



PFNDAI

FOOD, NUTRITION & SAFETY MAGAZINE

BULLETIN JUL 2026

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Report on the

White Paper Launch on

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Ms Anuja Padte

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Creating Awareness among Consumers

Everyone agrees that food is the most important aspect right from infancy for growth, development and health throughout our lives.

Also, food is composed of many different nutrients and other substances that may contribute to health, although some may not be so. The way we handle food, whether it is plant-based or animal-based, may also affect the quality of food when we consume it. Thus, it is very essential to know about all these aspects as most of us have to make a decision about what to eat, how to eat or how much to eat and many have to make a decision about how to prepare the food from ingredients to edible and acceptable format.

Because of its importance in our lives, we must know much more about food than just to prepare it so we enjoy it. There is so much information about food science and nutrition available that could be used by everyone to make most of the above-mentioned decisions. Some of it is now taught in schools but it looks like we have to do much more today.

We still have so many foodborne illnesses due to contamination and many health problems due to wrong choices or amounts that may turn into either deficiencies or over-nutrition. Therefore, we need to start consumer education right from the school stage.

Eat Right initiative started by FSSAI is a very good beginning. There are a couple of booklets published under this with the help of nutritionists and dieticians from colleges and universities that give interestingly the knowledge about food science and nutrition as well as food safety. There are many colourful illustrations in them that would make reading more enjoyable so young minds may be focused on learning. These booklets were meant for younger students in primary and high-school grades. There were a couple of booklets for detection of adulteration and unsafe foods that were probably a bit too difficult for students as even adults find it difficult to conclusively identify adulteration easily with some chemicals that are not easily available except in a chemical lab.

There is a need for even

greater emphasis on such learning and for that food science and nutrition should be made part of each school curriculum and should even be taught at college and university levels. This is not to make them all experts in food science and nutrition but at least to ensure that they learn about this most important factor that affects us from infancy to old age.

They have given plenty of resource material in the website:
<https://eatrightindia.gov.in/eatrightschool/resources>

These resources include books and activities that students could do while learning about food and nutrition. They also have videos, posters and other materials which make this quite useful and easy to learn or teach.

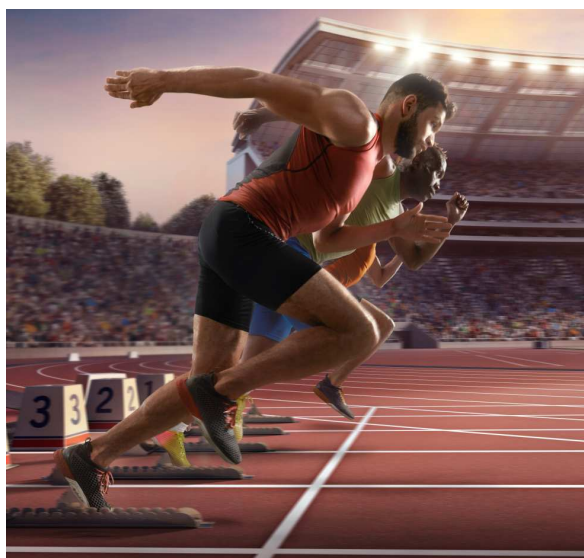
It is hoped that governments and schools realise the importance of this and start familiarisation of these important subjects from very young age while the children are still deciding their likes and dislikes about foods.

**Prof Jagadish Pai, Editor,
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Understanding Divergent Regulatory Approaches: TiO_2



AUTHOR

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A media post singled out titanium dioxide (TiO_2 , E171), which is banned in Europe but still permitted in India, spreading a dangerous impression of the Food Authority's ability to ensure the safety of Indian consumers. Open disclosures on food labels are used by social media influencers (SMI) to spread false and misleading narratives, without understanding the toxicological structure that Food Authorities use to make safety decisions. The influencer presumes that an additive banned in one country (or region) keeps its people safer than in another. Is it possible that consumer safety is not a global concern?

The EU banned TiO_2 as a food additive in 2022, citing "genotoxic concerns it could not rule out". In scientific risk assessments, saying "we cannot rule out a risk due to insufficient data" is vastly different from "we have proven this substance(s) causes harm". Risk assessment agencies worldwide carefully examine the same scientific data for evidential admissibility: differences are likely to arise here. The US FDA reviewed EFSA's opinion and concluded that the underlying studies and available safety data that led to its decision do not demonstrate any safety

concerns. JECFA concluded that the total daily intake of TiO_2 from food (exposure assessment) does not represent a health hazard, while Health Canada did not identify any health concern. Together, they disagreed with the EFSA ban, reiterating their approvals for use. What do businesses do when divergent regulations prevail in different countries?

They comply. Businesses operating in more than one geography align with these differences. The same enterprise uses an additive banned in the EU, not as a matter of choice or even safety, but a simple matter of compliance. While EFSA (risk assessor) raised uncertainty that genotoxicity could not be ruled out, the European Commission (EC), the risk manager, invoked the precautionary principle under a specific legal statute (Art. 7 EC 178/2002) to effect the ban: perhaps a hyper-cautious interpretation. Can such a conflicting action "to ban or not" arise when the available science is the same?

Note that EFSA's language admits to absence of compelling evidence. In deciding on the ban, they considered genotoxicity studies on test materials that were not representative of the real food-grade E171, but rather on nanoparticles. IARC classifies TiO_2 as a Group 2 possible carcinogen, specifically for inhalation exposure, not ingestion. This group represents substances with limited evidence in

humans and less-than-sufficient evidence in animal studies. Titanium dioxide (E171) sits in this category for inhalation only-not product exposure. This could have influenced the ban.

India does not operate in isolation; it aligns with the dominant global scientific consensus rather than the EU's localised stance. FSSAI relies on JECFA, which formally reviewed EFSA's stance, re-evaluated the data, and concluded that dietary exposure to E171 does not pose a health hazard. It reaffirmed its health-based guidance value of ADI "not specified", the safest possible classification for a food additive. The US FDA, too, did not establish a safe threshold (mg/kg body weight) but uses an exposure-based product limit (max 1% by weight of finished food). The EU established none. This addresses the heart of the technical debate between EFSA and other global food agencies.

EFSA regularly uses the Margin of Exposure (MoE) approach for genotoxic carcinogens; however, the European Commission refrains from applying this reference point specifically to food additives such as E171. Agencies like Health Canada, the US FDA, JECFA and others reached a different conclusion, as they considered the animal studies showing DNA damage to be flawed and unrepresentative of normal human eating habits; thereby, they ruled out genotoxicity and were able to establish a safe threshold for the food additive rather than banning it. When data suggest a substance might damage DNA (genotoxicity), regulators calculate an MoE (PFNDIA: Feb 2026); however, under EU food law, EFSA's inability to calculate a safety margin directly triggered the 2022 outright ban

From a global regulatory standpoint, it is accurate to say that E171 has not been proven to be unsafe. Debates comparing India's FSSAI to the EU often miss this core scientific nuance: the EU did not ban E171 because it proved it causes harm, but because it couldn't 100% prove it was harmless. The difference stems from contrasting regulatory philosophies rather than a disagreement over definitive harm.



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Nutrition In The Era Of GLP-1 Receptor Agonists



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The management of obesity and type 2 diabetes mellitus (T2DM) has transformed with the emergence of glucagon-like peptide-1 receptor agonists (GLP-1 Ras). These drugs not only facilitate significant weight reduction and glycemic control but also provide cardiovascular benefits.

GLP-1 RAs: Beyond Weight Loss

GLP-1 RAs mimic endogenous incretin hormones that regulate appetite, glucose metabolism, and energy balance. Their mechanisms of action include enhancing insulin secretion, suppressing glucagon

secretion, delaying gastric emptying, and promoting satiety through central appetite pathways. These effects contribute to meaningful weight loss and improved glycemic outcomes in individuals with obesity and T2DM. Selection of the right candidate is crucial for optimizing the benefits and safety of GLP-1 RA therapy. The Endocrine Society of India (ESI) recommends considering pharmacotherapy for obesity management in individuals with a BMI >27 kg/m² or those with a BMI $25 > \text{kg/m}^2$ in the presence of at least one obesity-related comorbidity, such as hypertension, dyslipidaemia, T2DM, or obstructive sleep apnea.

The use of GLP-1RAs necessitates careful patient selection and monitoring due to their potential to precipitate adverse events across multiple organ systems. Pre-treatment

evaluation should include assessment for gastrointestinal motility disorders such as gastroparesis, as well as gallbladder disease, given the association of GLP-1 RAs with impaired gastric emptying and increased incidence of cholelithiasis. In addition to gastrointestinal risks, GLP-1 RAs may exert neuropsychiatric effects, influencing mood, anxiety, and eating behaviours, thereby warranting vigilance in individuals with pre-existing or suspected psychiatric vulnerability. Particular caution is advised in patients with a history or elevated risk of disordered eating, as appetite suppression may exacerbate restrictive patterns; structured screening prior to initiation and ongoing surveillance for emergent symptoms or excessive weight loss are recommended. More broadly, clinical practice should

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incorporate systematic risk stratification across endocrine, renal, gastrointestinal, and psychiatric domains to ensure safe and effective implementation of GLP-1 RA therapy.

Why Medical Nutrition Therapy (MNT) Remains Essential

Although GLP-1 RAs reduce caloric intake by decreasing appetite, this may inadvertently increase the risk of inadequate essential nutrient intake and micronutrient deficiencies. Therefore, MNT remains a cornerstone of comprehensive obesity management alongside pharmacotherapy to optimize outcomes and minimize potential risks. Key nutritional priorities include preserving lean body mass, preventing nutrient deficiencies, supporting gastrointestinal tolerance, and promoting long-term adherence to healthy lifestyle behaviours.

Nutritional Recommendations during GLP-1RA Therapy

- Adequate protein intake is vital to preserve muscle mass during weight loss.

Current recommendations suggest a protein intake of approximately 60-75g/day, ranging between 1.2 to 1.5 g/kg/day or upto 30% of total energy. High-quality, lower-volume protein sources such as fish, eggs, Greek yogurt, cottage cheese, nuts, and oilseeds may help individuals meet protein requirements despite reduced appetite. The use of protein supplements can be considered in individuals who cannot meet their protein requirements through dietary intake alone.

- Moderate carbohydrate intake (45-65% of total energy) with preference for low glycemic index foods is recommended. These include whole grains, legumes, fiber rich fruits and non-starchy vegetables.
- Adequate dietary fiber intake through fruits, vegetables, and whole grains is advised. The type and amount of fiber recommended will depend on the individual's current fiber intake, as well as the presence and type of gastrointestinal adverse effects. Certain soluble, non-fermentable, gel-forming fibers, such as psyllium husk, and insoluble fibers, such as coarse wheat bran, can increase stool water content and bulk, which may facilitate stool passage. For individuals not meeting the recommended

fiber intake, gradually increasing fiber consumption along with adequate fluid intake and movement may help reduce constipation-related adverse effects. The use of fiber supplements may be considered when dietary fiber goals cannot be achieved through food alone.

- Healthy fat intake, constituting 20-35% of total energy, while limiting saturated fat to less than 10% is advised. High fat intake will increase the risk of gastrointestinal side effects.
- Sufficient hydration with more than two litres of water and non-carbohydrate fluids daily is advised.

Regular physical activity is equally important. Individuals should aim for at least 150 minutes of moderate-intensity aerobic exercise weekly, combined with resistance training two to three times per week, to preserve muscle mass and support metabolic health.

Addressing Micronutrient Deficiencies

Reduced food intake and gastrointestinal side effects such as nausea, vomiting, and diarrhea may predispose individuals receiving GLP-1 RA therapy to micronutrient deficiencies. Special attention should be paid to nutrients commonly

affected during weight reduction, including vitamins and minerals essential for bone health, immune function, and energy metabolism. Individualized dietary counseling focusing on nutrient-dense foods should be the primary approach. Targeted supplementation may be considered when dietary intake remains inadequate or clinical deficiencies are identified.

Managing Gastrointestinal Side Effects

Gastrointestinal symptoms are among the most common reasons for poor adherence to GLP-1 RA therapy. The following strategies can help improve tolerability:

- Eat slowly and consume smaller portions.
- Stop eating once full.
- Avoid using a straw while drinking to prevent bloating.
- Avoid eating too close to bedtime.
- Avoid lying down immediately after eating.
- Use simple cooking methods such as steaming, baking, sautéing, boiling, and avoid deep fried or high fat foods.
- Limit spicy, or heavily processed foods.
- Maintain adequate hydration while spacing fluid intake throughout the day.
- For individuals experiencing nausea or vomiting, fluids

may be better tolerated between meals rather than during meals. Ginger- or mint-based beverages may provide symptomatic relief.

- Sulfur burps, another commonly reported side effect, can often be managed by consuming smaller meals, reducing intake of sulfur-rich foods, maintaining hydration, and engaging in light physical activity such as 10-20 minute walk after meals.

Preserving Muscle and Bone Health

Rapid weight reduction associated with GLP-1RA therapy can result in loss of both fat mass and lean body mass. Evidence from clinical trials suggests that approximately 20% of total weight loss may represent muscle loss. Additionally, substantial and rapid weight loss may adversely affect bone density. Risk factors for muscle and bone loss include older age, female sex, sedentary lifestyle, inadequate protein intake, lack of resistance training, and repeated weight cycling.

