACE) food labeling and its effects on consumer behavior: A systematic review. *Appetite*, 182, 106400.
- ICMR-INDIAB Study Group. (2023). Physical activity patterns in India: Findings from a nationally representative study. *Indian Journal of Medical Research*, 158(1), 23–34.
- Marx, W., et al. (2021). Diet and mental health: Emerging evidence and future directions. *The Lancet Psychiatry*, 8(6), 487–500.
- Michie, S., et al. (2021). Digital behavior change interventions to improve diet and physical activity: Systematic review. *Journal of Medical Internet Research*, 23(10), e28111.
- Mozaffarian, D. (2022). Dietary and policy priorities for cardiovascular disease, diabetes, and obesity: A comprehensive review. *Circulation*, 145(14), 1067–1083.
- Rangel, A. (2021). The neurobiology of value-based decision making in eating behavior. *Nature Reviews Neuroscience*, 22(8), 528–542.
- Rozin, P. (2020). Food and eating as a window to culture. *Physiology & Behavior*, 227, 113–128.
- Small, D. M., & DiFeliceantonio, A. G. (2019). Processed foods and food reward. *Science*, 363(6425), 346–347.



REFORMULATION OF FOOD PRODUCTS WITH REDUCED FAT

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Many policymakers are recognizing the need to reduce caloric intake, especially from fats, as large sections of people are consuming excessive amounts of foods especially with higher calorie contents.

Health professionals are advising reduction of caloric intake, as with lesser physical activity due to modern conveniences, people tend to put on excess weight that contributes to obesity and hypertension, which in turn may increase the chances of heart diseases, diabetes and other diseases. Reformulations have been recommended for healthier diets, especially with reductions in calories. As fats are concentrated

sources of calories, and also as saturated and trans fats have links to some of the diseases, fat reduction in foods and products may reduce overall calories substantially that would contribute to healthier diets (1).

While health professionals think of fats as just a concentrated source of calories, fats have many functions in foods and products. So, when one tries to reduce the fat content, there is a simultaneous effect on many properties of food products which need to be considered.

Functions of Fat in Foods & Products

Fats have always been used in foods for elevating the taste and flavour. Kids love the smooth taste of butter

on bread or ghee on roti. Without it, food tastes dry and difficult to eat. The fat enhances the pleasure of food by improving its texture and mouth feel, appearance and flavour. During food preparation especially with heat, many flavours are formed as experienced during frying an omelette, sautéing of onions, garlic and tomatoes, stirring in spices and curry leaves, roasting of meat among others. Thus, fats have always been a part of cooking to improve the foods with respect to flavours and taste. As they are slower in digestion and absorption, they provide satiety and fullness.



There are many other functions during food preparation that fat has a role in. Cakes rise due to air incorporation that is stabilised due to solid fat. Crumbly or flaky texture is formed in pastry and cookies due to shortening fat coating particles preventing moisture absorption. Specialised fats with tailored solid fat index are used in coating, spraying, chocolates, biscuits, confections, etc, creating ingredient-led sensorial textures.

Fats also help retain moisture of food products during storage, preventing loss by evaporation. Fats also give glossy appearance to foods. Solid fats do not melt over a range of temperature so are useful in spreads and cheeses over oils. Also, as fats can be heated much above boiling water temperature, deep frying uses them for foods such as chips, wafers, fish, fritters, vada, samosa, chakli, sev, bhajias, jalebis etc. Fats also help carry flavours of foods and ingredients so without them flavours are not as effective (2).

Fats serve much more than simply as contributors of calories, and some are even essential nutrients. When reformulations are attempted, these

functions must be kept in mind and alternative means provided to give the foods similar characteristics provided when full fat formulations were used. Otherwise, the foods and products would not be acceptable to consumers.

Fat Reduction in Food Products

Reformulation in food products with respect to fat are of two types.

Firstly, the saturated fat and transfat are unhealthy as their consumption is related to many diseases including cardiovascular diseases. This can be tackled by replacing such fats with healthier ones. Simple replacement of saturated and/or trans fats does not help as there are many benefits of these fats including the higher melting point and providing textural & mouthfeel benefits as well as holding gases during fermentation and whipping in bakery goods.

Another way to reduce trans fats is to use fully saturated fat instead of partially hydrogenated fat and blending with oils or better interesterification with oils

so the final fat has the desired higher melting point but no trans fatty acids. However, in case saturated fat is to be reduced, then simple blending may not help.

Secondly, fats need to be reduced in total quantity and replaced by non-fat components. Emulsions and hydrocolloids play an important role in strategies for fat reduction. Emulsions mix oil and water with stabilisation by emulsifiers to provide smooth, creamy texture of fats in a variety of products such as desserts, sauces and spreads. Water replaces part of fat, especially saturated fat to give the appearance and feel of full-fat product. This not only reduces total fat, but also saturated fat which may be replaced by unsaturated oils. Some fat is replaced by carbohydrates so there is a reduction in calories. Thus, it has multiple benefits (3).

Gums and starches play an important role of hydrocolloids in providing structure and stability for the reduced fat formulation. They prevent separation of emulsion components that would otherwise cause problems in texture, mouthfeel and appearance. Hydrocolloids also help prevent moisture loss during storage especially in bakery applications.

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Protein and polysaccharide-based fat replacers are also useful in low-fat products for texture and mouthfeel.

Whey protein and casein can imitate smoothness and creaminess imparted to products by fat. When these proteins are micro- or nano-particulates, they closely mimic fat in these sensory perceptions. (4,5)

There are some polysaccharides that also can be used for such functions. Examples are modified starches, inulin and pectin can bind water in a gel-like matrix. This creates a mouthfeel sensation similar to fat. These ingredients are quite useful in dairy products, baked goods and meat substitutes to help stabilise and create sensory quality similar to fat.

Whey protein emulsions have been quite effectively used in dairy products to improve the sensory quality of low-fat dairy products

like yoghurt by elevating creamier texture and richer mouthfeel without additional fat.

Pectin and inulin have shown improved moisture retention and texture in baked products to make low-fat versions to be appealing to consumers.

Some flavours and seasonings are also used to impart appeal to low-fat food products. Many dairy products are appealing due to dairy aroma compounds present in dairy fat. When low-fat products are prepared the aroma diminishes.

When isolates of butter flavour compounds prepared by enzymic and spray drying process in powder form and added to bakery items, snacks, sauces and ready meals, authentic flavour of butter is perceived.

Seasoning compositions with inulin and dextrin, have also been used to impart heavy

body feel and palatability to confectionery, fried foods, instant noodles, non-fried foods, soups, breads and processed meat products (6).

Flavour carriers, encapsulated aromas and umami enhancers are also used to compensate for the flavour loss due to fat reduction. These can restore the richness as well as complexity provided by fats.

Plant proteins have also been used as fat replacers. A product made with plant protein, plant oil and water has been used as replacer and providing functionality of animal fat. (7)

Dietary fibres are useful in fat replacement and also are useful with health benefits. Apple fibre with high water-binding and swelling properties can help reduce sugar, fat and salt content in products without sacrificing taste and texture.

Nanofibers cellulose or unmodified chitin also can enhance fatty flavours of low-fat products.





Satiety is an important function of fat, especially the saturated fat. When proteins and dietary fibres are used in replacement compositions, they provide the similar sensation so excessive eating is avoided.

They also provide health benefits and help in providing better label with nutrition information and health rating or score as fat is lowered with increase in protein and fibre.

Manufacturers must now start reformulating their food products to reduce the nutrients with negative implication such as salt, sugar and fat, especially saturated and transfat.

Consumers have already started looking to avoid HFSS (high fat, salt & sugar) products. Doctors and nutritionists have been advising to reduce them in the diet. Regulators are planning to enforce labelling to help consumers with this.

Fats being more concentrate source of calories and certain fats having health implications, will soon be seen to be avoidable in food products.

However, developers should realise the important functions the fats play in food products. Otherwise, the low-fat products would be unacceptable to consumers.

So proper reformulation strategy must be employed to replace fats so foods continue to be tasty besides being nutritious and healthy.

References:

1. <https://www.who.int/publications/i/item/9789240039919>
2. <https://www.eufic.org/en/whats-in-food/article/facts-on-fats-the-basics>
3. <https://eu-assets.contentstack.com/v3/assets/bltb9ead2d4140390e0/blt97373031c490915f/66ec1b05>
4. <https://www.sciencedirect.com/science/article/pii/S2666154323000261>
5. https://www.researchgate.net/publication/251623967_Effect_of_microparticulated_whey_protein_with_varying_content_of_denatured_protein_on_the_rheological_and_sensory_characteristics_of_low-fat_yogurt
6. <https://pubs.acs.org/doi/abs/10.1021/acs.jafc.0c00882>
7. <https://insights.figlobal.com/foodtech/plant-protein-process-delivers-sensory-qualities-of-fat>



OPTIMISING MIXING PROCESSES IN FOOD MANUFACTURING



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Sometimes, we find ice cream with a gritty, icy texture or uneven colour, bread with a chewy texture and poor gas volume. These are typical examples of improper mixing while processing.

Improper mixing leads to an uneven distribution of particles, resulting in several product defects. They could be poor mouthfeel and undesirable taste, inconsistent flavour, clumping, or lumps in dry blends. Sometimes, part of the food product is not exposed to the correct temperature because of improper mixing, leaving parts unprocessed and

thereby microbial contamination, posing a food safety risk. Overmixing can also lead to product quality problems. In dry blends, it will cause separation or the unwanted breakdown of particle size. Overworked dough in bread will lead to poor gas retention. These defects in the product quality will affect consumer acceptance. Proper mixing will ensure batch-to-batch consistency. Therefore, optimum mixing is a vital step in food manufacturing operations.

Mixing ensures that the raw materials are converted to the finished product by establishing consistency. (1) Mixing is defined as the process of thoroughly combining different materials to produce a homogeneous product. The resulting mixture, in most

cases, is a combination of dissimilar materials. In some cases, a chemically homogeneous material may be mixed to produce a uniform blend of a desired weight or volume with consistent particle-size distribution, colour, texture, or other required attributes. Mixing is a critical process because the quality of the final product and its attributes are derived from the quality of the mix.

Improper mixing results in a non-homogeneous product that lacks consistency with respect to desired product attributes. In a mixing process, heterogeneous materials are converted into a homogeneous mass. The materials could be solid, liquid, or gas, depending on the applications. Mixing is carried out to facilitate the transfer of heat, mass, or both.

**Bourn
Vita**

**TAAKAT SE
SHURU HOTI HAI
TAYYARI JEET KI.**



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.

It can involve different phases such as solid-solid (dry blends), liquid-liquid (beverage emulsions), solid-liquid (dough formation), and gas-liquid (ice creams).

Different types of mixing equipment are used in food manufacturing. (2) (3) Their use and application are decided by the different phases (mentioned earlier) or by the physical characteristics (density or viscosity) of the finished product. In a practical situation, many types of mixers can be suitable for the same application. The decision should be made based on the initial investment and desired efficiency of operation. Process optimisation can be achieved by selecting the right equipment.

Dry mixing: This is a very important step for the manufacturing of most food products. It is either complete or part of the process. The degree of mixing depends upon many factors, such as particle size and density, surface and flow characteristics of each component, tendency of materials to aggregate, and the type of mixer used. The

following are various equipment used in dry mixing.

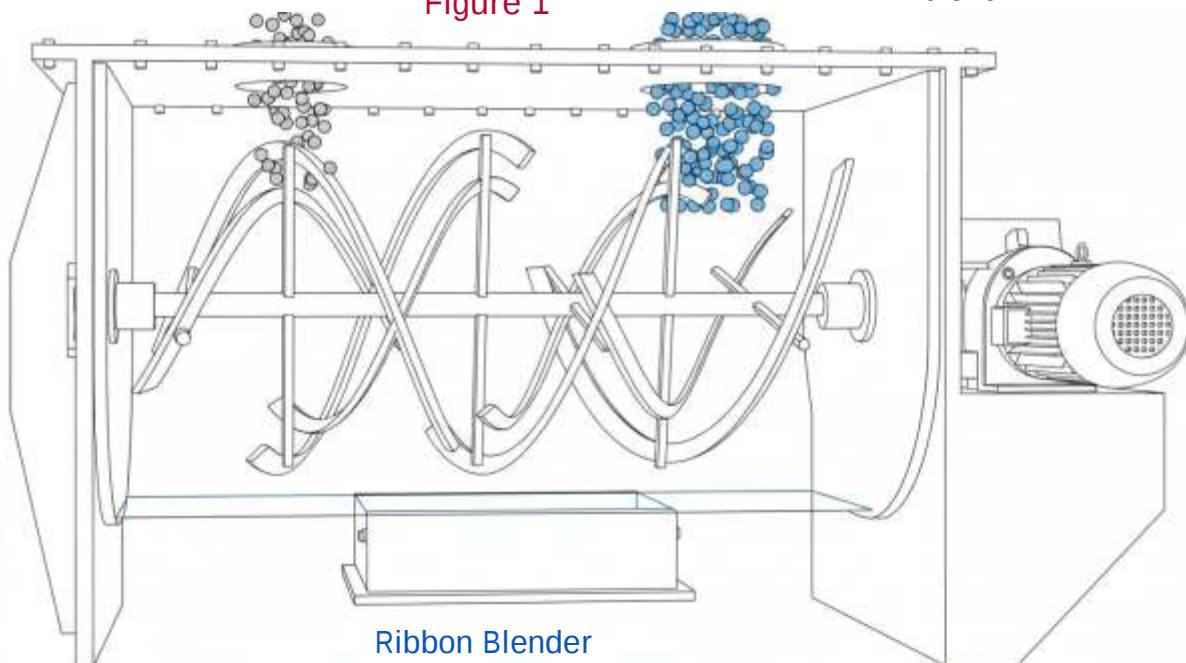
Ribbon blender: (Figure 1) It is a popular piece of equipment in the food and beverage industry. The equipment consists of a U-shaped horizontal trough and an agitator made up of inner and outer helical ribbons that move materials axially in opposite directions. Such blenders are quite useful in dry applications like cake and muffin mixes, flour, bread improvers, cereals, snack bars, spices and herbs, tea, and coffee powders. They are used in beverage blends such as whey protein shakes, chocolate drinks, powdered juices, etc. A relatively small amount of liquid can also be added during the mixing. This is done to coat colouring, flavours, oils, or other

additive solutions. This can be done via a spray nozzle placed above the agitator. Although commonly used for dry powders, the ribbon blender can also be used to prepare flowable slurries and pastes.

Tumbling Mixers: The tumbling mixers are used for the blends that require a gentle mixing action. In such blenders, the whole mixer is responsible for the mixing action. The V-shaped mixer, the Double cone blender, and the Cubical mixer are some examples.

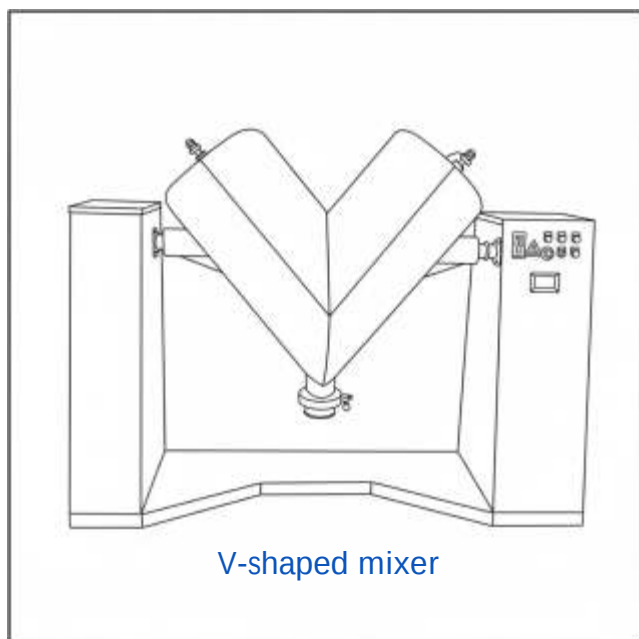
V-shaped Mixer: (Figure 2) It consists of two hollow cylindrical vessels joined at an angle of 75 degrees to 90 degrees, mounted on a trunnion to tumble. The free fall of material and the repetitive converging and diverging motion, coupled with increased friction, result in a homogeneous blend.