Preventive strategies include:

- Ensuring adequate protein intake along with calcium and Vitamin D.
- Incorporating regular resistance and strength training exercises.
- Promoting gradual,



sustainable weight reduction rather than rapid weight loss.

- Monitoring body composition and functional status, particularly in high-risk individuals.

Monitoring

Monitoring should include assessment of treatment response, especially during dose escalation phase, regular assessment of nutritional status, gastrointestinal symptoms, body composition changes, mood disorders, and the need for adjustments in concomitant medications. A multidisciplinary approach involving physicians, dietitians, diabetes educators, psychologists, and exercise specialists can enhance long-term success.

Conclusion

GLP-1 RAs represent a major advancement in obesity and diabetes management. However, medication alone is insufficient to achieve optimal and sustainable outcomes. Personalized nutrition therapy, adequate protein intake, regular physical activity, management of gastrointestinal side effects, and ongoing monitoring are essential components of comprehensive care.



There is no single dietary approach that works for everyone. Successful long-term weight management relies on individualized, nutrient-dense, and sustainable eating patterns that individuals can adhere to over time. Ultimately, the most effective strategy combines reduced-calorie nutrition, behavioural modification, increased physical activity, and appropriate use of pharmacotherapy within a patient-centered framework.

Keeping interventions simple, sustainable, and tailored to individual needs remains the key to successful obesity management in the era of GLP-1 Ras.

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Functional Beverages: It's More than a Drink!

AUTHOR

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Tea, coffee, milk, fruit juices and soft drinks have been part of our diets. Mainly consumed to quench thirst, provide energy, or sensory refreshment.

Nowadays, growing consumer awareness has transformed the beverage industry. The modern consumer is no longer satisfied with products that only satisfy thirst or hunger. The younger generation, especially Gen Z, is drawn to clean-label drinks that support self-care and health (1). There is a constant need to search for products that are healthy yet tasty. This need has led to the growth of Functional Beverages.

What are Functional

Beverages?

It is a non-alcoholic drink product, formulated with ingredients that have a specific role beyond basic nutrition, like digestion, bone and cardiovascular health, cognitive or physical performance, or immunity. They may contain vitamins, minerals, proteins, probiotics, dietary fibre, amino acids, omega-3 FAs, botanicals, or other bioactive ingredients that have demonstrated physiological effects when consumed in recommended amounts (2).

The concept is based on Hippocrates' principle, 'Let food be thy medicine and medicine be thy food'. Foods can positively influence health when consumed as part of a balanced diet. Functional

beverages require minimal preparation and are convenient delivery systems for such ingredients.

This concept is not new to Indians, as for ages we have been making functional drinks at home; for example, Nimbupani with black pepper, ginger, mint, amla or milk with haldi. Likewise, looking at the trend, the food industry has also started developing pre-packaged functional beverages, like fortified juice, vitamin water, value-added dairy products, etc.

However, not every beverage containing an added ingredient is functional.



The ingredient should be scientifically supported, safe for consumption, and incorporated for a specific nutritional or physiological purpose rather than simply for flavour (3). From a regulatory perspective, manufacturers should ensure that ingredients comply with applicable food regulations and that the nutrition or health claims are evidence-based and not misleading (4).

The effectiveness of a functional beverage depends on: the beverage base, the functional ingredient incorporated, and the intended health benefit. Different beverage matrices influence ingredient stability, absorption, sensory quality, and consumer acceptance.

Health applications of Functional Beverages:

- General Health
- Heart health
- Bone Health
- Gut health
- Immune function
- Mental & Physical performance
- Sports Performance
- Obesity & Diabetes Management

• Health conditions – like Anaemia
To achieve these benefits, various base ingredients are used. The beverage base contributes to health benefits, compatibility, and stability of the added functional ingredients.

Types of Functional Beverages based on Base Ingredient:

- **Dairy-based beverages:** Milk is an excellent base, rich in high-quality protein, calcium, phosphorus, vitamin B12, etc. Functionality can be enhanced with vitamin D, probiotics, dietary fibre, EPA and DHA, or plant bioactives. A functional milk was developed by adding omega-3 fatty acids from flaxseed oil, phenolic compounds from phytosterols, and fibre from polydextrose; it enhanced the nutritional as well as the therapeutic potential of milk (5). Fermented dairy products such as yoghurt drinks and kefir provide probiotics that contribute to gut health, whereas whey-based beverages are popular among athletes and physically active individuals because of their high-quality protein content.
- **Plant-based beverages:** Vegan diets, lactose intolerance, and sustainability have expanded this market. It is prepared from soy, oats,

almonds, coconut, rice, peas, fruits, and other legumes or cereals, with addition of fibre, calcium, vitamin D, and B12.

- **Tea- and coffee-based beverages:** Contain bioactive compounds, polyphenols and caffeine that contribute antioxidant activity and cognition. Functional versions may have additional ingredients like collagen peptides, adaptogenic herbs, vitamins, or minerals.

These bases are selected as delivery systems, but the functionality is achieved by addition of specific ingredients.

Functional Ingredients:

Selecting an ingredient depends on its stability during processing and storage, compatibility with the beverage matrix, and bioavailability after consumption, as it is a key determinant of product efficacy.

1) Amino acids- Protein-enriched beverages are a major segment of the functional beverage market. Amino acid beverages are mostly used by athletes. These are specialized products designed to improve hydration, muscle recovery, and boost energy. They typically feature Branched-Chain Amino Acids (leucine, isoleucine, and valine), Taurine, or L-Carnitine to support



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NUTRIENTS*



*"Strength Nutrients" refers to Vitamin D, Iron, Zinc, Vitamin A, B12, C. '2x Strength Nutrients' is based on 2 serves of Bournvita (40g) with 400 ml cow's milk vs 400ml plain cow's milk. Nutrient values are from IFCT, NIN 2017. Refer to pack for more details.



useful for weight and diabetes management. However, high fibre levels can affect texture, viscosity, mouthfeel, and stability of the beverage.

athletic performance, cognitive function, and fat metabolism without the heavy calories. These are available in the market, typically mixed with water or consumed as ready-to-drink sparkling beverages. But amino acids have a bitter taste, which can negatively impact the flavour profile of drinks. Hence, only minimal quantities are used (6).

2) Dietary Fibre, Prebiotics, and Probiotics-

Dietary fibre has a role in digestion, metabolic, and cardiovascular health. Soluble fibres such as inulin, FOS, GOS, resistant dextrin, beta-glucan, and polydextrose are commonly used because they dissolve well and minimally affect texture.

Prebiotic fibres promote beneficial gut bacteria such as Bifidobacterium and Lactobacillus, supporting digestive health, immunity, mineral absorption, and short-chain fatty acid production. Soluble fibres may help regulate blood glucose and increase satiety, making these beverages

Probiotic beverages are very popular. Probiotics are live microorganisms that support gut health, digestion, and immunity when consumed in required amounts. Probiotic benefits are strain-specific, and the organisms must remain viable during storage and be present in sufficient numbers at consumption to be effective (7).

New products now combine probiotics and prebiotics in synbiotic beverages to enhance the survival and activity of beneficial microorganisms within the GI tract.

3) Vitamins and Minerals-

Micronutrient-containing beverages can help reduce nutrient gaps and support people with restricted diets. Vitamin D and calcium are often added together to support bone health. Vitamin C has its role in collagen synthesis, antioxidant defence, immunity, and improving non-haem iron absorption, making it useful in iron-fortified beverages. B-complex vitamins support

energy metabolism, neurological function, and red blood cell formation. Minerals including magnesium, potassium, and zinc contribute to muscle and nerve function, fluid balance, blood pressure regulation, and immunity. Hydration drinks are commonly available in many flavours that are fortified with these vitamins and minerals. The formulator must consider nutrient interactions, as some nutrients enhance absorption while others may inhibit. Beyond essential nutrients, manufacturers incorporate plant-derived bioactive compounds that offer benefits.

4) Botanicals and Plant Bio-actives- High demand for organic ingredients has introduced botanicals in functional beverages. Herbs, spices, and plant extracts such as turmeric, tulsi, ginger, green tea, hibiscus, cinnamon, amla, beetroot, and ashwagandha provide bioactive compounds like polyphenols, flavonoids, carotenoids, and antioxidants.



These ingredients support energy, immunity, stress management, heart health, and metabolism. For example, curcumin in turmeric offers anti-inflammatory and antioxidant benefits, green tea catechins support cardiovascular and metabolic health, and beetroot nitrates may enhance exercise performance. However, botanical ingredients should be chosen carefully, considering safety, effective dosage, clinical evidence, and possible medication interactions.

Emerging Botanical ingredients:

a) Lemongrass-

Contains bioactives like citronellal, saponins, flavonoids, alkaloid polyphenols, and essential oils. In one of the research study, a drink was formulated with fresh lemongrass leaf extract and dry stevia leaf extract, which showed a significant effect on total phenol levels, flavonoids, antioxidative activity, and sensory quality (8).

b) Pandanus (screw pines)- Found in tropical regions. It contains alkaloids, flavonoids, tocopherols, etc. There is a kombucha

drink with rice and pandan leaf in the market which is a gut-friendly, antioxidant-rich beverage. Research on phytochemical content from pandan leaves showed high antioxidant activities (8).

c) **Matcha**- This Japanese tea is trending in the younger generation and functional RTD matcha drinks are becoming available. It is rich in L-theanine, antioxidants, and caffeine; it helps with focus, alertness, calmness and is good for better performance without energy crashes. Matcha's bioactive profile supports neuroprotection, metabolism, and brain performance.



d) **Chinese Wolfberry**- Contains all 9 EAAs, trace minerals (zinc, iron, copper, calcium, etc), also rich in flavonoids, polysaccharides, and carotenoids, with *Lycium barbarum* polysaccharides (LBP) exhibiting antioxidant, hypoglycaemic, anti-osteoporosis, and liver protection properties.

Tea infusions might not effectively utilize its



bioactive compounds. Thus, to enhance its effectiveness, it can be paired with other ingredients. A study explored a combination of wolfberry polysaccharides and whey protein; it created a significant impact on gut microbial communities and enhanced metabolic activities. LBP act as fermentation substrates and energy sources for gut microbes (9).

Besides nutrition efficacy, functional beverages must also satisfy consumer expectations regarding taste, appearance, texture, and shelf stability. Even with perfect extraction and stability, functional beverages often fail because consumers reject the taste. Ashwagandha can be bitter, turmeric earthy, ginger sharp, and matcha can be overpowering. Proper sensory development must be done (10). Shelf-life instability is another concern, as these compounds are highly sensitive to pH, oxygen, and heat, causing fading, separation, or loss of function over time.



various consumer needs. The sector needs scientific studies, proper formulation technologies, and a clear understanding of consumer preferences. This brings significant

opportunities for innovation in the food industry.

Formulators must be careful when selecting base composition, choosing sweetener, flavour pairing, pH stability, emulsification, and the taste and texture of the product (11). One needs to complement flavours that naturally pair well; for example, citrus and berry flavours can mask the earthy taste. New formulation methods like microencapsulation can be used. Use of non-nutritive sweetener, fruit sugars can be done to improve palatability.

Conclusion:

Functional beverages have become important as it offers health with convenience and sensory satisfaction. These cater to

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Innovative Snack Industry in India'

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Almost every Indian household will have snacks like chivda, chakli, biscuits, etc., stored to be either served as a tea-time snack or for the guests. A snack is any food or beverage that is consumed in between meals. It is usually a small portion of food to satisfy a craving or to get an energy boost between meals, preventing extreme hunger. A meal, on the other hand, is usually a complete food eaten as a primary source of nutrition and not just to satisfy cravings.

The Indian snacks market size was valued at INR 50,590.37 Crore in 2025 and is projected to reach INR 103,556.03 Crore by 2034, growing at a CAGR of 8.28% from 2026 to 2034. Chips

dominated the market with a share of 42% in 2025, driven by their universal appeal across age groups, extensive flavour variety, and continuous innovation, including healthier baked and multigrain variants (1).

Snack brand loyalty in India is highly fragmented, with consumers balancing between trusted legacy brands and emerging health-focused D2C brands. In this competitive market, continuous product development is essential to retain consumers. While regional flavours continue to resonate due to their emotional and cultural appeal, younger consumers are increasingly embracing global flavours despite higher price points. For example, conventional instant noodles priced at ₹10-20 remain popular, yet the premium Korean-style

ramen has rapidly gained traction, prompting brands to introduce Korean, Mexican, and Thai-inspired flavours, often as limited editions. Brands utilise intentional, minimalist layouts, embossing, and subtle metallic touches to visually communicate high value before the product is ever opened. Eye-catching colour palettes and bold typography are heavily utilized to create strong on-shelf visibility and high social media "shareability".

Demand is also shifting towards guilt-free indulgence, fuelling the growth of snacks such as roasted makhana and baked or air-fried options. Many startups are capitalising on this trend by offering



healthier alternatives. The rise of 10-minute delivery platforms has further intensified competition, as consumers frequently make impulse purchases and readily switch brands when their preferred product is unavailable.

Has the snacking pattern changed?