Figure 1



Ribbon Blender

Figure 2

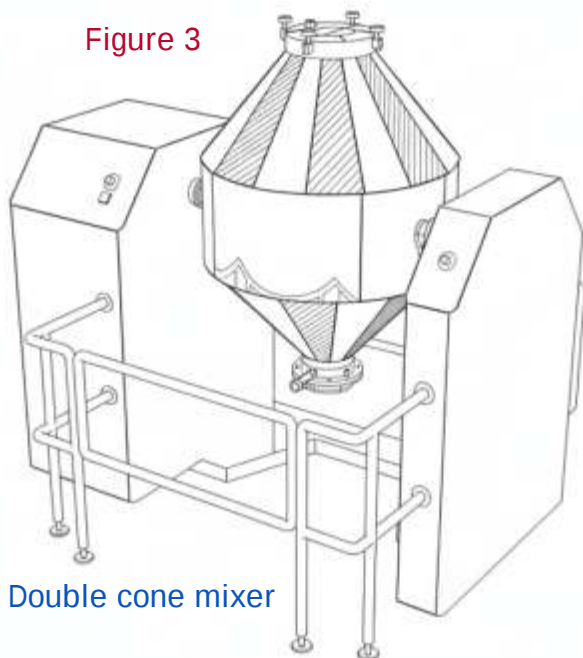


V-shaped mixer

Double cone mixer:

(Figure 3) It is an efficient and multipurpose blender used for mixing dry powders and granules. It is made up of two conical-shaped stainless-steel vessels separated by a cylindrical section. This is not suitable for mixing very fine particles or materials with a difference in particle size. It is very easy to clean.

Figure 3



Double cone mixer

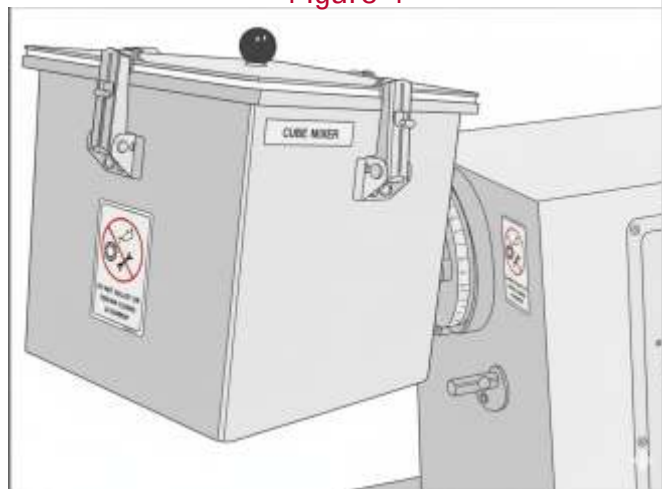
Cubical mixer:

(Figure 4) It is suitable for the gentle blending of dense powders and granules. A cube-shaped stainless-steel container is mounted at a tilted angle in the centre of the container, or it is hung from the

corner between two trunnions that allow it to rotate about an axis. Mixing occurs by the sliding of powders on its walls. The blender gives mixing in three dimensions. However, this is not a hygienic design to use. The presence of different corners makes it difficult to clean.

Y cone mixer: (Figure 5) It can handle large capacities (45 liters to 3200 liters) of materials. Two cylindrical cones are welded and fitted with a shaft mounted on bearings. The blender rotates at a slow speed, causing the mass to tumble along the cone, which results in the material crossing over itself to produce a uniform mix. It is easy to clean and suitable for free-flowing powders and granules.

Figure 4



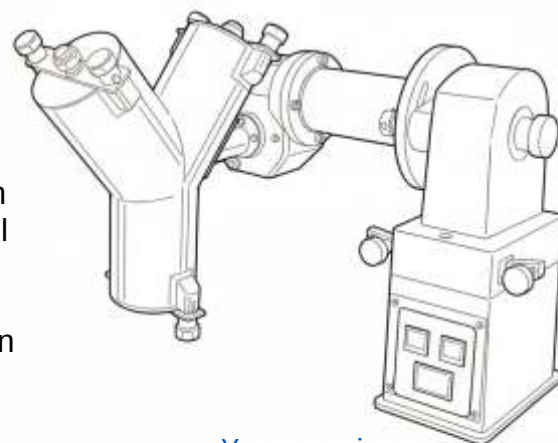
Cubical mixer

High shear Mixing and emulsification:

(4): Such mixers are used to disperse the solids into liquids, or even to make emulsions by adding oil into liquids.

They utilise a rotor/ stator assembly, which generates intense shear to puree solid ingredients in preparation of dressings, sauces, and pastes. These types of devices are also used to produce syrup solutions, beverage emulsions, and dispersions.

Figure 5



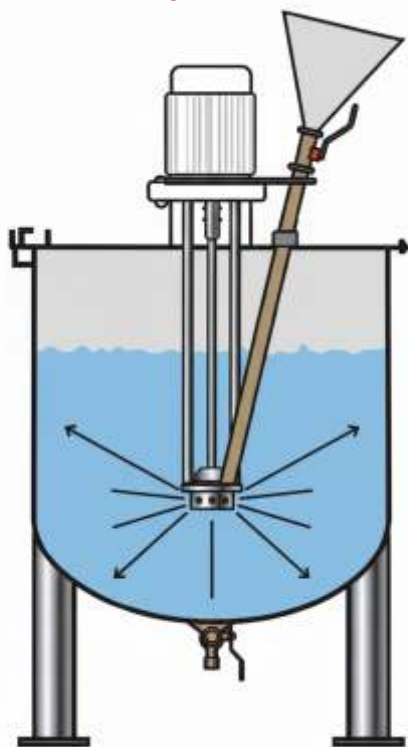
Y-cone mixer

They are available as batch and continuous batch, or inline configurations.

SLIM (Solid Liquid Injection Manifold) technology mixers are available in vertical and horizontal configurations. They are comprised of a rotor that turns at high speed within a stationary stator. As the rotating blades pass each opening in the stator, they mechanically shear particles and droplets and expel material at high velocity into the surrounding mix, creating hydraulic shear. As fast as material is expelled, more is drawn into the rotor/stator generator, which promotes continuous flow and fast mixing.

In a batch operation (Figure 6a), as the rotor reaches operating speed, the SLIM

Figure 6a



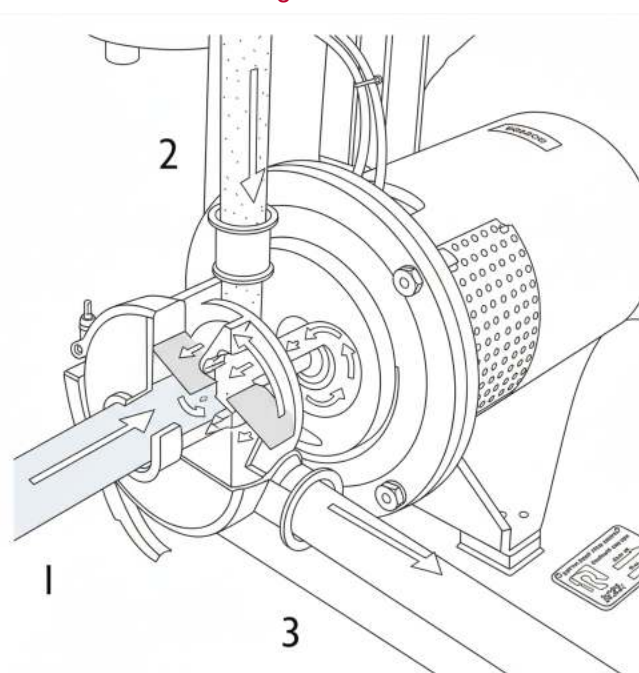
valve is opened, and powders are drawn quickly into the batch by virtue of the powerful vacuum generated by the ported rotor.

In the Inline operation, the liquid stream 1 enters the mixer and immediately encounters the powder injection 2 at the high shear zone of the rotor/stator assembly. The resulting dispersion 3 is expelled centrifugally through the stator openings at high velocity.

The quality challenges in mixing operations: Mixing is a very critical and complex operation in the manufacturing of Food and Beverages. It is utmost important to ensure that a homogenous mix is obtained. If proper care is not taken, it will lead to quality issues and may result in batch failures at times.

Selecting a batch size for optimum mixing volume for a mixer capacity is very critical for proper mixing. If the batch size is less than the optimum capacity, it will lead to improper mixing. In the case of powders, it will be overmixing, affecting the homogeneity of the final product. In the case of liquids, there will be vortex formation leading to

Figure 6b



foaming, and there will be a loss in the yield. The sequence of addition is also important. In the case of the dry mixes, the ingredients with the lowest weight are added by premixing with the bulk ingredients to ensure mixing. The fine powders are to be added first, followed by the larger solids, to get the right mix.

In the case of liquid mixing, the high viscosity liquid is added to the lower viscosity. For example, if water is added to the corn syrup, there will be resistance to mixing initially, which will lead to a longer time to get a uniform mix. Some ingredients, because of their unique nature, can lead to quality issues. For example, citrus ingredients can hinder the viscosity of the mix, resulting in a different final texture.



Some temperature-sensitive ingredients can clump instead of being free-flowing powders if the equipment gets hot. Such impacts can be minimised by pre-processing such ingredients. Upstream processing of the ingredients is crucial to get a uniform mix. Breaking solid ingredients by milling and passing them through sieves to achieve a uniform size before adding them to the mixer will ensure proper mixing.

Manufacturing of any food product involves mixing an innumerable number of ingredients, and the homogeneous mixing will ensure that it meets consumer demand for nutrition, taste, and texture. The food product contains ingredients that vary in quantities from micrograms to several tons.

A typical example would be a powder infant formula which contains vitamins and minerals in very minor quantities, to major ingredients like milk powders or maltodextrin in huge quantities. Therefore, maintaining the homogeneity of the final mix is vital.

In the production scale, the single-point data of the blend is not sufficient to conclude the homogeneity. Samples are drawn from multiple points and analysed to ensure homogeneity. Similar sampling techniques can be used in the case of liquids. There are efforts to develop the use of computer imaging techniques to ensure the homogeneity of the powders and granules. This will result in speed and accuracy in the analysis. There are reports of the development of online monitoring of viscosity and total solids by using Acoustic Flowmeters.

The mixing process is the heart of any product manufacturing. Improved mixing efficiency leads to shorter cycle times, resulting in savings of power and improved operational costs. Modern mixers are designed to combine different steps in a single piece of equipment.

For example, coating, granulation, heat transfer, and drying. The good mixing will ensure enhancing profitability and can therefore be a decisive business tool.

1) <https://en.wikipedia.org>

[/wiki/Mixing_\(process_engineering\)](#)

2) https://www.dairyfoods.com/ext/resources/White_Papers/Mixing-Equipment-and-Applications-in-the-Food-Industry.pdf

3) <https://www.slideshare.net/slideshow/mixers-and-different-mixers-in-food-industry/249902289>

4) <https://www.mixers.com/products/high-shear-mixers/slim-powder-induction-system/>

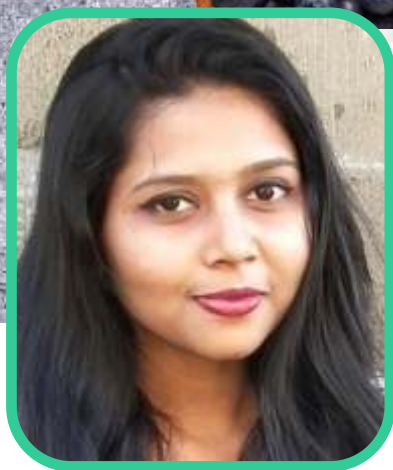
5) [How to address food quality challenges during the mixing process - Process & Control](#)

6) https://www.researchgate.net/publication/352663560_Homogeneity_of_the_selected_food_mixes

7) https://www.researchgate.net/publication/344355697_Monitoring_Viscosity_and_Total_Solids_Content_of_Milk_Protein_Concentrate_Using_an_Inline_Acoustic_Flow_meter_at_Laboratory_Scale



NATURAL ANTIOXIDANTS IN FOOD PROCESSING



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Introduction

Antioxidants are nature's own form of additives that protect the quality and stability of foods. Since the appeal of any food product is closely tied to its taste, texture, aroma, and appearance, antioxidants play an important role in maintaining these qualities. They prevent fats and oils from turning rancid, and help preserve the bright, natural colours of fruits and vegetables, ensuring freshness and consumer acceptance. Oxygen is an important chemical for all aerobic organisms; however,

it can degrade and alter food, leading to undesirable compounds. Antioxidants help to delay and prevent the degradation caused by oxygen and its reactive species and preserve the overall quality of these foods. They can be categorized into **natural antioxidants**, such as vitamin E, and **synthetic antioxidants**, such as propyl gallate (1).

Oxidative degradation: its impacts on shelf life, sensory quality, and nutritional value

Oxidation is a natural process that occurs when food is exposed to oxygen and other environmental factors. This process can lead to the degradation of

essential nutrients, alterations in physical, chemical, and organoleptic properties, as well as the formation of undesirable compounds, such as reactive oxygen species (ROS), which in turn shortens the shelf life of the product and reduces consumer acceptability. Oxygen initiates a cascade of reactions resulting in lipid peroxidation, protein modification, and pigment degradation.

Lipid peroxidation is most visible in foods containing unsaturated fatty acids, producing rancid odours and flavours that compromise the acceptability of foods like oils, meats, dairy, and snacks.



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Protein oxidation alters solubility, texture, colour, and nutritional quality, especially in meat and seafood. Oxidation also degrades vitamins and bioactive compounds(2).

Mechanism of action:

To counter these detrimental effects, antioxidants act through several mechanisms. Free radical scavenging involves neutralizing reactive oxygen species before they can attack food components. Metal chelation prevents pro-oxidant metals like iron and copper from catalyzing oxidative reactions, thereby slowing the formation of radicals. Singlet oxygen quenching reduces the activity of highly reactive oxygen species that otherwise accelerate pigment fading and lipid peroxidation. Together, these mechanisms are crucial in controlling oxidative degradation.

In foods, antioxidants often act together in ways that make their combined effect stronger than when they work alone. This synergy enhances oxidative stability by mechanisms such as regenerating oxidized antioxidants, forming new

active compounds during processing, or carrying out complementary roles in neutralizing free radicals. For instance, Vitamin C regenerates oxidized Vitamin E, prolonging its protective action in lipid systems. Similarly, combinations of polyphenols and flavonoids can target multiple oxidative pathways at once, enhancing overall activity. In whole foods and plant extracts, these interactions are especially important, as the wide mix of phytochemicals provides stronger protection than isolated compounds (3).