Snacking has evolved from an occasional between-meal indulgence into an integral part of modern eating habits, driven by changing lifestyles, health awareness and the desire for enjoyable food experiences. According to the 2026 Mondelez x Mintel State of Snacking Report, 59% of consumers snack at least once every day, while 24% report snacking more often than they did a year ago, highlighting the growing importance of snacks in daily diets. Mid-Morning and mid-afternoon are the most common snacking occasions. Consumers are increasingly eating snacks throughout the day, including in the evening, with snacks often replacing traditional meals due to busy work schedules, hybrid working, commuting and the need for convenient, portable food options.

Beyond satisfying hunger, snacks now serve as sources of comfort, stress relief, self-care and social connection, 79% of Indian consumers enjoy trying new snacks

with friends, reflecting the growing role of snacking as a shared experience. Consumers increasingly seek healthier options enriched with protein, fibre and functional ingredients alongside indulgent treats, while flavour innovation has expanded to include global cuisines, seasonal offerings and fusion combinations. Equally important is the growing emphasis on texture, with consumers seeking multisensory experiences through crispy, crunchy, crackly, chewy, creamy and layered products. 35% of Indian snack consumers aged 13-17 expressed interest in snacks that are crunchy on the outside, soft inside (2).

Latest trends in the snack industry

•Millet-based snacks

Millets are rich in protein, vitamins and minerals and are naturally gluten-free and have a low glycaemic index. India is currently the largest producer of millets in the world, contributing 38.4% of global production (3). With the Government of India incentivising value addition of these cereals, an increasing number of manufacturers are using

jowar, bajra, and ragi as part of mainstream snack companies' product offerings. They are now available in diverse formats, including chips, puffs, extruded snacks, namkeens, khakhra, crackers, roasted snack mixes, cookies, nutrition bars, breakfast cereals, granolas, and popped millet snacks, etc.

•Fruit/vegetable snacks

The healthy fruit & vegetable chips market in Asia Pacific is expected to register the highest CAGR of 9.0% from 2026 to 2033, as more consumers are becoming health-conscious and seeking nutritious, clean-label snacks instead of traditional fried snacks. Fruit- and vegetable-based snacks have expanded beyond conventional dried fruits to include dehydrated fruit chips, freeze-dried fruits, vegetable chips, baked vegetable crisps, and roasted vegetable snacks. Popular ingredients include banana, apple, mango, jackfruit, berries, beetroot, sweet potato, and carrot. Some unconventional vegetables like okra, taro, radish and mushroom chips are also available (4).

•Frozen snacks

Frozen snacks are emerging as a significant growth segment within India's snack industry, driven by convenience, evolving lifestyles and improving consumer trust. According to Godrej Yummiez' India's



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Frozen Snacking Report 2024, 53% of Indians incorporate frozen snacks into their daily diets, reflecting a shift from occasional consumption to regular meal and snacking occasions. Importantly, consumer perceptions are becoming increasingly favourable, with 67% trusting frozen snacks from reputed brands and 57% considering them safe for consumption (5). In India, the frozen snacks category has expanded beyond conventional fries to include samosas, aloo tikki, cutlets, kebabs, momos, spring rolls, nuggets, patties, cheese appetisers and ready-to-cook parathas, catering to both traditional and international taste preferences. The popularity of these products is driven by convenience, consistent quality and increasing demand for quick, ready-to-cook meals and snacking solutions.

• Functional snacks

The focus of snacking is moving from indulgence to overall well-being. High-protein snacks are leading this shift, with a leading e-commerce platform reporting a 150% increase in protein product orders between 2023 and 2025. Products such as protein

chips, Greek yoghurt, peanut butter, whey protein, soya chunks, and sattu have witnessed significant growth, highlighting both the popularity of protein-rich foods and the modernisation of traditional ingredients. In addition to their popularity as standalone products, whey protein, soya, and sattu are increasingly being incorporated into functional snacks, including protein bars, cookies, beverages, and traditional snacks like sattu bites, laddoos, khakhra, etc, highlighting both the popularity of protein-rich foods and the modernisation of traditional ingredients.

Some of the innovations in functional snacks include functional beverages, nutraceutical gummies, probiotic dairy snacks, and fibre-fortified bars, all of which incorporate bioactive ingredients to deliver health benefits. Functional beverages, such as protein shakes, electrolyte drinks, and vitamin-fortified beverages, are formulated to offer health benefits and convenience. Protein-enriched ready-to-drink beverages have become particularly popular among fitness enthusiasts and busy professionals.

Nutraceutical gummies are now available with ingredients such as L-theanine, magnesium, collagen, and biotin, targeting immunity,

digestive health, etc. For instance, Ashwagandha, an adaptogenic herb widely used in Ayurveda, has gained significant popularity in gummy formulations. Another example is melatonin, a natural hormone that helps induce sleep, which is now available in the form of gummies and mints.

Probiotic dairy snacks and drinks, such as Greek yoghurt and kefir, provide beneficial microorganisms such as Lactobacillus and Bifidobacterium that help maintain a balanced gut microbiota. To enhance the sensory appeal, manufacturers now offer Greek yoghurts with inclusions such as granola, cookie crumbs and dessert-inspired flavours. Fibre-fortified bars combine ingredients such as oats, chicory root inulin, FOS (Fructooligosaccharides), -glucan, psyllium husk, nuts, seeds, and dried fruits to increase dietary fibre intake. FOS not only adds fibre but also acts as a low-calorie sweetener in the products. These bars offer a convenient snack option for busy individuals seeking to increase their daily fibre intake. Increasing awareness of digestive wellness and the widening "fibre gap" in modern diets have driven innovation in snack bars that deliver both protein and fibre while maintaining clean-label formulations (6,7).



Technology behind the Innovations

Many of these innovations are enabled because of the advanced processing technologies, which help the manufacturers to develop healthier snacks without compromising on taste or texture.

Vacuum frying uses low-pressure conditions to fry foods at lower temperatures than conventional frying. This reduces oil uptake and helps retain the natural colour, flavour, texture, and heat-sensitive nutrients of fruits and vegetables. Air frying uses rapid hot air circulation to produce a crispy texture with significantly less oil than conventional frying, helping reduce fat content while retaining flavour. These technologies have gained popularity in products such as chips.

Freeze-drying removes moisture from foods, where frozen water turns directly to vapour without melting. It is widely used to produce fruit and vegetable snacks, offering a light, crunchy texture and an extended shelf life without the need for preservatives. Extrusion technology enables the production of innovative puffed snacks from cereals, pulses, and millets while providing desirable textures. Co-extrusion technology is expanding the possibilities for snack innovation.

Co-extrusion enables the production of snacks with a crispy outer layer and a filled centre, allowing manufacturers to combine different flavours, textures, or functional ingredients in a single product (8). This approach offers greater flexibility in product development and supports a wide variety of shapes, textures, and healthier processing options, making it an increasingly attractive technology for snack manufacturers.

Conclusion

The Indian snack industry is undergoing a significant transformation, driven by changing consumer preferences, advances in food technology, and continuous product innovation. From traditional regional flavours to functional and premium snack offerings, manufacturers are reimagining products to meet evolving demands for convenience, nutrition, and sensory appeal. As innovation continues, the future of snacking will be defined by products that successfully balance health, taste, and sustainability.

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Effects of Processing on Protein

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Proteins are an important macronutrient because of their structural, nutritional, and functional properties. With growing awareness of health and wellness, demand for protein from diverse sources is rising.

They are important ingredients in food products because of their functional properties, such as fat binding, emulsification, hydration, flavour retention, mouthfeel improvement, foaming, gelation, adhesion, coating, edible films, and texture improvement. These

properties make them useful in a wide range of food applications like beverages, cheese, ice cream, etc. Different processing treatments are applied to food systems for preservation, quality improvement, and sensory acceptance.

Conventional processing: (1), (2), (3) Processing of food involves mixing the protein with other food components. Most commonly used methods of processing include cooking, blanching, pasteurisation, and sterilisation. Heat treatment of foods will have both beneficial and deleterious effects on the proteins. One of the major reactions because of protein-carbohydrate interaction upon heating is the Maillard reaction. This is also called non-enzymatic browning. This is because of

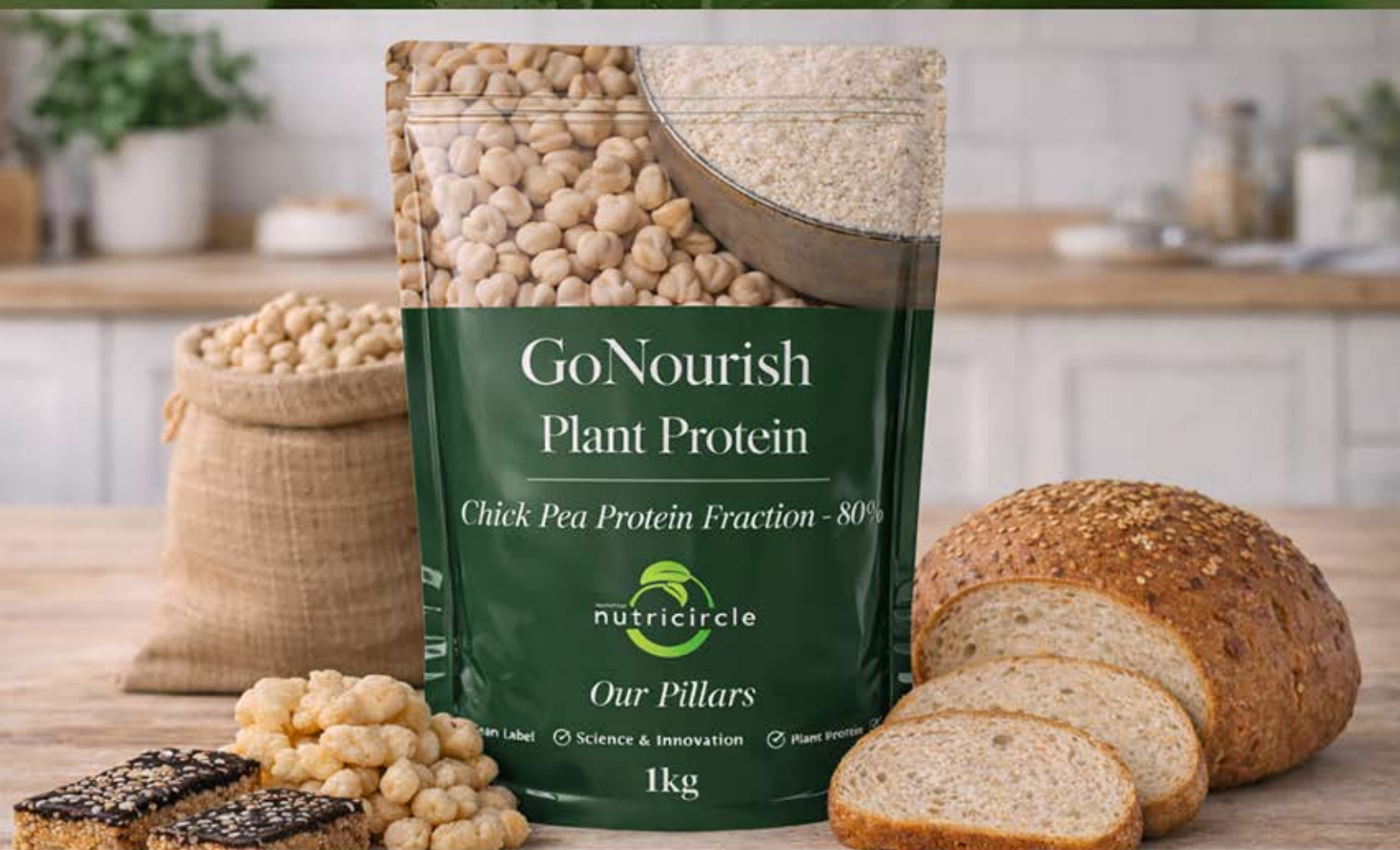
a complex set of reactions between amines and carbonyl groups at elevated temperatures, resulting in an insoluble brown product known as melanoidins. It improves the aroma of the food products. The Maillard reaction impairs protein nutritional value. Some of the Maillard reaction products are mutagenic. Moderate heat treatment (60 – 90 °C, 1 hr or less) causes denaturation of proteins. Extensive denaturation can result in insolubilisation, impairing functional properties. Partial denaturation improves the digestibility and biological availability of amino acids. Several enzymes in food denature during blanching because of moderate heating, which otherwise would cause undesirable effects on colour, flavour, undesirable changes in texture, and/ or a decrease in vitamin content.

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Most protein toxins and antinutritional factors in foods are denatured and inactivated by heat. Examples are trypsin and chymotrypsin inhibitors in Soybean. This is more beneficial for the plant proteins because they contain proteinaceous antinutritional factors. Lectins in legumes and oilseed proteins are inactivated, improving the digestibility of proteins. Protein toxins, such as botulinum toxin and enterotoxin from *Staphylococcus aureus*, are inactivated by heat treatment.