Shift from synthetic to natural antioxidants: drivers and implications

Synthetic antioxidants are often used because they are more stable, effective, affordable, and widely available. The most common examples in the food industry include butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate (PG), and tert-butyl hydroquinone (TBHQ). However, the growing consumer demand for minimally processed, organic, and sustainable products is driving a shift from synthetic antioxidants to natural alternatives. Synthetic antioxidants, though effective and widely used, face scrutiny due to safety concerns. Long-term

intake of compounds such as BHA and BHT in higher doses has been associated with adverse health effects, with BHA found to be carcinogenic in animal studies. However, there isn't enough evidence to link their exposure to cause cancer in humans. These additives are strictly regulated and are often found to be safe at low concentrations (8).

Studies have shown consumers strongly favour natural ingredients and "clean-label" products, as plant-based compounds are believed to be safer. However, natural origin does not automatically guarantee safety. Regulations still require that all food antioxidants, whether synthetic or natural, be proven safe. Food-grade antioxidants must meet regulatory criteria, including high safety margins, absence of adverse long-term effects, and proven stability and efficacy at low concentrations. They must also preserve sensory qualities such as taste, odour, and colour while remaining cost-effective.

Although natural antioxidants may show lower potency than synthetic ones, sometimes requiring higher doses, they remain a valuable alternative when carefully selected and used within regulatory limits.

Practical applications show their effectiveness, like chamomile and fennel extracts have been used successfully to preserve yoghurt and biscuits, while extracts of grape seed, green tea, pomegranate, cinnamon, sage, and rosemary have shown comparable or even better antioxidant activity to synthetic antioxidants like BHT (4).

Rosemary (*Rosmarinus officinalis* L.) has a long history of use as a food flavouring. Its extract and oil contain active compounds such as rosmarinic acid, carnosic acid, and carnosol, all with strong antioxidant properties. Studies have shown that rosemary essential oil (REO) can scavenge free radicals and has even better antioxidant activity than the synthetic antioxidant BHT.

Rosemary offers advantages over synthetic antioxidants, as it retains its efficacy during high-temperature processing, is natural, and is classified as GRAS (Generally Recognized As Safe) by US FDA. Although not the cheapest option, it provides a good balance between cost and performance. Rosemary extract helps slow lipid oxidation, reducing peroxide values, which enhances the shelf stability of oils and meats. For

example, in sunflower-soybean oil, it lowered the peroxide value by 38% after 30 hours of heating, while in meats, even a small addition of 0.02% extended shelf life without affecting sensory quality.

By preventing rancidity, it maintains desirable flavour and aroma, reduces bitterness in flaxseed oil during storage, and improves frying performance, keeping fried potatoes crisp and tasty for up to 15 fryings. It also shows synergistic effects with antioxidants like vitamin E, offering stronger protection against oxidation and further improving overall stability and quality. Extracts of rosemary (E392) are approved as a food additive in the EU, proving it a viable alternative for consumers and manufacturers who prefer natural options over synthetic antioxidants in food products (7).

Sources of Natural Antioxidants

Natural antioxidants mainly come from plants like fruits, spices, vegetables, and herbs, which are rich in phenolic compounds, carotenoids, and vitamins. Essential oils from herbs such as oregano, rosemary, lavender, and thyme are also excellent sources of



NAs. Aqueous tea extracts contain high levels of flavonoids, catechins, and tannins, making them rich in antioxidants (3).

1. Polyphenols are among the most common phytochemicals in plants, known for their antioxidant activity and health benefits. They are grouped into phenolic acids, lignans, flavonoids, and stilbenes. Their antioxidant effects come from donating hydrogen atoms or electrons, chelating pro-oxidant metals. Phenolic acids (e.g., caffeic, ferulic, gallic) are abundant in coffee, olives, berries, and grains, helping scavenge ROS and prevent lipid peroxidation.

Flavonoids occur in fruits, vegetables, tea, and wine. Stilbenes, notably resveratrol in grapes, peanuts, and red wine. Lignans in flaxseeds, grains, and legumes are converted by gut microbiota into enterolignans showing antioxidant effects.



vegetables. They act both as natural colourants and potent antioxidants.

Their double-bond structure enables them to effectively neutralise singlet

oxygen and peroxy radicals. Based on structure, carotenoids are divided into carotenes (e.g., β -carotene, lycopene) and xanthophylls (e.g., lutein, zeaxanthin). Key sources of β -carotene include carrots, pumpkin, and sweet potatoes, while lycopene is abundant in tomatoes, watermelon, and pink grapefruit. Leafy greens such as spinach, kale, and broccoli are sources of lutein and zeaxanthin.

1. Vitamins C and E are natural antioxidants, with Vitamin C being water-soluble and Vitamin E being fat-soluble, allowing them to protect both aqueous and lipid systems from oxidative damage. Vitamin C (ascorbic acid) is a strong reducing agent that neutralises ROS, regenerates other antioxidants (like vitamin E), and protects from oxidative stress.

Found in citrus fruits, berries, kiwi, papaya, and vegetables like broccoli and peppers, vitamin C is widely used in food preservation to prevent browning in fresh-cut produce and inhibit lipid

oxidation in meats and beverages. Vitamin E includes eight fat-soluble compounds (4 tocopherols and 4 tocotrienols), with α -tocopherol being the most biologically active. In food systems, tocopherols stabilize oils, margarine, and snacks against rancidity during storage and heat processing.

Alongside these compounds, several other phytochemicals significantly contribute to the antioxidant capacity of plants. **Alkaloids** are nitrogen-containing molecules with antioxidant properties. Examples include caffeine (in tea and coffee), which scavenges hydroxyl radicals and prevents lipid peroxidation.

Terpenoids include compounds like limonene (citrus peels) and menthol (mint). They act as antioxidants by scavenging radicals. Terpenoids and alkaloids aid flavour stability and prevent oxidation in oils and spices.

Beyond these compounds, the food industry is also exploring sustainable sources of natural antioxidants by reducing waste from fruits and legumes, as by-products like apple, olive, grape, and tomato pomace can provide valuable chemicals.

2. Flavonoids are a major group of polyphenols widely found in plants, important for plant defence and valued for their antioxidant properties. They have six subclasses: flavonols (quercetin, kaempferol) found in apples, onions, and kale, flavones (luteolin, apigenin) in celery, parsley, flavanones (hesperidin, naringenin) abundant in citrus fruits, flavanols (catechin, epigallocatechin gallate-EGCG) present in green tea, grapes, and chocolate, anthocyanins (cyanidin, delphinidin) give berries and eggplants their red, purple, and blue colours and isoflavones (daidzein, genistein) mainly in soy, known for phytoestrogenic effects.

Flavonoids act as antioxidants by scavenging free radicals and chelating metallic ions like Fe^{2+} and Cu^{2+} . Flavonoids extend shelf life, prevent rancidity, and protect colour and flavour.

3. Carotenoids are lipid-soluble pigments responsible for the red, yellow, and orange colours in many fruits and

Pomegranates are particularly rich in antioxidants, especially in their peels, which often have more bioactive substances than the fruit itself. Similarly, citrus peels, including those from lemons, grapefruits, and oranges, contain 15% more phenolic compounds than the flesh, while pineapple by-products have higher levels of phenolic molecules compared to fresh pulp.

Extraction Methods

Many natural antioxidants are contained within the plant matrices and must be separated for further use. They can be extracted from leaves, roots, stems, fruits, seeds, and peels. The quality of extracts and their antioxidant properties depend on the source (e.g., origin and storage conditions) and the extraction technology used. There is no standard procedure of extraction, since antioxidants differ in chemical and physical properties.

Organic solvent extraction is the most common method. A common method is Soxhlet extraction. Solvent choice is based on compound solubility, and ethanol, methanol, acetone, hexane, and water are widely used. Studies show that methanol and ethanol often give the best results for phenolics and anthocyanins, while acetone works well for

other compounds. From a food industry perspective, ethanol and water are preferred because they are safe (GRAS). Extraction yield and antioxidant capacity depend on solvent, process conditions, and method, which can cause breakdown or polymerization reactions. Efficient extraction maximizes bioactive compounds and minimizes degradation (4).

Non-Conventional Methods

There are newer methods that often cost more but have a lower environmental impact. Supercritical Fluid Extraction (SFE) uses fluids in their supercritical state, mainly carbon dioxide, which is non-toxic, low-cost, and compatible with food products. It is especially effective for lipids, essential oils, and aroma compounds, but less suitable for phenolics and other hydrophilic compounds.

High Hydrostatic Pressure (HHP) and Pressurized Liquid Extraction (PLE) methods allow faster and more efficient extraction, even at high temperatures, which is useful for heat-sensitive compounds. They have been used to extract essential oils from peppermint and carotenoids from carrot byproducts. Ultrasound-Assisted



Extraction (UAE) and Microwave-Assisted Extraction (MAE) are fast, efficient methods that reduce time, solvent, and energy use. MAE works best with polar solvents like ethanol, methanol, and water. Both methods are commonly applied to extract phenolics, carotenoids, and oils.

Stabilization

After extraction, antioxidants are sensitive to heat, pH, light, oxygen, and moisture, which can cause degradation. Stabilization methods are used to preserve their activity and include both chemical techniques, such as molecular inclusion in cyclodextrins, and mechanical techniques, such as spray drying.

Encapsulation is the most common method, where antioxidants are enclosed in capsule structures made of food-grade polysaccharides, proteins, or lipids. This protects them from degradation, makes handling easier, masks undesirable tastes or odours, and allows controlled release.



Influence of processing conditions on antioxidant efficacy

Processing conditions directly influence the stability and activity of antioxidants, and the effects can be both positive and negative depending on the compound and treatment. Moderate heating of tomatoes increases cis-lycopene isomers, which are more bioavailable and show higher antioxidant activity, but higher temperatures and longer exposure cause carotenoid degradation and oxidation.

In sweet potatoes, heat treatments such as boiling, steaming, microwaving, and baking raised the overall phenolic and anthocyanin levels; however, phenolic acids like chlorogenic and ferulic acid decreased. Strawberries retained more anthocyanins during pasteurization than steam blanching and canning of apricots preserved phenolics by inactivating enzymes and limiting oxidative loss.

Non-thermal methods such as pulsed electric fields and high-pressure processing enhanced carotenoid and phenolic extractability in

tomatoes and cranberry purees, while ultrasonication increased phenolic content in apple-grape juice

(5).

Applications in Food Processing (6)

Meat and Poultry

Meat and meat products are highly prone to oxidation due to their high content of unsaturated lipids and heme proteins, which accelerate lipid peroxidation and colour deterioration.

Cinnamon-deodorized aqueous extract has been shown to improve the oxidative stability and colour of chicken meatballs, showing performance comparable to that of synthetic antioxidants such as BHA (butylated hydroxyanisole), BHT (butylated hydroxytoluene), and ascorbic acid, without compromising sensory acceptability. Quercetin, rosmarinic acid, and grape seed proanthocyanidins have proven to be effective in various products, including meat, dairy, oils, and baked goods, while also exhibiting antibacterial properties.

Extracts from rosemary, green tea, sage, and thyme have been successfully applied to ground beef, patties, and sausages to inhibit lipid oxidation and

extend shelf life. α -tocopherol significantly enhanced the oxidative stability of cooked beef and chicken. Water-soluble oregano extract has been found to improve both oxidative and colour stability in raw beef and pork patties that are stored frozen under vacuum packaging.

Bakery and Snacks

Elderflower (*Sambucus nigra* L.) dry extract and juice concentrate, added to chocolate-coated gingerbread cookies, increased bound phenolic acid content by up to 28% while improving antioxidant capacity and sensory quality. Functional biscuits fortified with date fruit fibres improved overall acceptability, although they exhibited lower phenolic content and scavenging activity compared to other formulations.

Encapsulated mangosteen (*Garcinia mangostana* L.) peel extract at 5% concentration in chocolate biscuits showed the best balance of antioxidant activity, physicochemical stability, and organoleptic quality.

Dairy and Beverages

Grape pomace and olive leaf extract have been successfully incorporated into cheeses, enriching antioxidant activity.

Similarly, red ginseng extract (RGE) enhanced the antioxidant activity of milk, as the treated samples outperformed controls in physicochemical parameters and sensory acceptability. In yoghurt, chamomile and fennel decoctions provided greater antioxidant activity than potassium sorbate, with chamomile showing the strongest effect, thereby providing an alternative to synthetic preservatives.

Oils and Fats

Catechins derived from green tea, tocopherols (vitamin E), rosemary extract oil and sesamol (from sesame) have demonstrated strong efficacy in stabilizing vegetable oils, effectively preventing oxidation and minimizing rancid off-flavours. Standards for rosemary extract and green tea extract in vegetable oils are currently under consideration by FSSAI.

Conclusion

Natural antioxidants play an important role in food

processing by enhancing shelf life, protecting sensory qualities, and contributing to nutritional value. While synthetic antioxidants remain effective, increasing consumer preference for “clean-label” and sustainable products has driven the adoption of natural alternatives.

Advances in extraction and stabilization techniques, along with growing evidence of efficacy from plant-based sources, continue to expand their potential applications in food processing. Moving forward, the challenge lies in balancing cost, stability, and regulatory requirements while ensuring safety and consumer trust.

References

1. [ANTIOXIDANT FOOD ADDITIVES IN THE INDUSTRY - AmerexIngredientes](#)
2. [https://www.hilarispublisher.com/open-access/the-impact-of-oxidation-on-food-quality-and-preservation-111341.html#:~:text=The%20impact%20of%20oxidation%](https://www.hilarispublisher.com/open-access/the-impact-of-oxidation-on-food-quality-and-preservation-111341.html#:~:text=The%20impact%20of%20oxidation%20extends,a%20decline%20in%20antioxidant%20activity.)

[20extends,a%20decline%20in%20antioxidant%20activity.](#)

3. <https://link.springer.com/article/10.1007/s42452-025-07464-6#:~:text=Edible%20plants%2C%20comprising%20fruits%2C%20seeds,and%20more%20biocompatible%20%5B10%5D>

4. <https://pmc.ncbi.nlm.nih.gov/articles/PMC6891691/>

5. <https://www.sciencedirect.com/science/article/pii/S2590157522001328#s0015>

6. [Harnessing Natural Antioxidants for Enhancing Food Shelf Life: Exploring Sources and Applications in the Food Industry](#)

7. Varad Bende (2025), Rosemary Extract in Food and Nutrition

8. Susan P. Felter, et al Butylated hydroxyanisole: Carcinogenic food additive to be avoided or harmless antioxidant important to protect food supply <https://doi.org/10.1016/j.yrtph.2021.104887>.



REPORT ON PFNDAI ANNUAL SEMINAR ON ACHIEVING WHOLESOME NUTRITION THROUGH SUPPLEMENTATION



Held on 12th September 2025
at Hotel Orchid, Mumbai.

By
Ms Anuja Padte,
Food Scientist, PFNDAI

Marico Ltd, and Dabur India Ltd. The event also featured stall sponsorship from Hexagon Nutrition.

Ms Simran Vichare,
Nutritionist at PFNDAI, expertly hosted the seminar, gracefully introducing all the speakers and panelists for the event.



Dr. Shashank Bhalkar,
Executive Director PFNDAI, in his welcome address, noted that the rise in lifestyle diseases was linked to rapid urbanization, sedentary habits, and less home-cooked food—a global issue. He highlighted that post-COVID, increased awareness from various campaigns had driven the growth of the nutraceutical and functional



foods market, with diverse products gaining popularity. While the government regulated the industry for consumer protection, innovators faced the challenge of developing appealing, compliant products, as consumers increasingly demanded proof of efficacy and safety. He welcomed all the dignitaries for the session and thanked all the sponsors for their support of the seminar.