Oxidising agents such as hydrogen peroxide and benzoyl peroxide are used as bactericidal agents in milk, as bleaching agents in cereal flours, protein isolates, and fish protein concentrate. They cause oxidation of several amino acid residues. The most sensitive amino acids are sulphur-containing amino acids, tryptophan, and to a lesser extent, tyrosine and histidine. Functional properties like water binding, emulsification, and gelation decrease because

of oxidative reactions. This affects the solubility of proteins. Protein isolation from biological sources involves many unit operations, such as isoelectric/salt precipitation,

thermocoagulation, and ultrafiltration. Some of the proteins in the crude extract may get lost during the isoelectric precipitation process. Such losses can alter the amino acid composition and nutritional value of isolates as compared to the crude extract. For example, WPC prepared by ultrafiltration/diafiltration, ion exchange methods undergo marked changes in their proteose-peptone content, affecting foaming property.

Novel methods of processing to alter functional properties:

(4) (5)

Many novel methods are being explored to modify the functional properties of foods. These physical methods have an effect on the nutritional and functional properties of proteins. These methods will be helpful in innovations related to food protein modifications and their applications in the food industry.

Ultrasound: Ultrasound is

sound with a frequency above 20 kHz. It generates an instantaneous high pressure around the probe. It creates cavitation that produces some physical forces, including shear forces, micro jets, turbulence, and shock waves. Ultrasound treatment can also cause water vapour to dissociate, producing OH⁻ and H⁺ ions. These lead to the degradation of proteins and the inactivation of enzymes that can improve the functional properties of proteins. Particle size is decreased because of high shear forces associated with ultrasound cavitation in liquids. Cavitation forces disrupt granules of alpha-lactalbumin and beta-lactalbumin, making them more permeable to water.

Ultrasound treatment produces considerable forces that improve the water dispersion and solubility of proteins. This was observed in WPI, SPI, Bovine Serum Albumin, Casein, and fava bean protein isolates. High shear associated with ultrasound cavitation in liquids helps decrease the particle size and solubility of proteins. It was observed that the solubility and surface hydrophobicity of protein dispersions were enhanced after ultrasound treatment. Ultrasound could be used to improve gelatinisation and decrease the viscosity of proteins.

Low-frequency and high-frequency ultrasound can improve the emulsification of many dietary proteins, such as wheat gluten, SPI, and WPI. Ultrasound-treated proteins enhance the efficiency of protein digestion and influence the subsequent generation of potential bioactive compounds.

High-pressure homogenisation (HPH):

HPH is used for the modification of the physical properties of proteins. In HPH homogenisation, a homogeneous pressure of 150 to 350 MPa is applied. Turbulence, high-pressure shearing, and cavitation in HPH reduce the size and generate higher WHC of proteins. HPH improves emulsifying capacity but reduces emulsion stability. Increasing pressure during HPH could enhance the adsorption of emulsion droplets on the surface, which is important for the emulsion stability. The conformational structure changes in proteins, such as solubility, secondary structure, tertiary structure, gelatinization, and emulsification, after HPH improve the digestibility and nutritional composition.

Ball mill treatment: The ball mill breaks the particles of protein into a range of 1 nm to 100 micrometres. This provides a mechanical and

chemical effect by combining collision, friction, and shear. More hygroscopic groups are exposed from the inner molecule. The ball mill treatment decreases the particle size. Turbiscan Stability Index (TSI) is an indicator of the stability of the emulsion during storage. TSI of emulsions decreased after prolonged ball milling, indicating the emulsion stability. Ball mill-treated protein powder possesses higher dispersibility, stability, and fluidity. The solubility of nutritional components increases after ball milling treatment.

Enzymatic modification:

Enzymatic modification of proteins involves altering their structure by cleaving peptide bonds. The enzyme-treated proteins display improved digestibility, absorption capacity, modifications of flavour and texture, and biological availability, including antioxidant, immunomodulatory, antihypertensive, antithrombotic, and hypoglycaemic ability. The solubility, gelatinisation, and emulsification improve.

Ohmic heating: This involves heating the food product, which is placed between two electrodes. Heat is generated because of resistance, and there is a



rise in temperature. Heating is faster than conventional heating. This impacts the functional properties of proteins. One study reported that ohmic heating enhanced the water and oil holding capacity, emulsifying properties, and foaming properties of sesame protein isolate. Ohmic heating improved the bioactivity of sheep milk by proteolysis that produced antimicrobial, antioxidant, antihypertensive, antithrombotic, and immunomodulatory properties.

Cold plasma processing:

Several reports indicate the influence on the functional properties of proteins because of cold plasma treatment. This could be because of oxidative modification, causing protein structure to unfold, exposing hydrophobic groups. Water and fat holding capacity, emulsifying capacity, and emulsion stability were increased with cold plasma treatment. Reactive oxygen species (ROS) and Reactive Nitrogen species (RNS) from cold plasma play a significant role in protein oxidation, altering amino

acid side chains and disrupting noncovalent interactions that affect the structural integrity of proteins. ROS and RNS can react with various types of amino acids, and S-containing amino acids like Cysteine and methionine are linked to ROS oxidation.

Plasma-activated water (PAW): PAW treatment has the potential to alter the structure and functionality of many food proteins. It induces mild oxidation, unfolding, and alterations in protein structure. This leads to changes in secondary structure, increased hydrophobicity, and improved functional properties, including foam stability and gel strength. This is attributed to increased hydrophobic interactions between protein molecules.

Pulsed electric field (PEF): This is a non-thermal method of processing, which applies short, high-voltage electrical pulses to food placed between two electrodes. It induces structural changes in proteins. The mechanism of food protein modification by PEF includes unfolding, aggregation, covalent reactions, and oxidation. It disrupts the tertiary and quaternary structures of proteins via electrostatic

forces, leading to protein unfolding and exposure of hydrophobic areas, increasing their susceptibility to subsequent interactions. Functional properties of proteins, such as solubility, gelling, and emulsifying capacity, are modified by PEF due to the development of covalent bonds between protein molecules, such as disulfide bonds, stabilising aggregation.

Future perspective: These novel methods have interesting effects on protein properties, and each of them has drawbacks. A combination of thermal and nonthermal methods will lead to better protein modifications. A good example is a combination of ultrasonic heating and nonthermal PAW, where PAW is used as a pre-treatment. This will avoid protein denaturation from prolonged ultrasonic heating and help to provide energy to reactive species of both protein and plasma. Complexity of scaling up, controlling the process, and validating novel food process can be done with the help of computer-based tools.

Conclusion: Thermal processing of foods has been a method for food preservation used for a long

time. Processing at ambient temperatures has an advantage because there is less loss of nutrients, and therefore, physical methods are preferred.

Understanding the overall effects from nutritional, quality, and engineering perspectives of these techniques will facilitate process parameter optimisation, enhance food quality, and aid in the development of innovative foods with protein as the main ingredient. There is a need for future research on a clear understanding of the mechanisms of these effects and optimisation of parameters to obtain desired functionality.

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Postbiotics: Nutraceutical Innovations for the Gut Microbiome

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Introduction:

The human gut microbiota consists of up to 100 trillion diverse group of microorganisms. These microbes serve a number of important functions including; producing additional energy by breaking down soluble fibre; producing vitamins such as biotin, folate and vitamin K; metabolizing xenobiotics such as the inactivation of heterocyclic amines formed in meat during cooking; preventing colonization by pathogens and assisting in the development of a mature immune system. Imbalance of the normal gut microbiome has been linked with gastrointestinal conditions such as inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS), and wider systemic manifestations of disease such as obesity, type 2 diabetes, and allergic response. Gut bacteria produce vital neurotransmitters, regulate inflammation, and send chemical and neural signals

that heavily influence mood, behaviour, and neurological health. (1)

Probiotics, prebiotics, synbiotics, and postbiotics

Probiotics, prebiotics, synbiotics, and postbiotics represent important dietary interventions for modulating the composition and function of the gut microbiome, thereby supporting gut homeostasis and overall health.

The term “**probiotic**” was defined by the Food and Agriculture Organization (FAO) and World Health Organization (WHO) as “live microorganisms which when administered in adequate, amounts confer a health benefit on the host”. Probiotics are live microorganisms that support the body by maintaining the natural balance of microbes in the gut microbiome.

The current definition of a **prebiotic** is “a substrate that is selectively utilized by host microorganisms

conferring a health benefit. Prebiotics are food for probiotic microbes. Examples of prebiotics include human milk oligosaccharides (HMOs), the major carbohydrate component of human milk other than lactose, galacto-oligosaccharides (GOS). Other prebiotics from plant sources include fructo-oligosaccharides (FOS), arabin-xyl-oligosaccharides (AXOS), xyl-oligosaccharides (XOS) and inulin. The term “**synbiotic**” was defined as “a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host. Example is a combination of the prebiotic FOS with a probiotic Bifidobacterium.



The term of “postbiotic” was recently defined as “preparation of inanimate microorganisms and/or their components that confers a health benefit on the host” (1)

Types of probiotics

Researchers have identified diverse forms of postbiotic compounds generated by both extracellular and intracellular probiotic bacteria. These include unviable microbial cells, parts of the cells such as cell fragments, cell components or substances produced by the viable cells. These substances include short-chain fatty acids (SCFAs), exopolysaccharides (EPS), bioactive peptides (BAPs), organic acids and vitamins. Probiotics are known to have potential health benefits such as anti-inflammatory, antioxidant, anti-cancer, and antihypertensive properties. (2)

Inactive cells and parts of the cells

A number of components of the cell wall of bacteria are immunogenic, i.e., those substances are able to

produce an immune response which includes teichoic acids, lipoteichoic acids etc. Both teichoic and lipoteichoic acids demonstrate a range of bioactivities

including anticancer, immunomodulatory, and antioxidant properties (2). Bacterial lysates are made from bacterial cells that are broken down and are aimed to stimulate the immune system to recognize and fight infections.

Substances produced by viable probiotics

Cell-free supernatants (CFS) are liquids that contain the metabolites left behind from microbial growth and any unabsorbed nutrients from the growth medium. CFS produced by Lactic acid bacteria (LAB) can have an antibacterial effect due to organic acids, proteinaceous molecules, and fatty acids.

Examples of probiotics in CFS include:

Short chain fatty acids (SCFAs)

Short-chain fatty acids (SCFAs), primarily butyric, propionic, and acetic acids, are key intermediates generated by anaerobic bacterial production in the gut. Conjugated linoleic acid (CLA) is known to be produced by LAB.

Exopolysaccharides (EPS)

Exopolysaccharides (EPS) are branched, repeating units of sugars or sugar derivatives that are long-chain, high-molecular-weight polymers and are produced by mostly LAB. EPS can be classified into two depending on the chemical composition as homopolysaccharides, which contain only one type of monosaccharide unit; (examples include levan, curdlan, pullulan, and dextran) and heteropolysaccharides which contain repeating units of several different monosaccharides (examples include xanthan, gellan, galactan, and kefiran). Some of these polysaccharides such as pullulan and xanthan have application in food products.

Other Metabolites

Other postbiotic metabolites produced by bacteria include vitamins, aromatic amino acids, phenolic-derived metabolites, bioactive peptides. Vitamins cannot be produced by humans and are obtained either through diet or from microorganisms. Gut microbiomes have the ability to synthesize B group vitamins including B12, B2, B6, B9, and vitamin K.





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several fermented foods like yogurt, sauerkraut, pickled vegetables, and kombucha, and are produced by various bacterial and yeast species, the strains of which mainly include

postbiotics in a controlled and efficient manner to enable their study and use in food, pharmaceutical, and nutraceutical applications. Studies have shown that fermentation of probiotic bacteria such as Bifidobacterium and Lactobacillus strains can effectively produce postbiotics. Extracellular compounds can be harvested from cell free fermented material. Furthermore, co-culture fermentation strategies, involving the simultaneous growth of multiple microbial species, have demonstrated synergistic effects in producing a wider array of bioactive metabolites compared to monocultures.