Dr Shatadru Sengupta,
Chairman PFNDAI mentioned that he was delighted to welcome all the esteemed dignitaries and attendees to this seminar, and he specially appreciated the students whose enthusiasm for the webinar was inspiring. It was clear that a significant challenge facing our nation was



On September 12th, 2025, the Protein Foods & Nutrition Development Association of India (PFNDAI) organized a significant seminar titled “Achieving Wholesome Nutrition Through Diet Supplementation”. This seminar aimed to highlight key developments in the nutraceutical industry while encouraging insightful discussions on its role in shaping the future of nutrition. The Sponsors for the seminar were Amway India, Enterprises Pvt Ltd, Herbalife International India Pvt Ltd, Marico Ltd, SK Biobiz Foodtech Pvt Ltd, Nutricircle Ltd, CLAIMS Pvt Ltd, Hardcastle Restaurants Pvt Ltd. The gifting partners for the seminar were Nestle India Ltd, Mother dairy Fruit and Vegetable Pvt Ltd,

widespread nutritional deficiency across various age groups and economic strata, and while a balanced diet was the ideal remedy, factors like hurried lifestyles, economic constraints, and lack of awareness made it hard to achieve. It was in this crucial, real-world scenario that dietary supplements, when used judiciously, became an important tool for better human health by bridging the gap left by the average diet. Your Association, PFNDAI, was committed to advancing the science in this ever-evolving area of dietary supplements, and we organized this seminar to spread knowledge among our members and the wider public; He was confident that the valuable insights from our eminent speakers would enrich our understanding of this important domain, and he

wished the seminar great success.

Mr. Arun Kelkar, Founder & Chairman of Hexagon Nutrition Pvt Ltd, gave his Keynote Address, emphasizing that the seminar on "Achieving Wholesome Nutrition" celebrated their shared mission to improve health in India. He highlighted the contrast between the nation's economic growth and persistent malnutrition challenges. This, he stressed, made PFNDAI a vital movement that acts as a bridge for science and a voice for the fundamental role of nutrition. Recognizing the attendees as the custodians of India's nutrition future, he concluded by urging them to



look forward with renewed energy and offered his Best Wishes for Poshan Maah.

Before the technical session commenced, several distinguished individuals were recognized for their long-standing service as **Members Emeritus** of the PFNDAI. The honoured members included **Dr. G. M. Tewari**, **Mr. Arun Kelkar**, **Mr. Jaypal Sakhavalkar**, **Mr. Bhupinder Singh**, and **Mr. Nikhil Kamat**. **Dr. J. I. Lewis** and **Mr. R. D. Shenoy** were also honoured but couldn't attend the program as they were out of station. They were felicitated as the first group to receive this new title, which the PFNDAI grants to members who have served a total of **15 years on the Governing Board**, in recognition of their significant contributions to the association.



Session I of the seminar was titled "Driving Innovation, Quality and Efficacy of the products while meeting emerging consumer expectations."

The 1st speaker for the session was Mrs. P.

Meena, CTO of CLAIMS. Pvt Ltd. delivered a presentation on the Role of Claim Substantiation in Building Consumer Trust. She opened by defining claim substantiation as the process of proving that an advertised product claim is TRUE by providing scientific evidence or data. The core message highlighted that today's consumers are highly informed, actively demanding transparency, and carefully reviewing product labels, noting that misleading claims are a major factor that can erode trust. Mrs. Meena outlined a strategy for building consumer trust, which involved translating complex science into consumer-friendly language, avoiding overpromising in marketing, and using third-party certification to add credibility. Furthermore, the presentation addressed the challenge of claims being challenged by regulators, consumers, and competitors, underscoring the critical need for companies to invest in designing and conducting robust scientific studies to



proactively validate their claims.

Dr. Palaniyamma Durairaj, a Senior Manager of Clinical Affairs and Nutrition at Amway Global Services India Pvt

Ltd., presented on "Evidence-Based Nutraceuticals for Improved Outcomes" which highlighted the rising impact of food supplements, noting that their market is expanding rapidly and their nutritional effects and health benefits are gaining importance in healthcare. Dr. Durairaj defined nutraceuticals as food-derived components that provide health benefits beyond basic nutrition, including disease prevention and therapy support. She also shared a striking statistic, mentioning that more than 5 billion people worldwide do not consume enough essential nutrients like iodine, Vitamin E, and calcium. The discussion emphasized the critical importance of scientific evidence in nutraceutical development, stressing the need for rigorous clinical trial guidelines and validated methods to ensure efficacy and safety. Finally, she explored future trends in the field, such as personalized nutrition, the use of advanced delivery technologies, and a focus on



sustainable innovation.

Dr. V Nagalakshmi, Managing Director at IMIS Pharmaceuticals, delivered a presentation titled

"Ayurveda Meets Innovation: Bridging Ancient Wisdom and Modern

Nutraceutical Science." She began by exploring the intersection of these two fields, first providing modern definitions of nutraceuticals from bodies like the American Nutraceutical Association and FSSAI. She then explained that Ayurveda has long encompassed concepts akin to modern nutraceuticals, citing examples such as 'Rasayana' (which involves nutrition at a microcellular level), 'Ritucharya' (a seasonal dietary regimen), and 'Pathya' (foods specifically beneficial to the body). To demonstrate this bridge between ancient and modern, the presentation gave examples of how traditional Ayurvedic knowledge is being modernized into consumer-friendly nutraceuticals and functional foods, showcasing products like Giloy immunity gummies and Chyawanprash cookies. She concluded the talk mentioning that while a direct correlation between modern nutraceuticals





Panelists

and Ayurvedic systems isn't perfectly feasible, Ayurveda inherently encompasses the principles of nutraceuticals, having recognized the therapeutic potential of certain foods and herbs for centuries.

The session II was **Panel Discussion** on "Regulatory Landscape: Balancing Innovation and Compliance in alignment with Global best practices in the Sector," which was moderated by **Dr. Sonal Shidhore**, an accomplished Regulatory Affairs Leader. The panel featured key industry experts, including **Ms. Nirupama Sharma**, Lead – Regulatory Policy Advocacy & Scientific Credibility Amway India, **Ms. Dipti Saudagar**, Director -S.K. Biobiz, **Mr. Yogish BT** Senior Manager - Global Regulatory Affairs, Herbalife International India, **Mr. Vikramsinha Deshmukh** Head Quality Assurance, Nutrition & Nutraceuticals Dr Reddy's Laboratories, and **Mr. Vikas Talwar**, Associate Director & Lead – Regulatory Affairs Kenvue. The discussion

covered a broad spectrum of challenges and opportunities in the nutraceutical space, starting with how to bridge gaps between India's evolving regulatory framework and global best practices. Major talking points addressed the regulatory hurdles facing clinical research and science-based innovations and how regulators can balance ensuring safety without restricting the speed of innovation. Panelists also explored consumer-facing issues, such as whether consumers have enough awareness to drive informed choices and what truly drives consumer trust—Regulatory approval, Brand reputation, or Clinical evidence. A significant policy question was raised regarding the potential switch of nutraceutical regulation from the Food Authority (FSSAI) to the Drug Authority (CDSCO). Further discussion covered the challenges innovators face with new ingredients under current FSSAI rules, the role of industry

associations in shaping an innovation-friendly environment, the possibility of adopting global regulatory reforms, and fostering a collaborative approach between industry and authorities to promote ease of doing business. The panel also touched upon the adequacy of current labelling and health claim regulations, the opportunity presented by aligning with Codex Alimentarius standards for global trade, and the need for FBOs to adopt self-regulation models.

Technical Session III was on the topic Role of Community Engagement

Dr. Ashutosh Mittal, Director of the Centre of Excellence, Quality Control, Herbalife India spoke on "Authentication methods for Botanical in Ingredients (Extracts/Powder) and Dietary supplements". The presentation highlighted



the commercial importance of botanicals, noting that the Indian market for plant extracts was valued at approximately US \$56.6 million in 2019. The speaker emphasized that a major supplement company maintained a global network of quality control labs and employed over 300 scientists to ensure product integrity. The core of the talk focused on the three major challenges in botanical authentication: lack of scientific validation, absence of toxicology data, and the risk of adulterants. To address this, a company's approach to quality assurance was detailed, featuring a dedicated scientific team and a rigorous multi-pronged strategy. The presentation concluded by stressing that ensuring the authenticity of botanicals requires a combination of advanced analytical techniques (like genomic profiling) and sustained international collaboration.

Ms. Arohi

Bapna, Head of Scientific and Clinical Affairs at Zyudus Wellness Products Limited,

presented on the "**Role of Informed Choice and Consumer Awareness in Meeting Nutritional Goals.**"

She defined Informed Choice as decisions based on accurate information and



Consumer Awareness as understanding labels and health impacts. Ms. Bapna noted the high prevalence of obesity and overweight in India, suggesting that poor choices often stem from an inability to apply nutritional knowledge. She stressed the essential principles of labelling: transparency, standardization, and a scientific basis for claims. Her outlook involved leveraging digital tools and smart packaging to provide real-time nutritional information, ultimately empowering consumers for better health outcomes.

Dr. K. U.

Methekar, Joint Director of FSSAI WR, presented on "**Ethical Influencer Marketing for Enabling Informed Choices**".

He began by defining Influencer Marketing as individuals with strong audience connections promoting products or messages across online platforms. The presentation emphasised the significant impact influencers have on consumer decisions, noting that a large percentage of people use social media for purchasing advice and trust influencer recommendations. He highlighted the positive role influencers can play in empowering consumers by creating educational content and promoting



critical thinking about food and products. Crucially, the talk stressed the non-negotiable ethical considerations, specifically: credibility, transparency, social responsibility, and regulatory compliance. He concluded with a powerful message: Food safety is everyone's responsibility, and both influencers and the companies they partner with must fully abide by governing laws and ethical duties.

Dr. Malathy Venkatesan, UPF Coordinator for PFNDAI, concluded the event by summarizing the key takeaways. She



highlighted the value of the informative talks on food product claims and the critical role of evidence in nutraceuticals and health supplements for both consumers and product development. Insights were shared on Ayurveda-based food choices, emphasizing the importance of time, season, quantity, and ingredients. While the panel discussion was highly valuable, she noted the sole challenge was the lack of government representation. Other sessions addressed the necessity of testing and authenticating herbal materials and focused on consumer awareness and nutritional choices.



PFNDAI Staff and Volunteers



Speakers



Speakers

Dr. Methekar's discussion pointed out that modern consumers are heavily influenced by influencers, many of whom need a stronger scientific foundation for their views. Ultimately, Dr. Venkatesan proposed that PFNDAI is uniquely positioned to be

the vital connection point to address these complex challenges, protecting both industry and consumer interests.

At the close of the seminar, Ms. Anuja Padte, Food Scientist delivered a heartfelt

vote of thanks. She expressed gratitude to all the sponsors, speakers, panelists, delegates, and the PFNDAI team members and volunteers for their invaluable contributions in making the event a resounding success.





Dr Malathy



Ms Deulgaonkar



Mr Swarn



DELEGATES

REGULATORY ROUND UP



AUTHOR
Dr Shashank Bhalkar,
 Executive Director, PFNDAI
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Dear Readers,

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

[Introduction of new Kind of Business \(KoB\) for Ayurveda Ahara under FoSCoS for License/Registration](#) : Food authority notified the final regulation FSS (Ayurveda Ahara) Regulations 2022. To

facilitate the registration/ license for such products, a new kind of business (KOB) “Ayurveda Ahara” is introduced. Various requirements, such as the KOB name and definition of the food, are described.

This KOB will require central licensing fees of Rs. 7500/- plus GST. Ayurveda Foods have been assigned the Food Category 102.

The inspection checklist and documents required will be the same as those for the

“General Manufacturing” category.

Food Category 102 is open for Registration/State License/ Central License based on the existing license criteria and has come into effect from 01/09/2025.

[Validity Order of FSSAI notified Food Testing laboratories as on 1st July 2025](#) : This order provides the latest list of FSSAI-approved laboratories with validity of their accreditation as on 01.09.2025.

RESEARCH IN HEALTH & NUTRITION

Probiotics Show Promise for Improving Cognitive Function

Probiotics could become a key tool in managing cognitive decline, according to a new systematic review and meta-analysis.

The article by Cheryl Marie Tay presents findings from a systematic review and meta-analysis conducted by researchers at Henan University, China, which evaluated the impact of probiotic supplementation on cognitive function in individuals with cognitive impairment. Drawing from ten randomized controlled trials involving 778 participants, the study found a statistically significant

improvement in cognitive outcomes among those receiving probiotics compared to placebo.

The most pronounced effects were observed in trials using the Mini-Mental State Examination (MMSE), with a standardized mean difference (SMD) of 0.88. Single-strain probiotics outperformed multi-strain formulations (SMD of 0.81), and interventions lasting 12 weeks or less yielded the strongest results (SMD of 0.61). Longer durations showed diminished efficacy, raising questions about the sustainability of benefits over time.

These findings reinforce the therapeutic relevance of the gut-brain axis, a bidirectional

communication system linking gut microbiota with brain function through neural, hormonal, and immune pathways. Probiotics may modulate this axis by reducing inflammation, regulating neurotransmitters, and enhancing neural signalling—mechanisms implicated in neurodegenerative conditions such as Alzheimer's disease.

From a market perspective, the findings could catalyse growth in cognitive health-focused probiotic products, especially given the projected global rise in dementia cases. However, regulatory frameworks remain underdeveloped. While ISAPP recommends a minimum of one billion CFUs daily, no official standards exist for cognitive health claims, placing the onus on manufacturers to substantiate efficacy through robust clinical data.

<https://www.nutraingredients-asia.com/Article/2025/06/02/probiotics-show-promise-for-improving-cognitive-function-says-china-meta-analysis/>

B12 Discovery Fuels 'Food as Medicine' Trend

Sales of foods and beverages rich in B12 look set to surge as research uncovers new health benefits. The 'food as medicine' trend is changing the way consumers view the entire food and beverage industry.

It's fuelling sales of food and beverage products believed to promote health and wellbeing. What's more it's dominating the health and wellness conversation, with thousands of

related posts on TikTok, Instagram and X. Now, research on the role of vitamin B12 in the potential prevention and cure of acute pancreatitis, looks set to boost this megatrend.

The trend, which emphasizes the therapeutic potential of everyday foods, is gaining traction across consumer platforms and social media, particularly as new scientific findings link specific nutrients to disease prevention and management.

The catalyst for renewed interest in B12 is a study led by Dr. Chuanwen Fan and Professor Dr. Xianming Mo at Sichuan

University, investigating its role in acute pancreatitis—a severe gastrointestinal condition responsible for significant global hospital admissions. Using genome-wide association studies and Mendelian randomization, the researchers found a strong inverse correlation between serum B12 levels and pancreatitis risk. Experimental models in CD320 knockout mice, which lack the gene for B12 absorption, revealed that B12 supplementation protected pancreatic acinar cells from necrosis, reduced T lymphocyte infiltration, and enhanced ATP production—key mechanisms in

mitigating disease progression and promoting tissue repair.

Vitamin B12, or cobalamin, is essential for DNA synthesis, amino acid metabolism, and neurological function. It is naturally abundant in animal-derived foods such as red meat, poultry, seafood, dairy, and eggs. The study's implications could drive increased consumer demand for these foods, as well as fortified products—especially among vegans, who rely on supplementation or fortified

alternatives due to dietary restrictions.

This aligns with broader innovation and NPD strategies in the fortified foods market, which is currently valued at \$184.69 billion and projected to reach \$303.42 billion by 2032. Manufacturers are reformulating products to meet consumer demand for targeted health benefits, positioning B12-rich and fortified offerings as part of a proactive approach to wellness and disease

prevention.