Enzymes

Probiotics produce a variety of enzymes involved in diverse biological activities, such as peptidases, lipases, amylases, proteases, ureases, and phenoloxidases. Some of these enzymes, act as antioxidant proteins, contribute to controlling inflammatory processes. For instance, *L. acidophilus* strain 900 demonstrated more efficient control of inflammation than *L. plantarum* 30B strain in an animal model of inflammatory bowel disease (IBD). Two strains of *Lactobacillus fermentum* were reported to contain a significant amount of glutathione peroxidase which was later discovered to have strong in vitro antioxidant activities. (2)

those of *Lactobacillus*, *Bifidobacterium*, *Streptococcus*, *Eubacterium*, *Faecalibacterium*, and *Saccharomyces*. The amount of postbiotics produced during natural fermentation cannot be controlled and may be insufficient to generate a physiological response in vivo. Therefore, production methodologies have been explored by researchers to produce

Table 1: Food applications of postbiotics (4)

Postbiotic	Food product	Benefit
Nisin	Dairy & processed products, soups, sauces	Acts as a preservative
Polysaccharide extracts from <i>Lactarius volemus</i> Fr.	Yoghurts	Improvement in water retention, reduction in pH
<i>Bifidobacterium longum</i> spp. <i>infantis</i> and <i>Bifidobacterium pseudocatenulatum</i>	Cereal mixtures	Reduced contents of phytates and increased level of myo-inositol triphosphate
Supernatant of <i>Lactobacillus sakei</i> NRRL B-1917	Grilled beef	Reduced counts of <i>E. coli</i> , <i>Listeria monocytogenes</i>
Bacteriocin-like inhibitor substance of <i>Lactobacillus plantarum</i> ST16Pa	Chicken breast	Bioconservative against <i>Enterococcus faecium</i> for 7 days
Pirrolo [1,2-a] and pyrazine-1,4-dione from <i>Lactobacillus salivarius</i>	Ground beef and whole milk	Biofilm removal of <i>Listeria monocytogenes</i>

Production Technologies for Postbiotics

Postbiotics can be found naturally in

For instance, co-fermentation of *Lactobacillus* and *Saccharomyces* species can yield a richer postbiotic profile, benefiting functional food development. For intracellular postbiotics, the bacterial membrane is disrupted by applying a combination of treatments to obtain metabolites and/or cell wall components in the form of fragments. (3)



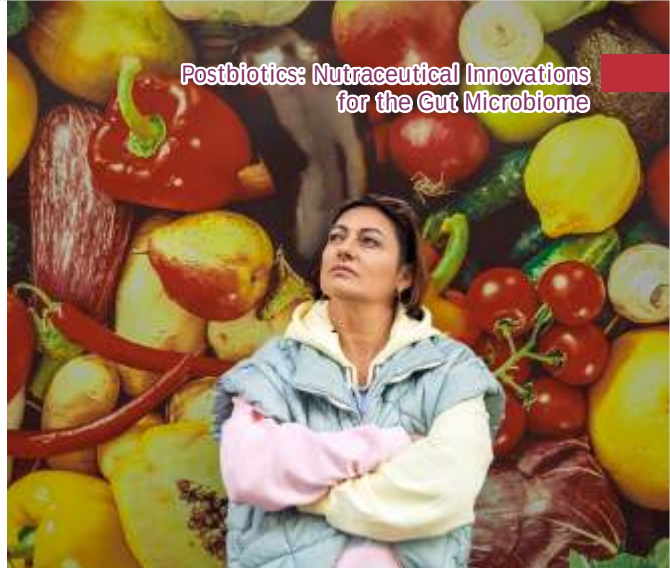
Potential Applications in Food industry

Nisin, used as a preservative in several foods (infant formula, canned soups, dairy products), can be produced by *Lactococcus lactis* subsp. *lactis*. Beyond dairy, postbiotics have found their way into beverages such as fruit juices, functional drinks, and smoothies, where they contribute health benefits without affecting taste or texture (3). The inclusion of postbiotics in dry foods like cereals and snack bars provides consumers with convenient options for daily intake of these bioactive compounds. The flexibility

of postbiotics to be integrated into both liquid and solid foods opens vast opportunities for product innovation aimed at health-conscious consumers. (3) Table 1 provides a summary of the applications and benefits of postbiotics in food products. (4) Research has shown that edible coatings developed using fermentation products of *Saccharomyces boulardii* ATCC MYA-796 and polysaccharides exhibit preservative effects on lamb meat, effectively reducing microbial growth, extending meat shelf life, and maintaining favourable sensory characteristics of lamb.

Stability of postbiotic formulations

Encapsulation is a widely adopted technique that involves surrounding postbiotic compounds with protective materials such as proteins, polysaccharides, or lipids. This approach shields the bioactives from degradation caused by processing, storage, or digestive enzymes, while also enabling targeted release within the gastrointestinal tract. Emulsification helps to uniformly disperse postbiotics in food systems, particularly in liquids or semisolid formulations, improving both product



Postbiotics: Nutraceutical Innovations for the Gut Microbiome

stability and sensory attributes. Spray-drying is another common method to convert postbiotics into powder forms that facilitate ease of handling, blending, and incorporation into diverse food products, while also extending shelf life (5).

Challenges and Safety Regulations

The regulatory environment surrounding postbiotics is still evolving and presents certain complexities. Agencies like the EFSA, and the US FDA have yet to provide clear, specific definitions or regulatory pathways explicitly for postbiotics, resulting in some uncertainty for manufacturers and consumers alike (6).

The need of a proper definition is also significant from a regulatory perspective since it makes it easier for its usage in food and supplements and approval. In the United States, the FDA's GRAS framework has recognized certain postbiotic ingredients.



For example, butyrate-producing bacterial metabolites and pasteurized *B. animalis* subsp. *lactis* have received GRAS notices under specific usage conditions. As postbiotic foods are a relatively new concept, there are no clinical or epidemiological reports of health hazards associated with its consumption.

Conclusions and Future Directions

Postbiotics have gained recognition as a promising and adaptable group of microbial derivatives that offer notable benefits over traditional live probiotics

since viability of probiotics is a challenge. Eating a diet that is high in probiotic and prebiotic foods could ensure that the gut has an adequate level of these essential compounds as postbiotics are

produced when probiotics feed on prebiotics.

In particular, postbiotics offer significant advantages for sustainability due to their non-viable nature, reducing reliance on cold-chain logistics and enabling longer shelf life in ambient conditions that are critical for extending functional food.

The bioactivities of postbiotics include anti-cancer, anti-obesogenic, anti-inflammatory, hypo-cholesterolemic, antioxidant, and immunomodulatory effects.

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Mango:

Nutritional Composition, Phytochemical Properties, Therapeutic Applications, and Functional Potential of Peel, Pulp, and Seed

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Mango is one of the most widely traded tropical fruits globally; however, large quantities of peel and seed generated during processing are commonly discarded as agricultural waste.

Mango peel constitutes approximately 15-20% of the total fruit weight and represents a major by-product of the juice and food processing industries. Despite being treated as waste, mango peel is rich in nutrients and bioactive compounds, creating opportunities for its utilization in food, nutraceutical, and pharmaceutical applications. Owing to its traditional use as both food

and medicine in several regions, mango peel is increasingly being explored as a potential ingredient in the development of functional foods (Puspita Ganguly et al 2025). Recent studies have further highlighted the industrial importance of mango by-products such as peel and seed kernel, which contain higher concentrations of

phenolics and antioxidants than the edible pulp (Lebaka, V. R et al 2018, Duarte et al., 2025). Mango by-products constitute nearly 35-60% of the fruit after processing and are now recognized as valuable raw materials for nutraceutical, pharmaceutical, cosmetic, and food industries (Food Bioscience Review, 2022).



Nutritional Information and Biochemical Composition

Mango Peel (Skin)

Mango peel, once considered agricultural waste, has emerged as a valuable source of bioactive compounds with industrial and therapeutic importance. Several studies indicate that mango peel possesses greater antioxidant activity than pulp due to its higher phenolic concentration (Kim et al., 2010).

The peel contains mangiferin, gallic acid, chlorogenic acid, ferulic acid, vanillic acid, rutin, catechins, epicatechins, quercetin, kaempferol, anthocyanins, carotenoids, tocopherols, and gallotannins. Chlorogenic acid and vanillic acid are especially important contributors to antioxidant activity.

Duarte et al. (2025) noted that mango by-products including peel are increasingly used in food fortification, biodegradable packaging, nutraceuticals, and pharmaceutical formulations because of

their high fibre and antioxidant content.

Mango peel is also rich in dietary fibre, pectin, cellulose, hemicellulose, proteins, and unsaturated fatty acids such as linoleic acid and oleic acid. Peel flour has been successfully incorporated into bakery products and functional beverages to improve nutritional quality.

Recent reviews on mango by-product valorisation highlighted that peel extracts exhibit antioxidant, antimicrobial, anti-inflammatory, anticancer, and anti-aging properties, making them highly valuable for nutraceutical and cosmetic industries (Food Bioscience Review, 2022).

According to the study by Ganguly et al. (2025), mango peel is a nutrient-rich agro-industrial by-product with significant nutraceutical and functional potential. Mango peel constitutes about 15–20% of the total fruit weight and is usually discarded during processing, contributing to environmental waste. However, the review highlights that mango peel is rich in dietary fibre, polyphenols, carotenoids, vitamins, and bioactive compounds with important health-promoting properties.

The article reports that mango peel contains soluble and insoluble dietary fibres such as starch, rhamnogalacturonans, lignin, and hemicellulose, which are beneficial for gut health and digestion. It also contains ascorbic acid, fructose, mangiferin, flavonoids, and antioxidant compounds that exhibit antioxidant, anti-inflammatory, antimicrobial, and potential anticancer activities.

Raw And Ripe Peels

Ajila et al. (2007) investigated the nutritional and functional components of raw and ripe peels from two Indian mango varieties. The study found that mango peel is a rich source of dietary fibre, phenolic compounds, carotenoids, and antioxidant constituents. Ripe peels showed higher levels of total carotenoids, while raw peels contained comparatively higher phenolic content. Both peel types exhibited strong antioxidant activity, indicating their potential health-promoting properties. The authors highlighted that mango peel, often discarded as waste, can be effectively utilized as a value-added ingredient in food formulations due to its bioactive compounds and functional benefits in improving nutritional quality.

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 **READY-TO-SERVE FRUIT DRINK.** Contains Mango pulp. Maaza is a registered trademark of The Coca-Cola Company. Images for representation purposes only.



Mango Seed Kernel

The mango seed kernel contains significantly higher concentrations of proteins, fats, and bioactive compounds than pulp. It is rich in essential amino acids including leucine, lysine, methionine, valine, histidine, and phenylalanine. The seed kernel contains carbohydrates, dietary fibre, and lipids rich in oleic acid, linoleic acid, palmitic acid, stearic acid, arachidic acid, and behenic acid. These fats resemble cocoa butter and therefore possess commercial value in confectionery and cosmetic applications.

Mangiferin, tannins, gallic acid derivatives, and polyphenols present in the seed kernel contribute to antioxidant, antimicrobial, antidiabetic, and hepatoprotective activities. Research indicates that mango seed extracts may inhibit α -amylase and α -glucosidase enzymes, helping regulate blood glucose levels (Lebaka, V. R et al 2018).

Mango leaves

Mango leaves contain a wide range of bioactive constituents, including amino acids such as leucine, alanine, valine, glycine, tyrosine, and γ -aminobutyric acid. They are also rich in phenolic compounds and polyphenols such as catechin, protocatechuic acid, mangiferin, hyperin, gallic acid, quercetin, ethyl digallate, shikimic acid, and ellagic acid. In addition, various alcohols including ethyl, isobutyl, and methyl alcohols have been identified. The leaf essential oil and extracts also contain diverse terpenes like friedelin, linalool, luteol, β -bulnesene, α -guaiane, humulene, α -farnesene, myrcene, car-3-ene, limonene, β -ocimene, β -terpinene, and α -terpinolene. Phenylpropene compounds such as elemicin, methyleugenol, and estragole are present, along with sterols including β -, γ -, and δ -sitosterol, highlighting the rich phytochemical diversity of mango leaves (Anjaneyulu, V., & Radhika, P. 2000, Ribeiro, S. M. R., & Schieber, A. 2010). Ayurvedic and modern studies report that mango leaf and its mangiferin-rich extracts provide gastrointestinal, metabolic, renal, and antimicrobial benefits (Rymbai et al., 2016; Saleem-Dar et al.,

2016).

Pharmacological Activities of Mango Seed, Kernel, Leaf, and Peel
Mango (*Mangifera indica* L.) seed, kernel, leaves, and peel exhibit diverse pharmacological activities due to their rich phytochemical profile, including polyphenols, flavonoids, mangiferin, carotenoids, and tannins.

Mango peel shows strong antioxidant, anti-inflammatory, and antimicrobial properties, while seed and kernel extracts demonstrate antidiabetic, anticancer, and cardioprotective effects. Mango leaves are widely reported for their antihyperglycemic, hepatoprotective, and immunomodulatory activities. These effects are mainly attributed to mangiferin and other bioactive compounds that regulate oxidative stress and metabolic pathways. Overall, mango by-products possess significant therapeutic potential for development of functional foods and pharmaceutical formulation (Rymbai, H., Srivastav, M., & Sharma, R. R. 2016).

Medicinal Uses

Mango leaf extracts rich in mangiferin are also widely studied for antidiabetic and neuroprotective activities.

Kumar et al. (2021) reported that mango leaves contain significant concentrations of polyphenols, flavonoids, and antioxidants that support metabolic and cardiovascular health.

Functional and Industrial Applications

The peel, often considered waste, is increasingly utilized for the extraction of dietary fibre, antioxidants, bioactive compounds, and natural preservatives. Similarly, mango seed kernels are being explored for the development of functional ingredients, bioactive powders, edible oils, and cosmetic formulations.

Conclusion

Mango peel and seed kernel, once considered industrial waste, have emerged as valuable sources of nutraceutical and pharmaceutical compounds with significant industrial applications. Scientific evidence increasingly supports the use of mango-derived products in functional foods, dietary supplements, cosmetics, and preventive medicine. Future investigations should focus on clinical validation, molecular mechanisms, sustainable processing technologies, and improved utilization of mango by-

products to maximize their health-promoting and economic potential.

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Plant-Based Meat: Advances, Challenges and Regulations



By
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The idea of plant-based meat is no longer limited to vegetarian patties or soya chunks placed in the "health food" corner of a store. In the last decade, it has moved into mainstream food science, retail shelves, quick-service restaurants and investment discussions.

Although the concept may sound simple, developing a plant-based food that can match meat in texture, juiciness, flavour and cooking behaviour requires careful ingredient selection, structuring technology and flavour design [1].

This category has grown because it sits at the intersection of several consumer concerns: health, sustainability, animal welfare, convenience and curiosity. Recent product development

and marketing have increased the visibility of plant-based meat alternatives, but the category is still developing and faces technological, nutritional and consumer-acceptance challenges [1].

Advances in Ingredients and Raw Materials

Early products were largely built around soy, wheat gluten and pea protein. These ingredients remain important because they are available, functional and protein rich. Soy protein has good emulsifying and texturizing properties, wheat gluten provides elasticity and chew, and pea protein has become popular because of its non-GMO positioning and non-allergen advantage compared with soy and wheat [1].

Researchers and companies are exploring proteins from faba bean, chickpea, lentil, mung bean, lupin, potato, rice, canola, sunflower and underutilised grains and oilseed meals.

Chen et al. (2026) reviewed advances in plant-based meat alternatives across ingredients, processing, consumer perception and future directions, and noted that novel plant-based protein sources can improve both nutritional and physicochemical properties [2]. This matters because proteins behave differently during hydration, extrusion, shearing, heating and flavour binding [2].

There is also growing interest in using side streams and by-products from food processing industry. Oilseed cakes, pulse fractions, cereal brans and other protein-rich by-products can become valuable raw materials if they are processed safely, standardized for quality and improved sensorially. For India, this is a strong opportunity because the country already produces a diverse range of pulses, cereals and oilseeds that can support affordable, locally sourced plant-based meat products [2].

Veg DHA Omega-3 Throughout the Life Cycle



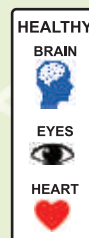
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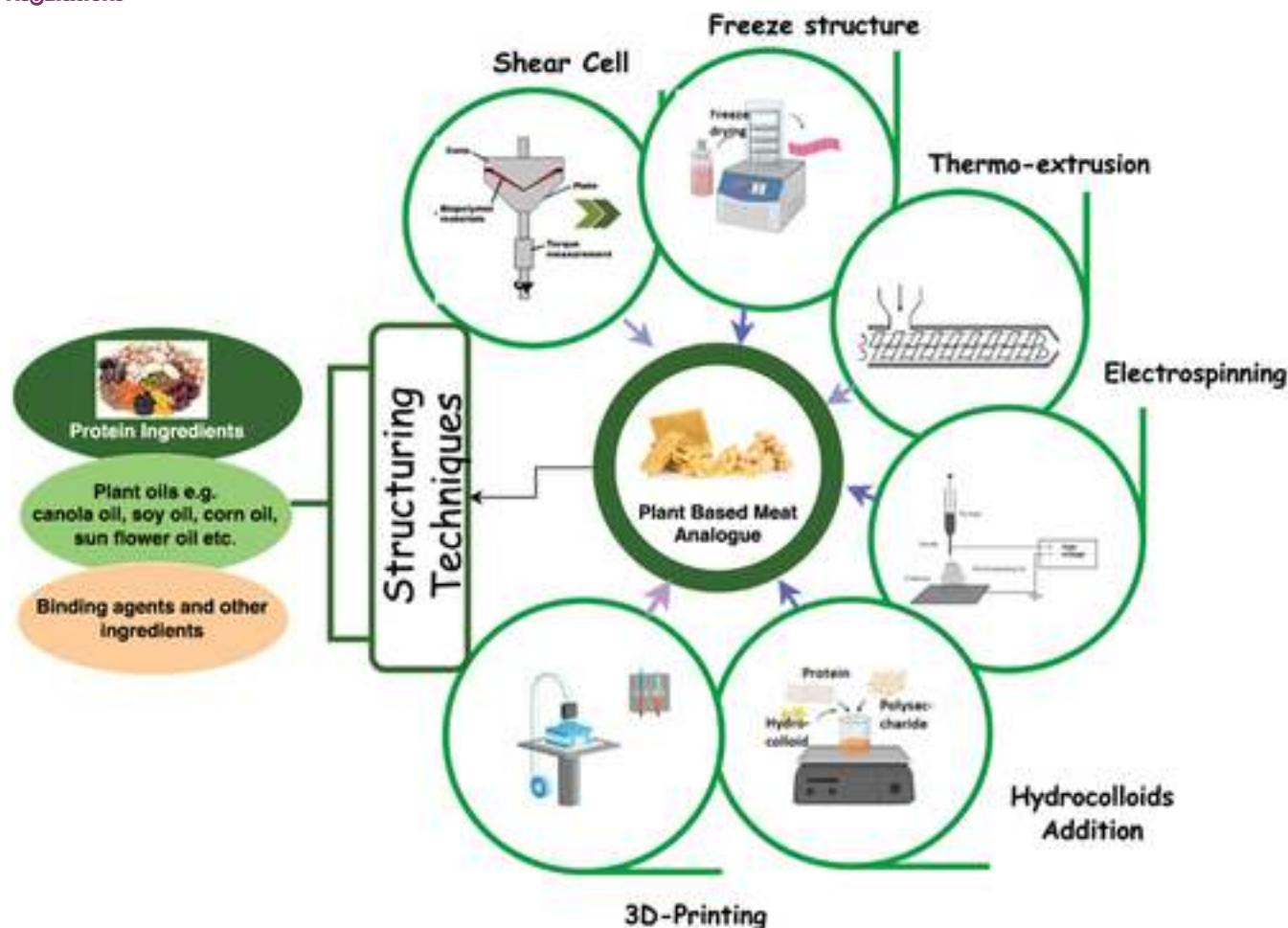


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Plant meat substitutes require more than protein alone. Fats, fibres, starches, hydrocolloids, colours and flavours support structure, juiciness, cooking stability, appearance and eating quality. Structured fats mimic animal fat, while binders such as methylcellulose, carrageenan and alginate improve structure. Beetroot, paprika, caramel and other colours help reproduce meat appearance.

Processing Technology, Texture and Mouthfeel

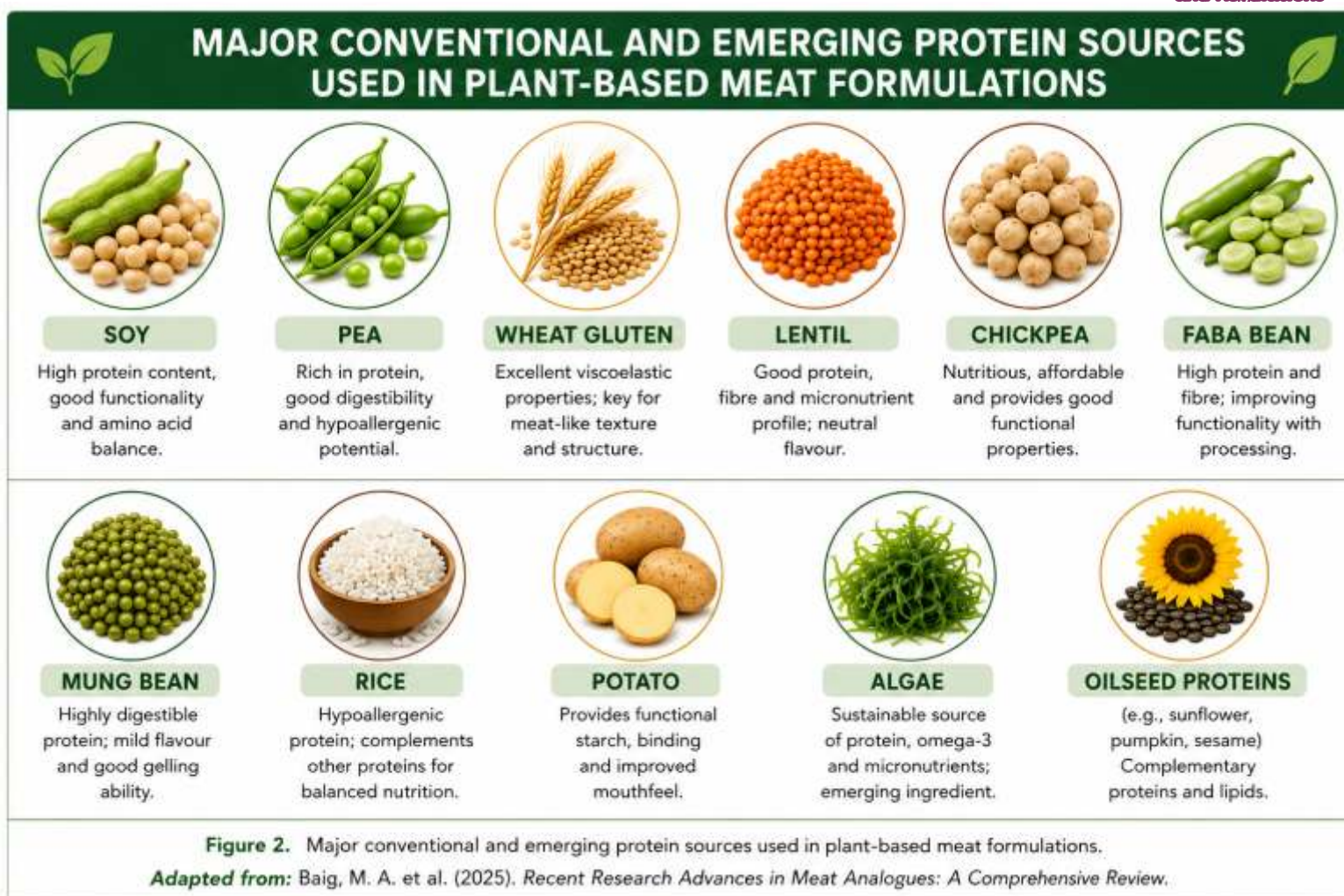
Meat has a complex fibrous structure created by muscle fibres, connective tissue

and fat distribution. The ability of plant proteins to form fibrous structures depends on their functional properties. Proteins with higher cysteine content can promote disulphide bond formation during processing, thereby improving structural integrity and meat-like texture [1,4].

Extrusion technology is most commonly used for meat substitutes. Low-moisture extrusion produces textured vegetable protein that can be hydrated and used in chunks or minced formats (e.g. soy). High-moisture extrusion, on the other hand, allows proteins to form layered, fibrous structures closer to cooked

meat. The choice of temperature, screw speed, moisture, cooling die design and protein blend can strongly influence the texture and mouthfeel [4].

Other technologies are gaining attention. Shear-cell processing can align proteins under controlled shear to produce meat-like sheets or fibres. 3D food printing is being explored where fat, protein and colour need to be placed in specific patterns. Fermentation is another promising route; Chen et al. highlights that incorporating fermentation in plant-based meat production can lead to products with better sensorial qualities [2].



Fungal mycelium is also emerging as a protein-rich material with naturally fibrous texture; for example, mycelium-based biomass can be used in mince, patty or nugget-style meat analogue applications [4].

The Flavour Challenge

Among the numerous technical challenges in the development of meat substitutes, replicating the characteristic flavour of meat continues to be one of the most significant and persistent obstacles. Meat flavour is a complex mixture of molecules created through reactions between

amino acids, reducing sugars, fats, nucleotides and minor compounds during cooking. Reviews on plant-based meat flavour identify aroma generation, flavour release and masking of plant-derived off-notes as key areas of product development [3]. Examples include beany notes in soy, bitter notes in pea protein, and grassy or astringent notes in some pulse proteins [3].

Flavour scientists use yeast extracts, hydrolysed vegetable proteins, smoke flavours, spices, Maillard reaction flavours and natural flavour systems to

build meat-like profiles. Fat is equally important because many aroma compounds are fat-soluble, and the way fat melts affects flavour release. A product may have a good flavour formula on paper but still fail if aroma release, juiciness and aftertaste are not balanced [3].

Indian culinary traditions offer a unique advantage for meat alternatives because spices, herbs, marinades, and traditional cooking methods can effectively enhance flavour and improve overall sensory acceptability.



Nevertheless, the base protein should be free from bitterness, dryness, and chalkiness, as these undesirable sensory attributes can adversely affect consumer acceptance (3).

Market and Consumer Challenges

Market challenges include price, consumer awareness. Price is a major barrier. Animal meat supply chains are mature, while plant-based meat often depends on specialized protein isolates, flavours and processing equipment. As scale improves and local sourcing grows, prices may reduce. Until then, plant-based meat would be priced at a premium [1,2].

Consumer expectation is another challenge. Vegetarians may not always want something too meat-like, while meat eaters often compare the product directly with chicken, mutton or beef. The target consumer therefore would be people who wish to replace meat from their

diet while enjoying the taste and texture of the food products. For them, plant-based meat must be positioned not as sacrifice, but as a tasty and convenient

choice [2].

Regulatory and Labelling Landscape

Regulation is becoming increasingly important as the category grows. In India, plant-based meat products fall under the broader food safety framework administered by FSSAI. At present, there is no separate FSSAI standard exclusively for plant-based meat; depending on the formulation, such products may be handled under applicable food categories or as proprietary foods, along with the Food Safety and Standards (Vegan Foods) Regulations, 2022 when a vegan claim is made [5]. Labelling must comply with general packaging, ingredient declaration, nutrition information, additive use and claims requirements [5].