The findings not only reinforce the clinical relevance of B12 but also exemplify how nutrient science is reshaping consumer behaviour, product development, and health communication in the food and beverage industry.

<https://www.foodnavigator-usa.com/Article/2025/06/02/b12-pancreatitis-discovery-fuels-food-as-medicine-trend/>

Forget Calcium: Milk Alternatives Have Bigger Nutritional Gaps to Fill

Protein and calcium are important, but ignoring fortification with riboflavin, iron and other key nutrients could spell real health woes for consumers. This is the takeaway from a new study conducted by University of Melbourne researchers, who modelled the health impact of consuming plant-based milk alternatives instead of dairy milk.

The University of Melbourne's dietary modelling study underscores a critical oversight in the nutritional equivalency of plant-based milk alternatives (PBMLs) to dairy milk. While calcium fortification has been the regulatory benchmark in Australia—requiring 100 mg per 100 ml for PBMLs to be deemed suitable—this narrow focus

neglects the broader nutrient profile of dairy, which naturally provides 13 essential nutrients.

The study reveals that most PBMLs sold in Australian supermarkets lack fortification with riboflavin (vitamin B2), vitamin B12, and iodine. These deficiencies are not trivial. Replacing dairy milk with unfortified PBMLs could result in significant nutritional shortfalls across various demographics. For instance, riboflavin deficiency could affect 31% of older women, compared to 20% among dairy consumers. Vitamin B12 inadequacy could rise to 11–17% among women aged 14+, and iodine deficiency could affect up to 16% of females—both substantially higher than among dairy consumers.

Protein content, while generally lower in PBMLs (except soy), was found to be a less critical concern for most of the population, though older adults may still be at risk of

inadequate intake. The study's findings are particularly concerning for females of childbearing age, where vitamin B12 plays a vital role in fetal neural development. Inadequate intake during pregnancy has been linked to developmental anomalies and low birth weight.

This research calls for a reassessment of fortification standards and public health guidance. It highlights the need for comprehensive nutrient profiling and mandatory fortification of PBMLs beyond calcium—especially with riboflavin, vitamin B12, and iodine—to ensure safe substitution for dairy milk. The findings also suggest that consumer education and clearer labelling are essential to prevent unintended nutritional deficits as plant-based consumption continues to rise.

<https://www.nutraingredients-asia.com/Article/2025/06/02/low-protein-in-plant-based-milks-has-minor-effect-on-health/>

How To Stem the Tide of Nutrition Misinformation on Social Media

More and more consumers turn to social media for tips and hacks on nutrition: and the advice they get is not always good. How can nutrition misinformation be addressed?

Social media is now one of the most prominent forces shaping the nutrition space. And yet the topic is anything but simple. Enter influencers, who take the complex subject and package it up into one-size-fits-all,

easily-digestible hacks. At best, well-intentioned tips can mislead consumers.

The report “Nutrition Misinformation in the Digital Age” presents a sobering view of how social media platforms have become fertile ground for dietary disinformation. With only 2.1% of nutrition content aligning with public health guidelines, the scale of misinformation is compounded by influencers who leverage emotional storytelling, perceived authority, and aspirational aesthetics to promote oversimplified and often misleading dietary advice.

Three dominant influencer archetypes—The Doc, The Rebel, and The Hustler—each deploy distinct messaging strategies that blur the line between personal branding and public health communication.

These personalities frequently promote carnivore diets, low-carb regimens, and generalized health claims, often tied to supplement sales. Over 90% of the accounts studied disseminated content spanning multiple misinformation themes, amplifying their reach and impact.

The erosion of trust in qualified health professionals—evidenced by 1 in 5 Americans placing more faith in influencers than local practitioners—further complicates the public health landscape. The report emphasizes that misinformation, whether intentional or not, undermines evidence-based dietary practices and can lead to harmful outcomes, particularly when restrictive diets or unverified supplements are involved.

To counter this, the authors

advocate for early nutrition education embedded in school curricula, coupled with digital literacy training to help young people critically evaluate online content. They also call for a shift in public health messaging—moving away from top-down communication toward emotionally resonant engagement by credentialed professionals on social platforms. Finally, stricter scrutiny of commercial claims cloaked in medical authority is deemed essential to curbing the spread of misleading content.

This analysis highlights the urgency of integrating scientific rigor with culturally attuned communication strategies to safeguard nutritional integrity in the digital age.

<https://www.foodnavigator-usa.com/Article/2025/06/03/influencers-social-media-and-nutrition-misinformation/>

Why Ultra-Processed Foods Aren't the Real Villain Behind Overeating

Researchers from Leeds found that overeating is driven more by what people believe about food than by its actual ingredients or level of processing. Foods perceived as fatty, sweet, or highly processed were more likely to trigger indulgence.

Surprisingly, the “ultra-processed” label explained almost none of the difference in overeating behaviour. The findings suggest that perception and psychology may be more important than packaging or processing.

Ultra-processed foods (UPFs) have become public enemy number one in nutrition debates. From dementia to obesity and an epidemic of “food addiction,” these factory-made products, including crisps, ready meals, fizzy drinks and packaged snacks, are blamed for a wide range of modern health problems. Some experts argue that they’re “specifically formulated and aggressively marketed to maximise consumption and corporate profits,” hijacking our brain’s reward systems to make us eat beyond our needs. Policymakers have proposed bold interventions: warning labels, marketing restrictions, taxes, even outright bans near schools. But how much of this urgency is based on solid evidence?

The article challenges the prevailing narrative that ultra-processed foods (UPFs) are the primary cause of overeating. Researchers from the University of Leeds conducted studies involving over 3,000 UK adults who rated more than 400 common foods based on how much they liked them and how likely they were to overeat them. The foods ranged from apples and jacket potatoes to custard creams and cottage pie.

The study distinguished between “liking” a food (based on taste) and “hedonic overeating” (eating for pleasure beyond hunger). While calorie-dense foods were more likely to be overconsumed, the most significant insight was the role of perception.

People were more likely to overeat foods they believed to be sweet, fatty, or highly processed, regardless of their actual nutritional content. Conversely, foods perceived as bitter or high in fibre were less likely to trigger overeating.

By combining nutrient data with beliefs about sensory qualities, the researchers could predict 78% of the variation in overeating behaviour—41% from nutrient content and 38% from perception. In contrast, the Nova classification system, which categorizes foods by processing level, explained less

than 2% of variation in liking and only 4% in overeating. This suggests that the UPF label is a weak predictor of eating behaviour.

The authors argue that the UPF label oversimplifies the issue, grouping together nutritionally diverse items such as sugary drinks and fortified cereals. While some UPFs are calorie-dense and easy to overconsume, others may be beneficial for specific populations, such as older adults or those with dietary restrictions. The study emphasizes that people eat

based on taste, emotional needs, and personal goals—not just labels or processing levels.

Ultimately, the findings highlight that psychological and sensory factors play a more significant role in overeating than the degree of food processing. Demonizing UPFs as a category may mislead consumers and policymakers, obscuring the more complex drivers of eating behaviour.

<https://www.sciencedaily.com/releases/2025/10/251005085625.htm>



Researchers found that omega-3 fatty acids may help protect against myopia, while saturated fats may increase risk. Kids with more omega-3 in their diet had healthier eye measurements linked to slower vision deterioration. In contrast, those with high saturated fat intake showed worse outcomes.

This study, published in the British Journal of Ophthalmology and summarized by BMJ Group, investigates the relationship between dietary fat intake and the development of near-sightedness (myopia) in children. Drawing on data from 1,005 Chinese children aged 6 to 8 years, recruited through the Hong Kong Children Eye Study, researchers assessed both dietary patterns and ocular measurements to

explore potential nutritional risk factors for myopia.

The children's diets were evaluated using a comprehensive food frequency questionnaire covering 280 items across ten food categories. Nutrient intake—including omega-3 polyunsaturated fatty acids (PUFAs), saturated fats, and other macronutrients—was calculated alongside lifestyle factors such as screen time, outdoor activity, and parental history of myopia.

Approximately 27.5% of the children were found to have myopia. The study revealed that higher dietary intake of omega-3 fatty acids was significantly associated with healthier eye metrics: shorter axial length (a key indicator of myopia progression) and lower cycloplegic spherical equivalent (SE), which reflects the degree of refractive error. In contrast, children with the highest intake of saturated fats exhibited longer axial lengths and higher SE values, suggesting a greater risk of myopia.

No other nutrients showed a significant association with either axial length or SE. The researchers propose that omega-3 fatty acids may exert a protective effect by enhancing blood flow through the choroid, thereby preventing scleral hypoxia—a condition linked to the development of myopia.

While the findings are compelling, the study is observational and relies on self-reported dietary data, which introduces limitations in accuracy and causality. Moreover, the high prevalence of myopia in Hong Kong may limit generalizability to other populations with different genetic and environmental profiles.

Nonetheless, the study provides human evidence supporting a link between omega-3 intake and reduced risk of myopia, positioning these fatty acids as a potentially beneficial dietary factor in pediatric eye health.

<https://www.sciencedaily.com/releases/2025/09/250907172653.htm>

Eating Meat May Protect Against Cancer, Landmark Research Shows

A large study found no link between eating animal protein and higher death risk.

Surprisingly, higher animal protein intake was associated with lower cancer mortality, supporting its role in a balanced, health-promoting diet. Eating animal-sourced protein foods is not linked to a higher risk of death and may even offer protective benefits against cancer-related mortality, new research finds.

This study, conducted by researchers at McMaster University and published in *Applied Physiology, Nutrition, and Metabolism*, analysed data from nearly 16,000 adults aged 19 and older using the NHANES III dataset to investigate the relationship between protein

intake and mortality risk. Contrary to common concerns, the findings revealed no association between higher consumption of animal protein and increased risk of death from any cause, including cardiovascular disease and cancer. In fact, individuals with higher animal protein intake showed a modest but statistically significant reduction in cancer-related mortality.

To ensure accuracy, the researchers employed advanced statistical techniques such as the National Cancer Institute method and multivariate Markov Chain Monte Carlo modelling. These approaches allowed for more precise estimates of long-term dietary patterns and minimized errors due to daily intake fluctuations.

The analysis showed that

neither total protein intake nor plant protein intake was linked to increased mortality risk. While plant protein had minimal impact on cancer outcomes, animal protein appeared to offer a small protective effect. The consistency of these results across different models strengthens the reliability of the findings.

Although observational studies cannot establish causality, the results align with existing clinical trial evidence suggesting that both animal and plant proteins can contribute to a health-promoting diet. The study underscores the importance of evaluating dietary patterns through rigorous methodology and cautions against oversimplified narratives that demonize specific food groups without robust evidence.

<https://www.sciencedaily.com/releases/2025/08/250825015640.htm>

Opting For Plant-Based Foods Instead of Animal Products Leads to Weight Loss, Reduction in Hot Flashes in Postmenopausal Women

This study from the Physicians Committee for Responsible Medicine, published in *Menopause*, offers compelling evidence that a low-fat vegan diet—particularly one incorporating soybeans—can significantly reduce both body weight and the severity of hot flashes in postmenopausal women. What's especially striking is that the benefits were observed regardless of whether the plant-based foods were unprocessed or ultra-processed.

The intervention group, which consumed a daily half-cup of cooked soybeans and avoided all animal products, saw a 92% reduction in severe hot flashes and lost an average of 3.6 kg over 12 weeks. In contrast, the control group—who maintained their usual diets—experienced negligible changes. The dietary records were analysed using the NOVA classification system, which stratifies foods by processing level. Interestingly, while reductions in animal product consumption (across all NOVA categories) correlated with health improvements, the processing level of plant-based foods did not influence outcomes. This suggests that the shift toward plant-based eating itself—rather than the degree of processing—is the primary driver of benefit.

From a regulatory and consumer trend perspective, this study challenges the conventional dichotomy between “whole” and “processed” plant foods in health narratives. It also reinforces the therapeutic potential of soy, which has long been studied for its phytoestrogenic effects in menopausal symptom management. The inclusion of ultra-processed vegan items like soy milk and meat alternatives—often criticized in clean-label discourse—adds nuance to the conversation around food processing and health outcomes.

<https://www.pcrm.org/news/new-s-releases/optiming-plant-based-foods-instead-animal-products-leads-weight-loss-reduction-hot>

Snackification Trend Changing How People Eat

The article by Donna Eastlake explores the rising phenomenon of “snackification,” a shift in consumer eating habits, where traditional three-meal structures are increasingly replaced by frequent, smaller eating occasions throughout the day.

The global snacking industry, valued at \$269.45 billion in 2025, is projected to grow at a CAGR of 6.2% through 2030. A 2024 survey by the International Food Information Council revealed that 56% of respondents now substitute meals with snacks, and 73% snack at least once daily.

This trend is largely driven by convenience, as fast-paced lifestyles prompt consumers to seek quick, portable food options. Additionally, the availability of healthier snack choices has made it easier for individuals to maintain nutritional goals without relying on traditional meal formats. Many consumers report improved energy levels and reduced post-meal fatigue

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when eating smaller portions more frequently. BBC data indicates that 20% of people experience tiredness after consuming large meals.

Snacking preferences vary by age group. Children tend to favour sweet items like cookies and cakes, while adults gravitate toward health-oriented options such as fruits, nuts, and yogurts. This demographic segmentation is critical for brands aiming to tailor products to specific consumer needs.

The snackification trend is fuelling innovation and new product development across the food and beverage sector. As snacking becomes a primary mode of consumption, opportunities arise across all dayparts. However, the health and wellness movement is influencing consumer expectations, with increasing demand for snacks that balance taste with nutritional value. Products high in protein, fibre,

and natural ingredients are gaining popularity, and Mintel research shows that 45% of consumers are willing to pay more for snacks with healthier ingredients.

Private label brands are rapidly gaining market share in the snacking category. Retailers are leveraging consumer data to develop targeted offerings—such as gluten-free, organic, and vegan snacks—at competitive price points. The quality of private label products has improved significantly, leading many consumers to view them as equal or superior to national brands. This strategic use of data and targeted innovation is helping private labels attract a broader customer base and foster brand loyalty in an increasingly competitive market.

<https://www.foodnavigator.com/Article/2025/05/30/snackification-trend-changing-how-people-eat/>

5 Ingredients Powering the High-Protein Craze

Protein is popping up in everything. Which ingredients promise to further propel this powerful trend? The high-protein food and drink trend is booming.

Once the domain of bodybuilders and gym-goers,

protein-packed products have now hit the mainstream. The movement shows no signs of slowing. Today, it's easy to find bars, breakfast cereals, and even bottled water products making the high-protein claim.

According to analyst firm, the high-protein product market will grow \$50.2bn (€44.2bn) between 2023 and 2028. Traditionally, high-protein food and drink makers have leant heavily on whey, a byproduct of the cheese and yogurt-making

process. But as consumer demand evolves, innovators are exploring new ingredients to elevate everyday food and drink into functional, protein-rich alternatives.

The high-protein trend is undergoing a notable transformation, driven by a diversification of ingredients that extend beyond traditional sources like whey. Emerging and reimagined protein inputs are reshaping functional food and beverage innovation,

with sustainability, digestibility, and sensory appeal playing increasingly central roles.

Microalgae, particularly spirulina and chlorella, are gaining traction due to their exceptionally high protein content—up to 70%—and complete amino acid profiles. Their minimal land and water requirements position them as a sustainable alternative to conventional proteins. Macroalgae, or seaweed, also contribute significantly, with dry weight protein levels comparable to animal-derived sources. These aquatic proteins are being incorporated into diverse formats, from pasta and cheese to beverages and soups.

Mycoprotein, derived from fermented mycelia, offers a compelling combination of umami flavour, fibre density, and low environmental impact. Despite market challenges faced by legacy players like Quorn, newer entrants are

innovating with hybrid formulations, such as oat-mycelia blends, to enhance nutritional and sensory profiles. The global market is projected to nearly double by 2035, reflecting continued interest in fungi-based proteins.

Collagen, traditionally associated with beauty and joint health, is now being integrated into mainstream food and beverage categories. Its expansion into formats like granola, nut butters, and functional waters reflects a shift toward multifunctional wellness. While most collagen is animal-derived, cultivated and plant-based alternatives are emerging, potentially broadening its appeal across dietary preferences.

Duckweed, or water lentils, represents a novel entrant recently approved for consumption in Europe. With up to 43% protein and sixfold productivity over soy per hectare, it offers a compelling

sustainability narrative. Its versatility in soups, stews, and meat analogues makes it a candidate for broader adoption, especially in regions with limited arable land.

Soy and pea protein remain foundational to the high-protein category, particularly in powders, alt-meats, and baked goods. However, flavour challenges persist, prompting ongoing work in clean-label masking technologies. Investment in infrastructure, underscores the continued commercial relevance of these ingredients. Together, these five ingredients reflect a convergence of nutritional science, environmental stewardship, and consumer-driven innovation, signalling a more inclusive and resilient future for protein-rich food systems.

<https://www.foodnavigator-asia.com/Article/2025/06/02/which-functional-proteins-are-used-in-food-and-drink/>

Scientists Create More Stable Microparticles to Unlock Iron-Fortified Foods

US researchers have developed a new way to fortify foods and beverages with iron using crystalline microparticles — structures that combine the mineral with organic molecules for improved stability.

These can be sprinkled on food and added to staple foods like bread or drinks like coffee and tea. The particles could also be adapted to carry other critical minerals, such as zinc, calcium, or magnesium.

The Massachusetts Institute of

Technology (MIT) scientists believe their solution can help fight malnutrition, as around two billion people worldwide suffer from iron deficiency. This condition can lead to anemia, impaired brain development in children, and increased infant mortality.

Traditional fortification methods, such as polymer encapsulation, improve iron stability but add bulk, limiting dosage and versatility. The new MOF approach circumvents this by allowing high nutrient loading without compromising taste or texture, making it suitable for diverse staples—from bread to coffee.

This MIT-led study introduces a

breakthrough in micronutrient fortification by developing crystalline microparticles that stabilize iron and iodine for seamless integration into everyday foods and beverages. These metal-organic frameworks (MOFs), built from iron and food-grade fumaric acid, offer a porous, rigid structure that protects the mineral from degradation and unwanted reactions—particularly with polyphenols—until it reaches the stomach's acidic environment, where it releases its payload.

The innovation extends to dual-nutrient delivery. By incorporating iodine into the same framework, researchers

overcame the challenge of iron-iodine reactivity, enabling the development of double-fortified salts. These particles demonstrated resilience under harsh conditions—heat, humidity, and boiling—and were rapidly absorbed in animal models, confirming

bioavailability.

This platform could be adapted to other essential minerals like zinc, calcium, and magnesium, offering scalable solutions for malnutrition, especially in regions with limited access to fortified foods. The team plans

to commercialize the technology through fortified beverages and salts, potentially transforming global nutrition strategies with a modular, food-compatible delivery system.

<https://www.nutritioninsight.com/news/iron-iodine-deficiency-food-fortification-particles.html>

Cow milk vs. fermented dairy: Experts find differences in bacteria and protein diversity

The nutrition industry is milking the rise of sustainable dairy alternatives based on yeast fermentation, but a new US study led by University of Nevada, Reno, researchers question how similar they are. The results reveal differences between cow whey protein and its bio-manufactured counterpart, including variances in microbial diversity.

The study reveals that while both versions share a core protein component, the fermentation-based option has fewer types of protein and different sugar structures, known as N-glycans, which may affect how the proteins interact with gut bacteria.

This study published in Microbiology Spectrum, offers a compelling molecular and microbiological comparison between traditional cow's milk whey protein and its fermentation-derived

counterpart produced via genetically modified yeast. While both share β -lactoglobulin as their dominant protein, the cow's milk whey contains a broader spectrum of proteins—including α -lactalbumin, albumin, and casein—whereas the synthetic version is nearly 98% β -lactoglobulin, indicating significantly lower protein diversity.

The researchers also uncovered structural differences in sugar molecules (N-glycans) attached to these proteins. These post-translational modifications, which influence how proteins interact with gut microbes, were more varied and complex in cow's milk whey. In contrast, the yeast-derived proteins had fewer and structurally distinct glycans, potentially altering their biological behavior. Using a fecal fermentation model to simulate digestion, the team found that cow's milk whey consistently fostered a more diverse and beneficial gut microbiota across samples. The synthetic whey, while not necessarily harmful, led to reduced microbial diversity. This

suggests that despite functional and sensory similarities, the two protein sources are not biologically interchangeable.

The findings are particularly relevant as fermentation-based dairy alternatives gain traction for their sustainability benefits—lower resource use and absence of hormones or antibiotics. However, the study urges caution in equating these alternatives with traditional dairy, especially when considering their impact on gut health and nutrient interactions.

The research underscores the importance of evaluating novel proteins not just by their compositional similarity but by their functional and microbiome-modulating effects. As the food industry pivots toward precision nutrition and sustainable innovation, understanding these molecular nuances will be critical for informed product development and regulatory oversight.

<https://www.nutritioninsight.com/news/cow-milk-dairy-alternatives-fermentation-whey-protein.html>

WUR Study Shows Oil Palm Is the Most Land-Efficient Crop Despite Higher Emissions

Palm oil, one of the world's most traded vegetable oils, has

been a controversial food ingredient due to its links with deforestation and greenhouse gas (GHG) emissions. However, a new study by Wageningen University & Research (WUR) reveals that it significantly outperforms both soybean and rapeseed oils across critical

sustainability metrics such as efficiency and economic impact.

The findings highlight that palm oil remains the most land-efficient crop, with more than double the yield of soybean and rapeseed under ambitious

2040 scenarios. However, it leads to higher GHG emissions due to peatland cultivation and methane emissions from processing waste.

This Wageningen University & Research (WUR) study offers a nuanced reassessment of palm oil's sustainability profile, challenging its reputation as an environmentally damaging crop by highlighting its superior land-use efficiency and socio-economic contributions. While palm oil has long been criticized for its links to deforestation and greenhouse gas (GHG) emissions—particularly from peatland cultivation and methane from mill effluent—the study reveals that it significantly outperforms soybean and rapeseed oils in terms of yield, economic impact, and employment generation.

Under ambitious 2040 scenarios, oil palm yields reach 4.8 metric tons of crude oil per

hectare, compared to 3.1 for soybean and 2.6 for rapeseed. This productivity means that replacing palm oil with other vegetable oils would require substantially more land, potentially exacerbating land-use pressures. The study also accounts for co-products and by-products, allocating land use based on economic value, which further strengthens palm oil's efficiency metrics. The study also emphasizes palm oil's role in food security, especially in low-income regions where it helps close the "fat gap"—a dietary deficiency in energy-dense fats. Its affordability and availability make it a staple cooking oil, replacing more expensive alternatives like coconut oil.

To mitigate environmental concerns, the researchers advocate for targeted interventions: banning peatland use, capturing methane emissions, and enforcing

deforestation-free sourcing. The EU Deforestation Regulation (EUDR) is expected to drive compliance, though it may introduce monitoring costs. Still, the potential to generate carbon credits from reduced emissions could offset these expenses.

Ultimately, the study calls for a balanced view of sustainability—one that integrates environmental, social, and economic dimensions. It urges the downstream industry to implement innovations that reduce palm oil's environmental footprint while preserving its efficiency and developmental benefits. Properly managed, palm oil could remain a cornerstone of sustainable vegetable oil production.

<https://www.foodingredientsfirst.com/news/wur-palm-oil-efficiency-sustainability.html>

Scientists Unlock the Science Behind Cocoa Bean Fermentation for Improved Chocolate Flavour

Researchers at the University of Nottingham, UK, have identified important factors that influence the flavour of chocolate during the cocoa bean fermentation process, and have the potential to enhance and standardize the production of fine chocolate.

The study examines the relationship between temperature, pH levels, and microbial communities during cacao bean fermentation. The researchers identified specific microbial species and

metabolic processes linked to high-quality, fine-flavour chocolate by understanding how these factors interact.

This study published in *Nature Microbiology*, marks a significant advancement in decoding the microbial and environmental dynamics that shape chocolate flavour during cocoa bean fermentation. Traditionally, fermentation occurs spontaneously on farms, where harvested beans are piled in boxes or heaps and left to ferment under uncontrolled conditions. This variability leads to inconsistent flavor profiles across regions and harvests.

Led by Dr. David Gopaulchan, the research team examined how abiotic factors like temperature and pH, and biotic

factors such as microbial communities, interact to influence flavour development. They identified specific bacteria and fungi, along with their metabolic pathways, that are consistently associated with high-quality, fine-flavour chocolate. These findings allowed them to engineer a defined microbial consortium—a curated blend of microbes—that replicates the chemical reactions and sensory outcomes of traditional fermentations.

By partnering with Colombian farmers and replicating the fermentation process in a controlled lab setting, the team demonstrated that chocolate produced using this standardized microbial system matched the flavour complexity and reduced bitterness of

traditionally fermented beans. This breakthrough enables chocolate producers to rely on measurable parameters—such as microbial composition, temperature, and pH—to predict and control flavour outcomes.

The implications are profound:

cocoa fermentation could transition from a spontaneous, variable process to a precision-guided, reproducible technique akin to how starter cultures revolutionized beer, cheese, and yogurt production. This opens the door to consistent quality, novel flavour profiles, and enhanced traceability in

premium chocolate manufacturing. It also lays the foundation for a new era of data-driven, microbe-powered chocolate innovation.

<https://www.foodingredientsfirst.com/news/cocoa-bean-fermentation-chocolate-flavor.html>

Coffee And Fermentation: Scientists Harness Unripe Cherries to Reduce Waste

Researchers at the Federal University of Uberlândia (UFU) in Brazil have unveiled an innovative fermentation method that transforms unripe Arara coffee cherries into high-quality specialty coffee. This process could significantly impact coffee production by unlocking the potential of the immature fruits, traditionally discarded for their astringent taste.

The team used self-induced anaerobic fermentation to seal beans in bioreactors without oxygen for up to 96 hours, and created coffee beverages that scored above 80 points in blind tests, meeting the Specialty Coffee Association's standards.

This study introduces a transformative approach to coffee production by using self-induced anaerobic fermentation (SIAF) to convert unripe Arara coffee cherries—typically discarded due to their astringent

taste—into high-quality specialty coffee. The technique involves sealing cherries in oxygen-free bioreactors for up to 96 hours, allowing

naturally occurring microorganisms to metabolize the pulp and mucilage, producing flavour-enhancing compounds such as organic acids, esters, ketones, and alcohols.

Remarkably, the researchers used a mix of 70% unripe cherries and still achieved sensory scores above 80 points in blind tests, meeting the Specialty Coffee Association's standards. This challenges conventional assumptions that only optimally ripe cherries can yield premium coffee and opens new avenues for reducing waste and increasing value from harvests with uneven ripening.

Led by Professor Líbia Diniz Santos and her team—including master's researcher Luiza Manuela Alves Braga Cardoso—the project is part of the “From Seed to Cup” initiative, which focuses on post-harvest innovation in Brazil's Cerrado Mineiro region.

The group has also launched a specialty coffee brand, Porandu, named after the Tupi-Guarani word for “to research,” to showcase the practical applications of their findings.

The study emphasizes the importance of controlling fermentation variables such as temperature and time to optimize flavour outcomes. It also highlights the use of advanced tools like AI, IoT, and next-generation sequencing to monitor and refine fermentation processes.

Looking ahead, the team plans to expand their database, conduct longitudinal studies, and implement pilot projects across diverse regions in collaboration with NGOs, governments, and industry stakeholders. Their goal is to bridge academic research with actionable strategies that empower coffee producers to improve quality, reduce waste, and unlock new market opportunities—even when dealing with imperfect harvests.

<https://www.foodingredientsfirst.com/news/coffee-cherries-fermentation-waste-solution.html>

Scientists Unlock Liquorice Extract As “Natural Shield” To Prolong Poultry Meat Freshness

Extract from liquorice, traditionally used for its flavour in the food industry, can

effectively extend the shelf life of ready-to-eat (RTE) chicken breast while maintaining its quality, a study in China has revealed.

Hailed as a “natural shield,” the extract can curb the growth of spoilage bacteria, particularly *Paraclostridiumbifermentans*, which can lead to unpleasant odour, texture degradation, and reduced shelf life in RTE chicken.

This study from Nanjing Agricultural University presents a compelling case for liquorice extract as a natural preservative in ready-to-eat (RTE) poultry products, particularly chicken breast.

Traditionally valued for its flavour, liquorice is now being recognized for its potent antimicrobial properties—especially against *Paraclostridiumbifermentans*, a spoilage bacterium known to degrade texture and produce off-odours in meat.

Using microbiological assays and predictive mathematical

modelling, the researchers demonstrated that a 50 mg/mL concentration of liquorice extract could double the shelf life of RTE chicken stored at 15°C and 20°C.

This is especially significant given the high susceptibility of chicken breast to microbial contamination due to its protein and moisture content.

Beyond microbial control, liquorice extract also helped reduce fat oxidation and protein degradation, preserving the meat’s colour, texture, and overall sensory quality during extended storage.

These findings align with broader trends in meat science, where plant-based preservatives—such as artichoke leaf and moringa leaf extracts—are gaining traction as clean label alternatives to synthetic chemicals, which may carry toxicogenic or

carcinogenic risks.

The study’s predictive models offer practical tools for manufacturers to optimize storage conditions and establish microbial safety thresholds.

By integrating liquorice extract into commercial meat processing, producers can enhance product safety, reduce food waste, and appeal to health-conscious consumers seeking natural ingredients.

In essence, this research bridges traditional botanical knowledge with modern food safety science, offering a scalable, sustainable solution for improving the shelf life and quality of poultry products.

<https://www.foodingredientsfirst.com/news/scientists-unlock-licorice-extract-as-natural-shield-to-prolong-poultry-meat-freshness.html>

Cornell Scientists Develop Stable Algae-Based Blue Food Dye

Cornell University researchers have developed a blue food dye from an algae protein that is more stable than existing natural alternatives and could replace petroleum-based artificial colorants.

The findings, published July 24 in *Food Hydrocolloids*, describe a method to improve the stability and functionality of phycocyanin, a protein found in spirulina.

Phycocyanin is a natural blue pigment that can also serve as an emulsifier. According to doctoral candidate Qike Li, “Consumers don’t want artificial ingredients in their food. They want something healthier and more natural. Specifically, they want to see a ‘clean label,’ which is a major reason we have chosen to work to increase the functionality of phycocyanin as a colorant and emulsifier.”

Cornell University researchers have made a significant breakthrough in natural food colorants by enhancing the stability and functionality of phycocyanin—a blue pigment

derived from spirulina algae. Traditionally, phycocyanin has been limited in food applications due to its sensitivity to heat and light, which compromises its stability during processing and storage. However, the team’s new method reorganizes the protein from large, uneven polymers into smaller, uniform particles using a denaturant, dramatically improving its performance.