International regulations are not harmonised. In the United States, there is no single federal ban on meat-like descriptors for plant-based foods, but labels must be truthful and not

misleading, and some states have attempted additional restrictions [7]. In Canada, plant-based products may be described as meat alternatives, but terms such as "simulated" and statements such as "contains no meat" or "contains no poultry" are used to avoid consumer confusion [7]. Singapore and Japan generally allow familiar category terms when qualifiers such as "mock", "plant-based" or other disclaimers are present [7]. In parts of Europe, meat-related naming remains politically sensitive, with restrictions debated or introduced in some markets [7].

The Way Forward

Plant-based meat is rapidly evolving beyond conventional meat substitutes into a diverse category of innovative food products. Future growth is expected to include realistic meat analogues for flexitarian consumers, Indian-inspired products developed for local palates, hybrid protein formulations, and minimally processed, nutrient-rich alternatives that appeal to health-conscious consumers [2].

For food technologists, the opportunity is exciting. Better protein functionality, fermentation, extrusion, flavour chemistry, fat structuring and nutrition design can all contribute to

improved products. For industry taste, trust and value decide repeat purchase [1,2,3].

Plant-based meat has moved from a niche vegetarian option to a serious area of food innovation. The strongest progress is visible in protein diversification, extrusion-based structuring, fermentation, flavour design and more transparent labelling. At the same time, the category still must solve practical problems of flavour, fibrous texture, mouthfeel, nutrition, affordability, clean-label perception and regulatory clarity.

For India, the opportunity lies in developing Indian formats such as kebabs, keema, tikka-style products and biryani applications using locally available pulses, cereals, oilseed proteins and safe food-processing by-products.

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Report on the White Paper Launch on "Gut Health in Modern Nutrition: Understanding the Role of Food Composition, Lifestyle & Preventive Nutrition"



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Ms Anuja Padte,
Food Scientist, PFNDAI

The Protein Foods and Nutrition Development Association of India (PFNDAI), in collaboration with Marico Ltd., successfully organized the launch of its White Paper titled "Gut Health in Modern Nutrition: Understanding the Role of Food Composition, Lifestyle & Preventive Nutrition" on 25th June 2026 through an online Zoom webinar. The event brought together nutrition scientists, academicians, healthcare professionals, students, researchers, and food industry experts from across the country to discuss the growing significance of gut health in preventive nutrition and public health.

The programme was hosted by Ms. Anuja Padte, Food Scientist, PFNDAI, who warmly welcomed all the distinguished speakers, delegates, industry representatives, academicians, and students. She introduced the theme of the White Paper and highlighted the importance of understanding the relationship between food composition, dietary patterns, lifestyle factors, and gut microbiota in promoting long-term health and preventing lifestyle-related disorders. She also briefed the audience about the programme schedule and invited everyone to actively participate in the discussions.

The webinar commenced with the **Welcome**



Address by Dr. Shashank Bhalkar, Executive Director, PFNDAI, who welcomed all the participants and acknowledged the collaborative efforts of PFNDAI and Marico Ltd. in developing the White Paper. He emphasized that gut health has emerged as one of the most important areas in nutrition science and preventive healthcare. He highlighted that the objective of the White Paper was to compile evidence-based scientific information that would help nutrition professionals, healthcare practitioners, researchers, educators, and the food industry understand the evolving science of gut health and translate it into practical dietary recommendations.



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High Protein



Zero Added
Preservatives





Following the welcome remarks, the

Keynote

Address was delivered by

Dr. Jagmeet Madan,

National President,

Nutrition

Science Professional Council (NSPC), NCAHP, Ministry of

Health & Family Welfare, Government of India, and

Professor & Director, Research, Innovation,

Collaboration and

Consultancy Centre (RICCC), SVT SNT Women's

University, Mumbai.



Dr. Madan emphasized that gut health is no longer viewed only from the perspective of digestive wellness but is increasingly recognized as a key determinant of overall health. She explained that the gut microbiome influences immunity, metabolism, mental health, inflammation, and the risk of several non-communicable diseases. She stressed that dietary diversity, adequate fibre intake, fermented foods, balanced nutrition, and healthy lifestyle practices are essential in maintaining

a healthy gut microbiota. She appreciated PFNDAI and Marico Ltd. for bringing together experts from academia and industry to develop a comprehensive White

Paper that translates current scientific evidence into practical recommendations for healthcare professionals and consumers.

The first author presentation was delivered by

Dr. Minelly Rodrigues,

Assistant Professor,

Department of

Foods, Nutrition and Dietetics, College of Home

Science, Nirmala Niketan.



Dr. Rodrigues introduced the audience to the science of the human gut microbiome and explained how trillions of microorganisms residing in the gastrointestinal tract play a vital role in digestion, nutrient absorption, immune regulation, and metabolic health. She highlighted that several factors, including age, dietary habits, environmental exposures, medication use, stress, and lifestyle choices, influence the composition and diversity of the gut microbiota. She discussed the concept of gut dysbiosis and explained how an imbalance in gut

microorganisms may contribute to obesity, diabetes, inflammatory bowel disorders, allergies, and other chronic diseases. She emphasized that healthy dietary practices, particularly the inclusion of fibre-rich foods, fruits, vegetables, whole grains, legumes, and fermented foods, can positively influence microbial diversity and improve gut health.

The second author presentation was delivered by Dr. Kejal Joshi, Nutrition Manager, Marico India Ltd.

Dr. Joshi focused on the relationship between

food composition, food processing, and preventive nutrition. She highlighted that modern dietary patterns characterized by excessive consumption of ultra-processed foods, refined carbohydrates, unhealthy fats, and high sugar intake have significantly altered gut microbial composition and contributed to the increasing burden of metabolic disorders. She explained the importance of selecting nutrient-dense foods, incorporating functional ingredients, and adopting evidence-based dietary interventions that support gut health throughout different stages of life.



She further discussed the growing opportunities for the food industry to develop products that combine scientific evidence with consumer needs, thereby supporting healthier food choices and preventive healthcare.

The final technical presentation was delivered by Dr.

Subhadra Mandalika, Former Faculty, Department of Foods, Nutrition & Dietetics, College of Home Science, Nirmala Niketan, Mumbai.



Dr. Mandalika presented a comprehensive overview of the influence of macronutrients on the gut microbiome. She explained that dietary carbohydrates, proteins, and fats each have distinct effects on the composition and metabolic activity of gut microorganisms. She emphasized the importance of dietary fibre as a microbiota-accessible carbohydrate and discussed how different types of dietary fibre influence the production of beneficial short-chain fatty acids such as acetate, propionate, and butyrate, which are essential for maintaining

intestinal health and reducing inflammation. She also elaborated on the impact of refined dietary fibres, protein quality, protein digestibility, and microbial protein fermentation on gut health. Furthermore, she discussed how the quality and quantity of dietary fats, including saturated and unsaturated fatty acids, influence gut microbial diversity and metabolic outcomes. She concluded by highlighting evidence-based dietary recommendations that encourage balanced dietary patterns rich in whole foods, adequate fibre, healthy fats, and quality protein to promote a resilient and healthy gut microbiome.

Following the technical sessions, the **official launch of the White Paper** titled "Gut Health in Modern Nutrition: Understanding the Role of Food Composition, Lifestyle & Preventive Nutrition" was carried out virtually in the presence of all the distinguished speakers and participants. The White Paper represents a collaborative scientific effort by experts from academia and industry to provide evidence-based guidance on gut health,



dietary composition, lifestyle practices, and preventive nutrition. The publication aims to serve as a valuable resource for nutrition professionals, educators, healthcare practitioners, researchers, students, policymakers, and the food industry.

The programme concluded with the **Vote of Thanks** delivered by **Ms. Anuja Padte**, Food Scientist, PFNDAI. She expressed her sincere gratitude to all the distinguished speakers for sharing their expertise and valuable insights. She thanked Marico Ltd. for partnering with PFNDAI in developing the White Paper and acknowledged the enthusiastic participation of nutrition professionals, academicians, students, researchers, healthcare practitioners, and industry representatives. She also thanked the PFNDAI team for successfully coordinating the event and contributing to the development of another important scientific publication.

REGULATORY ROUND UP



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

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

[Final FSS \(Vegan Foods\) amendment Regulations, 2026 relating to specification of vegan logo :](#)

This gazette notification is regarding vegan logo shape, dimensions, colour scheme etc. The regulation will come into force on 01/07/2027.

[Final FSS \(Prohibition and Restrictions on sales\) amendment Regulations,](#)

[2026 relating to omission of provision of restriction on salseed fat :](#)

Previously, Sal seed fat was permitted in limited products like bakery fat. Vide the present notification, this restriction is removed and can be used in all products. The permission comes into force from 27.05.2026.

[Validity Order of FSSAI notified Food Testing laboratories as on 05th June, 2026 :](#)

This order provides the latest list of FSSAI-approved laboratories with the validity of their accreditation as on 05.06.2026.

[Withdrawal of Method for Determination of Fruit Content in Fruit Juices :](#)

The method for the determination of fruit content in Fruit Juices available in the Manual of Methods of Analysis of Foods by FSSAI is withdrawn. The testing laboratories are allowed to adopt validated methods prescribed by AOAC/ ISO/ BIS/ Pearson's etc., until the revised method is approved and notified by the food authority.

[Immediate discontinuation of use of metallic pins/wires in food products and packaging materials :](#)

Food authorities have observed that FBOs use

metallic staple pins/ wires to prepare decorative cakes, or such products, and for fastening food packets, cake boxes, takeaway parcels etc. These can cause a public food safety hazard. There is a risk of consumers inadvertently consuming these, leading to adverse health effects. FBOs are directed to immediately discontinue the use of metallic pins/ wires for sealing, fastening, securing, or packaging any food item, food parcel, takeaway meal, bakery product, cake box, sweet box, snack packet, or any other food packet.

[Advisory dated 15.06.2026 regarding use of food-grade and corrosion-resistant knives, blades and other cutting equipment by food businesses](#) :

Food authorities have observed that certain FBOs are using rusted, corroded, chipped, painted, damaged, unclean knives, blades, and cutting equipment during food handling, preparation, processing, cutting, slicing, and packaging operations. Use of such equipment may result in physical, chemical, and microbiological

contamination of food. This is also a non-conformance of Schedule 4 of the FSS (L & R) Regulations, 2011. All FBOs are directed to use only food-grade, corrosion-resistant knives, blades and cutting equipment in food handling and processing operations. They should be in a sound hygienic condition and free from rust, corrosion, chipping, paint, cracks, breakage, or any other defect that may contaminate food. Such equipment should be replaced and adequately cleaned.

[Gazette Notification relating to Food Safety and Standards \(Licensing and Registration of Food Businesses\) Regulation, 2011](#) :

This gazette notification is an amendment of the FSS (L&R) Regulation, 2011. The following two amendments to the regulations are suggested.

i) The requirement of maintenance of daily records of production and storage of raw material utilisation separately, as



stated in Schedule 2 - Annexure 3 - serial number 8, does not apply to non-manufacturing food business operators.

ii) The requirement of subjecting raw material storage, ingredients, work in progress and processed/ cooked or packaged products to FIFO, FEFO as stated in Schedule 4, part 2, section 5.2.5, does not apply to Retailers. These regulations shall come into force on 24.06.2026.

[In continuation to Order dated 25 July 2025, Part -2 Ayurveda Aahara Recipes](#) :

FSSAI order dated 25.07.25 provided a list of Ayurveda Aahara recipes under category A. This order gives Part 2 of the list with additional recipes.



RESEARCH IN HEALTH & NUTRITION

Guava Juice and Iron Supplements May Address Anemia

The review published in *BMJ Prevention & Health* examined the impact of combining guava juice with iron supplements on anemia, focusing on adolescent girls and pregnant women in Indonesia.

Guava is naturally rich in vitamin C, folate, and dietary fibre, with vitamin C being particularly important because it enhances iron absorption. Across 17 studies included in the synthesis, 12 were analysed quantitatively, showing that guava juice consumption led to an average increase of 1.71 g/dL in hemoglobin levels. Among adolescents, the

improvement was 1.52 g/dL, while pregnant women saw an average increase of 1.84 g/dL. When guava juice was combined with iron supplements, the hemoglobin rise was greater than with supplements alone, with a pooled difference of 1.29 g/dL. This improvement could shift individuals with mild-to-moderate anemia into a healthier range, potentially reducing fatigue and improving cognitive and productivity outcomes.

The authors argue that integrating guava juice into school nutrition programs, antenatal care, or community health initiatives could provide a low-cost, culturally accepted intervention to address anemia, especially in low- and middle-

income countries where iron deficiency is widespread. They emphasize that guava's affordability and nutritional profile make it a promising adjunct to iron therapy. However, the findings are limited by small sample sizes, quasi-experimental designs, and the fact that all studies were conducted in Indonesia. Variations in guava dosage, type, and intervention duration further restrict the ability to generalize results. The researchers caution that while guava juice enhances iron absorption, more rigorous trials are needed to determine optimal dosage, duration, and long-term sustainability of hemoglobin improvements. Professor Sumantra Ray of the NNEdPro Global Institute notes that without stronger evidence, guava juice should not be considered a replacement for conventional iron therapy, though it may serve as a valuable complementary approach.