These restructured particles not only produce a vibrant blue hue but also exhibit superior emulsifying properties, enabling them to protect and deliver nutrients in oil-based formulations.

This dual functionality positions phycocyanin as a clean-label alternative to both synthetic dyes and emulsifiers, aligning with growing consumer demand for natural, health-conscious ingredients.

Using small-angle X-ray scattering, the researchers analysed structural changes at the nanoscale, confirming the enhanced stability and

emulsification potential. As lead author Qike Li explains, the goal is to meet consumer expectations for “clean label” products by replacing multiple synthetic ingredients with a single, multifunctional natural compound.

The implications are broad: this algae-based dye could help food manufacturers phase out petroleum-derived colorants

like Blue No. 1 and Blue No. 2, which are increasingly targeted by regulatory bans. It also reflects a wider industry shift toward sustainable, bio-derived ingredients that offer both aesthetic appeal and functional benefits.

<https://www.foodingredientsfirst.com/news/cornell-algae-blue-food-dye.html>

How Asia and the Middle East are shaping beverage trends

Beverage brands across Asia and the Middle East are staying competitive by blending cultural familiarity with health-focused creations and tech-driven convenience.

From local supermarket labels to global giants, beverage brands across Asia and the Middle East are incorporating traditional, health-focused ingredients into new creations. Brands are also blending traditional wisdom with digital tools to boost engagement and drive sales, such as through the inclusion of traditional and herbal ingredients. Health-focused innovation combining traditional herbal remedies with new formats and new brand images is key to product innovation.

South Korea's food industry is undergoing a dynamic transformation, with sugar-free innovation—locally termed “Sugar Zero”—emerging as a major growth driver. According to the Ministry of Food and

Drug Safety (MFDS), the country's food production rose 5.8% year-on-year in 2024 to KRW114 trillion (US\$84.36 billion), while food exports climbed 10% to US\$7.26 billion. This growth is closely tied to evolving consumer health trends and the government's push for healthier food options.

The Sugar Zero category saw a remarkable 20.1% increase in value, reaching KRW572.6 billion (US\$423.7 million). Notably, innovation expanded beyond beverages into bakery products, sauces, and other food formats, with non-beverage Sugar Zero products growing by an astonishing 109.7%. The number of Sugar Zero product launches more than doubled—from 261 in 2023 to 590 in 2024—indicating a surge in consumer demand and industry responsiveness.

This shift is driven by two dominant lifestyle trends: “Healthy-Pleasure,” which balances indulgence with wellness, and “Well-Ageing,” which promotes graceful aging through nutritious choices. Consumers are moving away from restrictive eating habits toward foods that offer both taste and health benefits, with sugar substitutes playing a

central role.

Beyond sugar-free products, these trends are fuelling growth in plant-based and high-protein categories. Production of plant-based items—such as peanut butter, lemon juice, and apple cider vinegar—grew fivefold to KRW69.1 billion (US\$51.1 million). High-protein products rose 24% to KRW568.8 billion (US\$420.9 million), reflecting increased interest in fitness and body composition.

Social media platforms like KakaoTalk, YouTube, and Instagram have amplified these trends, making health-conscious eating a mainstream cultural phenomenon. For global brands, South Korea now represents a strategic entry point for sugar-free, plant-based, and protein-rich innovations—either through export or by adapting Korean innovations for other markets. The country's consumer appetite for taste without compromise is setting a new benchmark for functional, indulgent, and health-aligned food development.

<https://www.foodnavigator-asia.com/Article/2025/06/17/how-tech-and-local-flavours-drive-beverage-trends-in-asia/>



Next level functional snacks: High protein chocolates?

High-protein chocolates look set to lead the next wave of innovation in the functional snacks category. The increasing popularity of functional snacks in markets all over the world has been no secret – but while chocolate-flavoured protein products have been common, the idea of a chocolate snack that is high in protein has been less so.

High-protein chocolate concept represents a compelling evolution in the functional snack space, blending indulgence with nutritional innovation. Unlike conventional chocolate protein bars that often rely on protein isolates or concentrates, COA's approach uses fermented soy clusters embedded in 60% milk chocolate. This not only enhances protein content but

also introduces bioactive compounds and probiotics, thanks to the fermentation process.

Founder Eduardo Burg emphasizes that fermentation improves the bioavailability of plant-based proteins—an important consideration given the common critique that such proteins are less efficiently absorbed than their animal-based counterparts. The fermented soy clusters resemble nuts or cereal pieces, offering both texture and visual appeal, while sidestepping the chalky or synthetic taste often associated with protein-enriched snacks.

Initially targeted at women aged 35–55 for its potential hormone-regulating benefits, the product has since found broader appeal. It resonates with health-conscious parents, students seeking functional snacking options, and fitness enthusiasts alike. The key differentiator is its ability to deliver protein without compromising on the sensory

experience of eating real chocolate.

Sourcing strategy also reflects a commitment to regional expertise and sustainability. Cocoa is procured from Vietnam's Central Highlands, while soy is fermented in Indonesia—a country with deep-rooted traditions in soybean fermentation, such as tempeh production. This not only supports local economies but also leverages indigenous knowledge in fermentation science.

In essence, high-protein chocolate is more than a snack—it's a convergence of culinary pleasure, nutritional science, and cultural heritage. It exemplifies how functional foods can evolve beyond utilitarian formats to meet the growing demand for healthful indulgence.

<https://www.foodnavigator-asia.com/Article/2025/06/25/next-level-functional-snacks-is-coa-on-the-money-with-high-protein-chocolates/>



Mitigating Cocoa Challenges: New Method Uses 30% More Cocoa Fruit

A patented technique uses up to 30% more of the cocoa fruit to make chocolate, aiming to reduce waste and increase value for cocoa farmers.

The method is currently at the pilot stage. Traditional chocolate production uses only cocoa beans, while much of the fruit—including pulp,

placenta, and pod husk—goes unused. New process collects the entire fruit as a wet mass, which naturally ferments before being ground, roasted, and dried into chocolate flakes.

Newly patented technique represents a significant innovation in cocoa processing, aiming to address both sustainability and economic challenges in the chocolate supply chain. Traditionally, chocolate production relies solely on cocoa beans, leaving much of the fruit—including the pulp, placenta, and pod husk—unused. This approach

not only reduces agricultural waste but also enhances the value of each cocoa harvest, offering farmers a more efficient yield.

If scaled successfully, the technique could reshape chocolate production by maximizing resource use, improving farmer livelihoods, and maintaining flavour integrity—all while supporting long-term resilience in the cocoa sector.

<https://www.foodingredientsfirst.com/news/nestle-tests-cocoa-fruit-technique.html>

New food labels: What your snack won't be able to hide anymore

Story by S Farah Rizvi

From supermarket aisles to kitchen shelves, packaged foods have become a daily staple. But hidden in those colourful wrappers are sugars, salts, and fats driving India's epidemic of lifestyle diseases.

Soon, every packet will carry a star rating and warning signs up front, making sure the risks are no longer tucked away in fine print. In a landmark step to fight lifestyle diseases like obesity, diabetes, and hypertension, India is set to introduce a new food labelling system.

By October, packaged foods could carry two key markers: the Indian Nutrition Rating (INR), a star-based score, and Front-of-Pack Nutrition Warning Labels (FOPNL).

The move follows a Supreme Court directive, which asked the Centre to finalise food safety norms within three months after a PIL was filed by NGOs 3S and Our Health.

How does it affect you?

Makes it easier to spot unhealthy foods at a glance. Could push brands to reformulate products with less

sugar, salt, and fat. Encourages consumers to make healthier swaps, nudging long-term lifestyle changes. Tentatively from October 2025 or maybe later in the year, after FSSAI clears the final design.

Warning labels in Chile, Brazil and Israel reduced sugary drink sales. The New Label Rulebook Star-rating system already used in Australia and New Zealand.

<https://www.msn.com/en-in/health/other/new-food-labels-what-your-snack-won-t-be-able-to-hide-anyone/ar-AA1N0t0b>

Fibre claims rising as health trend expands

Fibre is becoming more popular among consumers as interest in digestive and gut health grows. Fibre, while not technically a 'nutrient', is an important part of a healthy diet.

The recent boom in consumer interest in health, nutrition and functionality has heavily focused on protein, which is necessary but shouldn't be the sole focus of nutritionally complete eating habits.

However, the times they are a-changing. According to Innova Market Insights, fibre claims are ratcheting up across Europe and consumers are paying more attention to the healthy carb.

What is dietary fibre?

The article examines the rising prominence of dietary fibre in consumer health consciousness and product innovation across Europe. Historically overshadowed by protein, fibre is now gaining traction as a key component of functional nutrition, particularly amid growing interest in digestive health, satiety, and chronic disease prevention. According to Innova Market Insights, fibre-

related product claims have grown at a compound annual growth rate (CAGR) of 5.4% between May 2020 and May 2025, with a notable acceleration in the past year due to increased product launches.

Dietary fibre, a carbohydrate found in plant-based foods such as fruits, vegetables, pulses, seeds, and wholegrains, is associated with improved digestive function and reduced risk of conditions like heart disease, stroke, bowel cancer, and type-2 diabetes. Consumer interest in fibre now exceeds that of probiotics, with 39% of Europeans expressing strong interest in fibre versus 24% for probiotics.

NIQ data further shows that 78% of Western Europeans and 77% of Eastern Europeans have a positive perception of high-fibre foods, with a significant portion planning to increase their consumption.

The perception of fibre is evolving beyond gut health, driven by innovations targeting younger demographics, such as probiotic beverages and plant-based meat alternatives.

Fibre is increasingly associated with broader health benefits including weight management, cardiovascular support, and glycaemic control.

The surge in GLP-1 weight loss drug usage has also influenced demand for nutrient-dense, fibre-rich foods, prompting

brands like Nestlé to develop targeted product lines such as Vital Pursuit.

Despite this momentum, fibre still lags behind claims like low fat and low sugar in consumer prioritization. Mintel data indicates that only a minority of consumers in countries like Finland, France, Germany, and the UK consider fibre a key factor when purchasing food.

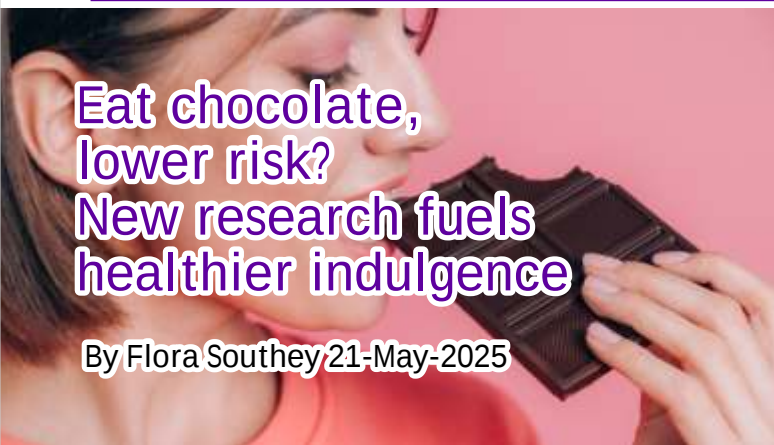
Fortification is playing a growing role in fibre claim expansion. While naturally fibre-rich categories like fruits and vegetables are seeing 15% CAGR growth in claims, fibre is also being added to traditionally fibre-poor categories such as meat substitutes (16% CAGR) and desserts (15% CAGR).

The market for food fortifying agents is projected to grow at a CAGR of 9.1% from 2024 to 2030.

Additionally, products featuring multiple fibre types—referred to as “stacked sources”—are proliferating, with rice fibre and flaxseed fibre showing the fastest growth rates at 127% and 77% respectively.

Overall, the article highlights a shift in consumer and industry focus toward fibre as a versatile and increasingly valued component of health-oriented food innovation.

<https://www.foodnavigator.com/Article/2025/05/22/fibre-claims-growing/>



lower blood pressure, reduced metabolic disease risk, and cut diabetes risk.

Can chocolate lower blood sugar?

Can chocolate really improve blood pressure and reduce heart disease risk?

Emerging research suggests it might – and the findings are sweet news ‘Healthy chocolate’ may sound like an oxymoron to many.

But over the past six months alone, new links have been identified between this confectionery favourite and

Flora Southey’s article synthesizes recent findings that position dark chocolate—particularly varieties rich in cocoa polyphenols—as a potentially beneficial component of a health-conscious diet.

Over the past six months, multiple studies have linked cocoa consumption to improvements in blood pressure, vascular health,

metabolic syndrome risk, and type 2 diabetes outcomes.

Cocoa powder, derived from cacao beans, contains polyphenols such as flavan-3-ols, which have been shown to improve blood sugar regulation, cholesterol levels, and reduce inflammation.

A UK-based study published in the European Journal of Preventive Cardiology found that flavan-3-ols, present in high concentrations in dark chocolate, tea, apples, and grapes, can significantly lower blood pressure—especially in individuals with hypertension.

While not a substitute for medication, regular intake of these compounds may yield effects comparable to some pharmaceutical interventions.

In terms of metabolic syndrome, which is a major precursor to cardiovascular disease, research from Brazil involving 6,378 participants over eight years demonstrated that diets rich in polyphenols—sourced from chocolate, wine, coffee, and fruits—can reduce risk by nearly 25%.

Within this cohort, flavan-3-ols were again highlighted, with chocolate ranking as the second most significant source after red wine.

A separate U.S. study explored chocolate's impact on type 2 diabetes risk. It found that

consuming at least five servings of chocolate per week correlated with a reduced risk, with dark chocolate offering the most pronounced benefit—a 21% lower risk. Each additional weekly serving of dark chocolate was associated with a 3% reduction in diabetes risk.

In contrast, white chocolate consumption was linked to long-term weight gain, a known diabetes risk factor. Researchers attributed these differences to the polyphenol content, which appears to mitigate the adverse effects of sugar and saturated fat in dark chocolate.

Collectively, these studies reinforce the idea that not all chocolate is nutritionally equivalent.

Dark chocolate, due to its higher cocoa and polyphenol content and lower sugar and dairy levels, emerges as the most promising variant for health benefits related to cardiovascular and metabolic health.

<https://www.foodnavigator.com/Article/2025/05/21/chocolate-health-benefits-for-healthy-indulgence/>

India's quest to quash misleading food labels hinges on consumer awareness

Food Safety and Standards Authority of India (FSSAI)'s recent launch of a digital reporting tool designed to empower consumers to flag misleading claims on packaged food products.

This initiative is part of a broader regulatory push to enhance transparency and accountability in food labelling.

The tool—accessible via the Food Safety Connect mobile app and the Food Safety Compliance System (FoSCoS) portal—enables users to submit photographic evidence, such as front-of-pack and back-of-pack images, along with manufacturer details and FSSAI license numbers.

This facilitates faster regulatory follow-up and strengthens ground-level vigilance by positioning consumers as active participants in food safety enforcement.

However, the article emphasizes that the success of this initiative depends heavily on public awareness. Former FSSAI director Pradip Chakraborty, now an advisory board member at the Health Foods and Dietary Supplements Association (HADSA), notes that only a small, relatively literate segment of the population currently pays attention to food labels.

He argues that without widespread education and outreach—particularly through FSSAI's Information, Education and Communication (IEC) division—the tool's impact will be limited.

Chakraborty also highlights the

importance of training food business operators to promote compliance from within the industry.

He points out that under existing provisions, consumers already have the right to purchase food items, submit them for lab testing, and pursue legal action if non-compliance is confirmed.

The new tool builds on this by streamlining the complaint process and reinforcing FSSAI's mandate that all food product claims must be truthful, evidence-based, and not misleading.

In essence, while the digital tool represents a significant step forward in regulatory enforcement, its effectiveness will be determined by how well consumers are informed and engaged in the process.

<https://www.foodnavigator-asia.com/Article/2025/06/04/india-looks-to-remove-misleading-food-labels/>



Industry expert cautions against “blanket policies” based on Nova UPF definition

The debate around ultra-processed foods (UPFs) continues to escalate as research links these foods to adverse health effects and regulators explore policies to limit UPF consumption.

At the same time, experts warn that not all UPFs have the same poor nutritional value.

Rocco Renaldi, the secretary general of the International Food and Beverage Alliance (IFBA), tells Nutrition Insight that UPFs, defined by the Nova classification system, are not a valuable basis for policymaking. This model groups the majority of packaged foods in this category.

Instead, he calls for a more balanced approach that includes whole and processed foods in a healthy diet — emphasizing healthier reformulations and policy-driven consumer education toward better food choices.

This article presents a critical industry perspective on the use of the Nova classification system as a regulatory

framework for ultra-processed foods (UPFs).

Rocco Renaldi, secretary general of the International Food and Beverage Alliance (IFBA), argues that Nova’s definition—categorizing foods based on processing levels rather than nutritional content—is

scientifically flawed and administratively impractical for policymaking.

Renaldi warns that applying blanket policies based on Nova, such as labelling or taxation, risks misclassifying a vast array of packaged foods, including those with improved nutritional profiles.

He cites Colombia’s failed attempt to implement a UPF tax as a cautionary example, where the tax indiscriminately targeted product categories like crisps and sausages, regardless of reformulation efforts.

He contends that such approaches discourage innovation and confuse consumers, especially when health warnings are applied broadly across supermarket aisles.

The Nova system, developed in 2009, defines UPFs not only by processing level but also by packaging, marketing, and profit motives—criteria Renaldi deems ideologically driven and unscientific. He emphasizes

that nutritional value should be central to food classification, noting that products with vastly different health profiles are often lumped together under Nova’s category four.

Instead of exclusionary tactics, Renaldi advocates for a balanced dietary approach that includes whole and processed foods.

He calls for comprehensive food policies that empower consumers through education and incentivize manufacturers to reformulate products. He stresses that food system transformation requires nuanced, culturally sensitive strategies rather than one-size-fits-all regulations.

Renaldi also highlights IFBA’s long-standing commitments to nutritional improvements, including the global elimination of industrial trans fats and sodium reduction targets. These initiatives, he notes, must be tailored to local tastes and consumer acceptance to be effective.

Ultimately, the article underscores the tension between ideological purity and pragmatic nutrition policy.

Renaldi’s position challenges the prevailing narrative around UPFs, urging policymakers to prioritize evidence-based reformulation, consumer empowerment, and systemic governance over reductive classification schemes.

<https://www.nutritioninsight.com/news/upf-regulations-nova-classification-ifba-policymakers.html>



Experts explore natural colours formulation challenge for supplements

This article from Nutrition Insight explores the complex regulatory and formulation challenges facing the dietary supplement and pharmaceutical industries as they prepare for the U.S. FDA's upcoming ban on Red No. 3, a synthetic colorant, effective January 2027 for foods and supplements and January 2028 for drugs. The ban, triggered by the Delaney Clause due to a decades-old rodent study showing thyroid tumours at unrealistically high doses, is not based on human safety concerns, but on a legal technicality.

Experts from the U.S. and India, including Vishaka Metkar of Colorcon Asia and David Schoneker of Black Diamond Regulatory Consulting, caution that while consumer demand for natural colours is rising, transitioning away from synthetics is fraught with

technical and regulatory hurdles.

Natural colours often lack the vibrancy, stability, and shelf life of synthetic dyes, and are sensitive to heat, light, pH, and ingredient interactions. Reformulating products to match synthetic shades is difficult, and natural alternatives may impart unwanted taste or vary significantly between batches. Global regulatory inconsistencies further complicate reformulation. While synthetic colours enjoy broad approvals across markets, natural colorants are often restricted to specific uses and categories. For example, riboflavin is approved as a food colour in the U.S. but not for drugs due to the absence of a petition for that application. The FDA's Color Additive Petition process is lengthy and data-intensive, discouraging broad submissions for natural colours.

Supply chain limitations also

pose a risk. Many natural colorants are derived from food crops, and scaling production to meet rising demand could lead to shortages and increased costs, affecting both supplements and food products. Schoneker warns that replacing all synthetic colours by 2026 is unrealistic given current supply and regulatory constraints. Despite consumer perceptions that natural colours are safer, experts stress that safety is determined by toxicological data, not origin. Some natural colorants can trigger allergic reactions, and there is no credible evidence linking synthetic colours to cancer or hyperactivity in children.

In light of these challenges, the article urges manufacturers to begin evaluating reformulation strategies now, but to proceed cautiously. Regulatory clarity, ingredient compatibility, and long-term stability testing are essential before committing to full-scale transitions.

<https://www.nutritioninsight.com/news/supplements-natural-color-fda-ban-red-no3.html>



Why ultra-processing should not be an argument against alt proteins

Ultra-processing is often cited as a key factor hindering alternative protein acceptance in Asia – but perhaps better communication is all that is need to solve this quandary.

The alternative protein industry has suffered a multitude of setbacks in Asia over the past two years after peaking in 2018 and through the pandemic. Plant-based

protein in particular has been put through the wringer in terms of pricing, taste, formats and so on – but one of the newest and most-debated arguments against its adoption has been its 'ultra-processed' status.

While there are many plant-based companies in the region working to overcome this by developing minimally-processed or even whole food options, industry experts generally believe it is wrong to demonise 'processing' as a term. The first thing that needs to be understood is this: Not all processing is bad.

The prevailing narrative that

ultra-processing is inherently detrimental, especially in the context of alternative proteins in Asia. After a peak in popularity around 2018 and during the pandemic, plant-based proteins have faced mounting scrutiny—not just over taste and price, but increasingly due to their classification as "ultra-processed." However, industry leaders argue that this label is often misunderstood and misapplied.

Processing itself is not inherently negative. Everyday staples like bottled water, frozen chicken, and ground spices are all processed, yet widely accepted.

The issue, she suggests, lies in the perception of unfamiliar additives rather than the act of processing itself. Some additives are essential for safety, shelf life, and functionality.

The term “ultra-processed” lacks a standardized scientific definition and is often used in a reductive way. Processing can also enhance nutritional profiles—by reducing saturated fats or increasing micronutrients—yet these benefits are rarely

acknowledged in critiques of alternative proteins.

Processing is indispensable in today's food system. With a global population nearing 8.5 billion, relying solely on traditional, minimally processed foods is impractical. Processing ensures food safety, scalability, and accessibility—especially in urbanized societies where supermarket supply chains dominate.

Rather than condemning ultra-processing outright, it advocates for balanced education that considers both nutritional value and technological necessity. In doing so, it reframes processing not as a compromise, but as a tool for innovation and food security—especially vital for the future of alternative proteins.

<https://www.foodnavigator-asia.com/Article/2025/06/03/ultra-processing-should-not-be-argument-against-alt-protein/>

Singapore to enforce stricter sodium and fat labelling by 2027

Singapore will tighten labelling and advertising laws for sodium and saturated fat by 2027 — here's what food brands need to know about this change. Singapore's Ministry of Health (MOH) will extend its Nutri-Grade labelling and advertising rules to cover sodium and saturated fat in retail food products sold at supermarkets, convenience stores, and online platforms.

This regulatory change is especially significant for firms across the Asia-Pacific region, given its role as a strategic trade gateway into South East Asia and broader Asian markets.

Ministry will implement stricter labelling and advertising regulations for sodium and saturated fat in food products expanding its Nutri-Grade system beyond sugar-sweetened beverages to include 23 sub-categories of prepacked salt, sauces, seasonings, instant

noodles, and cooking oils. This move is part of a broader public health strategy to combat chronic diseases like hypertension and high cholesterol, which affect over one-third of Singapore's population.

Under the revised Nutri-Grade framework, products will be graded from “A” (lowest levels of nutrients of concern) to “D” (highest levels), with mandatory front-of-pack labels for grades “C” and “D.” Advertising restrictions will be strict: products graded “D” cannot be advertised at all, while “C”-graded items may be promoted only if the Nutri-Grade label is clearly displayed. Grades “A” and “B” may carry labels voluntarily, offering a marketing advantage for healthier products.

International manufacturers will need to assess their products against Singapore's differentiated grading thresholds, which vary by sub-category. This could require reformulation or market-specific packaging, raising concerns about cost and competitive fairness—especially

for smaller exporters. Sticker labels are allowed but considered costly and inefficient.

The MOH and Health Promotion Board (HPB) recommend declaring “sodium” rather than “salt” on Nutrition Information Panels to ensure consistency and comparability. Nutrient values should be listed per 100g as sold, with optional data for the product as prepared. This regulatory expansion builds on the success of Nutri-Grade in reducing sugar consumption and aims to replicate that impact for sodium and saturated fat. With Singapore's strategic position in Asia and its rigorous standards, compliance could offer brands a competitive edge in regional markets. The measures follow extensive public consultation involving over 7,000 stakeholders and reflect a growing global trend toward transparent, health-driven food labelling.

<https://www.foodnavigator-asia.com/Article/2025/06/09/singapore-to-enforce-stricter-sodium-and-fat-labelling-by-2027/>



India's FSSAI to tighten licensing rules for 'high risk' products

Firms producing infant nutrition, packaged drinking water, and other "high-risk" items must obtain either a State or Central License that involves stricter compliance requirements.

The Food Safety and Standards Authority of India (FSSAI) has proposed stricter licensing rules for manufacturers of high-risk food products – including infant formula, milk powders, packaged drinking water, non-carbonated water-based beverages – citing concerns over safety compliance among small-scale operators. Under the new proposal, no new FSSAI registrations or renewals will be allowed for firms producing these categories. Instead, manufacturers must obtain either a State or Central License, both of which involve higher compliance requirements, technical oversight, and regular inspections.

India's Food Safety and Standards Authority (FSSAI) is set to overhaul its licensing framework for manufacturers of

"high-risk" food products, including infant formula, milk powders, packaged drinking water, and non-carbonated water-based beverages. The proposed regulation, issued on 1 May 2025, will prohibit new registrations and renewals under the basic FSSAI registration system for these categories. Instead, affected businesses must upgrade to either a State or Central License within six months—both of which require stricter compliance, technical oversight, and regular inspections.

The move stems from concerns that basic registration lacks essential safeguards such as mandatory product testing, qualified technical personnel, third-party audits, and robust hygiene protocols. These gaps are particularly problematic for products requiring precise formulation and microbiological safety, such as infant nutrition and drinking water. FSSAI data indicates that over 12,000 manufacturers currently operate under basic registration in these high-risk segments.

To support the transition, local authorities will launch a "special drive," and during the

six-month window, businesses may continue using existing packaging and labelling. Afterward, the Food Safety Compliance System (FoSCoS) portal will automatically revoke registration-based manufacturing rights for the affected categories.

Additionally, FSSAI proposes mandatory pre-license inspections for infant nutrition and non-carbonated beverages, aligning with existing requirements for dairy and mineral water units. This regulatory tightening reflects broader Asia-Pacific trends toward harmonized food safety standards, especially for vulnerable populations like infants and young children.

The implications extend to international trade as well. Overseas exporters must ensure their Indian partners hold the appropriate licenses, as foreign businesses are subject to the same regulatory standards. Former FSSAI director Pradip Chakraborty emphasized that this initiative signals a firm commitment to strengthening food safety protocols.

<https://www.foodnavigator-asia.com/Article/2025/06/11/india-fssai-to-tighten-licensing-rules-for-high-risk-products/>



South Korea emerges as hotspot for sugar-free innovation

South Korea has rapidly emerged as a global hotspot for sugar-free innovation, driven by shifting consumer preferences and robust government support for health-forward food development.

According to the Ministry of Food and Drug Safety (MFDS), the country's food industry grew 5.8% year-on-year in 2024, reaching KRW114 trillion (US\$84.36 billion), with food exports rising 10% to US\$7.26 billion—underscoring its expanding influence in international markets.

The standout trend is the

explosive growth of "Sugar Zero" products, South Korea's term for sugar-free offerings. Production in this category surged over 20% in 2024, with value climbing to KRW572.6 billion (US\$423.7 million). Notably, non-beverage Sugar Zero products—such as bakery items and sauces—grew by an astonishing 109.7%, reflecting a diversification beyond traditional soft drinks.

The number of Sugar Zero products more than doubled from 261 in 2023 to 590 in 2024, signalling a broadening consumer base and innovation pipeline.

This momentum is fuelled by two dominant lifestyle trends: “Healthy-Pleasure,” which balances indulgence with wellness, and “Well-Ageing,” which promotes graceful aging through nutritious choices. These trends are reshaping food consumption from restriction-based habits to enjoyment-focused health management, with sugar substitutes playing a central role.

Beyond sugar-free, the Healthy-Pleasure movement is catalysing growth in plant-based and high-protein categories.

Production of plant-based foods—such as peanut butter, lemon juice, and apple cider vinegar—grew fivefold to KRW69.1 billion (US\$51.1 million). Meanwhile, high-protein products saw a 24% increase, reaching KRW568.8 billion (US\$420.9 million), driven by rising interest in fitness and body composition.

Social media platforms like KakaoTalk, YouTube, and Instagram have amplified these

trends, making health-conscious eating a mainstream cultural phenomenon. For global brands, South Korea now represents a strategic entry point for sugar-free, plant-based, and protein-rich innovations—either through export or by adapting Korean innovations for other markets. The country’s consumer appetite for taste without compromise is setting a new benchmark for functional, indulgent, and health-aligned food development.

<https://www.foodnavigator-asia.com/Article/2025/06/16/south-korea-new-hotspot-for-sugar-free-innovation/>

China enforces plant-based colours:

China’s new regulation on food colouring, effective from May 1, 2025, marks a significant shift toward clean-label transparency and plant-based innovation in the food and beverage sector.

Jointly developed by the China National Food Industry Association (CNFIA) and the Ministry of Industry and Information Technology (MIIT), the standard mandates that all food colourings must be derived from edible sources—specifically fruits, vegetables, plants, or algae that are commonly consumed as food.

Crucially, these colourings must be produced using only physical

processing methods, excluding chemical solvents. This ensures that the final ingredients retain the natural colour, flavour, and nutritional value of their source materials. As a result, such colourings are now classified as ingredients rather than additives, allowing brands to label them more transparently—for example, “carrot colouring ingredient” instead of a cryptic E-number.

For manufacturers, both domestic and international, this regulation provides long-needed clarity and enforces reformulation. Brands must replace synthetic dyes with plant-based alternatives like fruit concentrates or colouring foods to remain compliant. Non-compliance can result in fines ranging from RMB 2,000 to RMB 50,000, or even licence revocation for severe breaches.

From a consumer standpoint,

the regulation aligns with growing demand for clean-label products and natural ingredients, especially in China’s wellness-driven market. It supports the national “Healthy China 2030” initiative and is expected to accelerate innovation in categories like functional beverages, plant-based dairy, and reduced-sugar products.

The move also mirrors global trends, such as the FDA’s push to phase out petroleum-based synthetic dyes in the U.S. With China’s food market revenue surpassing that of the U.S. and India, this regulatory shift positions the country as a key influencer in Asia-Pacific food safety and sustainability standards.

<https://www.foodnavigator-asia.com/Article/2025/06/26/china-enforces-plant-based-food-colouring/>