<https://www.nutritioninsight.com/news/guava-juice-boosts-iron-absorption.html>

Clinical Trial Suggests Rapid Weight Loss Is More Efficient and Sustainable Than a Gradual Approach

The clinical trial presented at the 2026 European Congress on Obesity in Istanbul challenges the long-standing belief that gradual weight loss is more sustainable than rapid approaches.

Conducted by Vestfold Hospital Trust in Norway in partnership

with Roede, the study followed 284 obese adults, most of them women, over 52 weeks. Participants were randomized into two groups: one followed a rapid weight loss program with strict calorie restriction (1,000–1,500 calories daily over 16 weeks), while the other pursued gradual reduction averaging around 1,400 calories daily. Both groups then entered a structured 36-week weight maintenance program with regular group sessions.

Results showed that rapid weight loss was not only safe but also more effective in

achieving greater initial reductions, with participants maintaining or continuing to lose weight during follow-up. Importantly, those who lost weight quickly did not regain more than those who lost gradually, provided they received ongoing behavioural and dietary support. This finding directly contradicts the assumption that slower weight loss better prevents rebound weight gain. Instead, the trial demonstrated that structured maintenance support—weekly, biweekly, and monthly sessions—was key to sustaining results.

Lead author Dr. Line Kristin Johnson emphasized the relevance of these findings in the era of GLP 1 receptor agonists, which also produce rapid weight loss by suppressing appetite. She argued that nutrition-based programs could serve as cost-effective or complementary alternatives to GLP 1 therapies, particularly where access or affordability is limited. The study highlights the importance of adequate protein, fibre, micronutrients, and essential fatty acids during calorie restriction, alongside

physical activity to preserve lean mass and regulate appetite. Johnson noted that while no single approach fits all, achieving a calorie deficit remains essential, and rapid strategies can be sustainable when embedded in comprehensive frameworks.

The trial's implications extend to public health and commercial weight-management programs, suggesting that clinically supervised rapid interventions could be integrated into

primary care and community health systems. With obesity-related healthcare costs rising, the findings open opportunities for nutrition companies and functional ingredient suppliers to design programs that deliver "GLP 1-like" results without pharmacological intervention, while ensuring nutrient adequacy and long-term adherence.

<https://www.nutritioninsight.com/news/rapid-weight-loss-sustainable-trial-results.html>

Nutrient-Dense Foods in Pregnancy Help Boost Birth Weights in Low-Income Regions

The study published in PLOS Medicine highlights how balanced energy and protein (BEP) supplements can significantly improve birth outcomes in low- and middle-income countries.

Unlike traditional prenatal interventions that focus mainly on micronutrients such as iron and folic acid, BEP supplements provide additional calories and protein alongside micronutrients, directly supporting fetal growth. By pooling data from eight randomized trials across Africa and South Asia, researchers found that BEP reduced the risk of small vulnerable newborns—babies born too

early, too small, or underweight—by up to 30%. The protective effects were strongest when mothers began supplementation before the 20th week of pregnancy, a critical window for placental development and nutrient transfer.

The analysis of more than 10,000 pregnancies showed that BEP lowered risks across multiple categories: premature and underweight babies, full-term infants with restricted growth, and those facing combined complications. These benefits were greater than those typically reported for micronutrient tablets alone, especially in food-insecure regions where women often lack sufficient dietary energy and protein. The study emphasizes that BEP is not simply "high-protein" supplementation—protein must account for less than 25% of total energy to avoid risks to

mother and fetus.

Lead author Dongqing Wang stressed that BEP represents a practical, food-based intervention that can be integrated into existing maternal health programs. However, scaling up poses challenges in cost, logistics, storage, and cultural acceptability. Supplements must be affordable, shelf-stable, and aligned with local food preferences, while programs need strong counselling, reliable supply chains, and community support to ensure consistent use. Wang also noted that BEP should be seen as a complementary intervention in undernourished settings, not a universal substitute for healthy diets or prenatal care.

<https://www.nutritioninsight.com/news/pregnancy-prenatal-nutrition-birth-weight-premature.html>

Are Some Ultra-Processed Foods Good for You?

An expert panel convened by the Physicians Committee for Responsible Medicine has emphasized that ultra-processed foods (UPFs) should not be lumped together under a single negative label.

Their argument is that the current discourse around UPFs often paints them all as harmful, when in reality there is a spectrum of products ranging from those that undermine health to those that actively support it.

The panel calls on federal regulators to draw a clear line between these categories, ensuring that public health policies are both scientifically accurate and practically effective.

Central to their position is the endorsement of Healthy Eating Research (HER) recommendations, which propose that UPFs with demonstrated nutritional benefits should be exempt from restrictive measures targeting unhealthy products. This reflects a growing consensus among nutrition experts that the term “ultra-processed” is too blunt an instrument when applied indiscriminately. For instance, fortified plant-based milks provide essential nutrients such as calcium and vitamin D, while whole-grain breads contribute fibre and other compounds that support cardiovascular and digestive health. These foods, though technically ultra-processed, are often recommended by doctors as part of balanced diets.

The panel’s stance highlights the complexity of modern food systems. On one hand, there are UPFs like sugary sodas, packaged snacks high in salt and fat, and processed meats, which are strongly associated with obesity, type 2 diabetes, cardiovascular disease, and other chronic conditions. On the other, there are products that undergo processing to improve safety, shelf life, or nutrient content, and which can help close gaps in dietary intake for populations with limited access to fresh produce or dairy.

This debate signals a shift toward more nuanced regulation, where the focus is not simply on the degree of processing but on the overall nutritional profile and health impact of the food. Such an approach could prevent unintended consequences, like discouraging consumption of foods that are beneficial, while still curbing the marketing and availability of products that contribute to poor health

outcomes. It also reflects a broader movement in nutrition science to move beyond simplistic categorizations and toward evidence-based distinctions that recognize the diversity of foods within the UPF category.

Ultimately, the panel’s recommendations aim to balance public health protection with dietary inclusivity, ensuring that policies do not inadvertently penalize foods that can improve nutrition, particularly for vulnerable populations. This perspective underscores the importance of precision in food regulation, acknowledging that while some UPFs are indeed harmful, others can be allies in the fight against malnutrition and chronic disease.

<https://www.foodnavigator.com/Article/2026/05/22/not-all-upfs-are-created-equal-and-a-new-expert-panel-says-federal-regulators-should-draw-a-clear-line-between-those-that-are-harmful-and-those-that-doctors-recommend/>

Gut-Brain Axis and Botanicals Fuel Next-Gen Sleep and Stress Supplements

The gut-brain axis is increasingly being leveraged in the development of next-generation supplements targeting sleep and stress.

Researchers and industry innovators are focusing on the interplay between gut microbiota and neurological pathways, recognizing that the

gut communicates directly with the brain through hormonal and neural signals. This connection influences mood, stress resilience, and sleep quality, making it a promising area for functional nutrition.

Botanical ingredients are being combined with microbiome-supporting compounds to create multi-benefit formulations. Adaptogens such as ashwagandha and calming botanicals like chamomile are being paired with prebiotics, probiotics, and postbiotics to enhance stress management and sleep regulation. The stability of postbiotics allows

them to be incorporated into diverse formats, including beverages and gummies, while prebiotic fibres support gut health and indirectly influence neurotransmitter activity. These combinations aim to provide holistic solutions that address both digestive and mental well-being.

The growing popularity of GLP 1 therapies for weight management has also heightened interest in gut-brain axis research, as these drugs alter appetite and satiety signals. Nutrition companies are positioning gut-focused supplements as complementary

strategies, helping consumers maintain nutrient intake and emotional balance. The article emphasizes that the future of sleep and stress supplements lies in integrated approaches

that unite microbiome science with traditional botanicals, offering consumers evidence-based, multifunctional products designed to improve resilience, relaxation, and restorative

sleep.

<https://www.nutritioninsight.com/news/gut-brain-axis-botanicals-sleep-stress.html>

High-Dose Prenatal Vitamin D3 Linked to Better Childhood Memory

The study published in JAMA Network Open examined whether high-dose prenatal vitamin D3 supplementation influences children's cognitive outcomes at age 10.

Conducted among 623 Danish mother-child pairs, the trial compared women who received the standard 400 IU daily dose of vitamin D3 with those given an additional 2,400 IU from week 24 of pregnancy until one week postpartum. Follow-up neurocognitive testing was completed by 498 children, assessing 11 domains including intelligence, memory, attention, and executive function.

Results showed that children whose mothers received the higher dose performed modestly better in specific areas of visual and verbal memory, as well as cognitive flexibility, which involves shifting attention and adapting to new tasks. No significant differences were observed in overall intelligence or other cognitive domains. Experts praised the study's robust design and long-term follow-up but cautioned that the findings represent a post hoc analysis, meaning cognition was not the original primary outcome. The observed effects were relatively small, and most participants were already vitamin D sufficient, limiting generalizability to populations with greater deficiency.

Researchers highlighted that the associations align with emerging evidence suggesting

prenatal nutrition can influence neurodevelopment in subtle, domain-specific ways rather than broad measures of intelligence. However, experts stressed that the results should not be interpreted as proof that high-dose vitamin D supplementation universally improves cognitive ability. They emphasized the need for further trials in more diverse populations and with varying baseline vitamin D levels to clarify the clinical significance and optimal supplementation strategies. Overall, the study adds to the growing body of literature linking prenatal nutrition to child development, while underscoring the importance of cautious interpretation and continued research.

<https://www.nutritioninsight.com/news/prenatal-vitamin-d3-child-memory-benefits.html>

Scientists Engineer Gut Bacteria to Treat Mental Health Issues in Liver Disease

A recent meta-analysis has found that higher consumption of legumes and soy is linked to a significantly lower risk of hypertension.

The review, published in BMJ Nutrition, Prevention & Health, analysed data from 12 observational studies across seven countries, involving up to 88,475 participants and 35,375 cases of high blood pressure.

The findings suggest that consuming 170 g of legumes daily, such as lentils, peas, chickpeas, and beans, is associated with a 30% lower risk of hypertension, while 60–80 g of soy products like tofu, edamame, soymilk, tempeh, and miso is linked to a 29% lower risk.

Legumes and soy are rich in potassium, magnesium, and dietary fibre, nutrients known to lower blood pressure. Fermented soluble fibre from these foods produces short-

chain fatty acids that aid blood vessel dilation, while soy's isoflavones also appear to contribute to blood pressure reduction. The study emphasizes that these cardioprotective effects strengthen the case for integrating legumes and soy into global dietary guidelines as a public health strategy against hypertension. The authors highlight that current legume consumption in Europe and the UK averages only 8–15 g per day, far below the recommended 65–100 g for cardiovascular health.

They note limitations such as variations in legume sources, preparation methods, and definitions of high blood pressure, but stress the importance of these findings given the global rise in hypertension. Professor Sumantra Ray of the NNEdPro Global Institute commented

that the study provides rigorous dose-response analyses offering practical dietary targets, though further research is needed to clarify whether the plateauing benefits of soy at 60–80 g reflect a biological limit or limited study data.

Overall, the research adds

weight to the evidence supporting plant-based diets as a means to reduce hypertension and cardiovascular disease risk, underscoring the need for improved dietary habits worldwide.

<https://www.nutritioninsight.com/news/legumes-soy-hypertension-risk-study.html>

Fitspiration On Social Media Drives Unhealthy Eating Behaviour and Poorer Body Image Among Youth

A recent study has shown that “fitspiration” content on social media, which promotes motivational messages around diet and exercise, can negatively affect young adults’ health and well-being.

The research, published in Health Communications, analysed 26 studies involving 6,111 participants aged 18–33 across several countries. It found that even short-term exposure to fitspiration imagery and videos led to poorer body image, reduced self-esteem, increased social comparison, and unhealthy eating behaviours. In some cases, these effects were linked to restrictive dieting and a heightened risk of developing clinical eating disorders.

The study highlights that fitspiration often emphasizes restrictive eating practices such as calorie monitoring, elimination diets, and rigid

“clean eating” rules. It also promotes optimization-focused routines like high-protein or low-carb diets, supplement use, and structured meal-prepping. These messages are typically paired with aspirational imagery and motivational language, framing dietary habits as pathways to discipline, success, and attractiveness. While appearing health-oriented, they can foster guilt around eating and encourage unhealthy relationships with food.

Dr. Valerie Gruest, co-author of the paper, explains that much of this content is created by influencers rather than trained nutrition professionals, meaning the focus is often on aesthetics and quick results rather than balanced, evidence-based dietary guidance. This can lead to oversimplified and restrictive interpretations of healthy eating, with little attention to micronutrient balance, energy sufficiency, or long-term health needs.

The findings reveal a consistent pattern: exposure to fitspiration content increases negative emotions, body

dissatisfaction, and unrealistic diet and exercise motivation. Over time, these behaviours can contribute to chronic dieting, binge-restrict cycles, compulsive exercise, and orthorexic tendencies, placing strain on both physical and mental health. Sustained body dissatisfaction and restrictive eating are also associated with higher risks of clinical eating disorders, which require comprehensive care.

The study underscores the importance of promoting evidence-based nutrition messaging on social media. Instead of appearance-driven ideals, experts call for content that reflects scientific understanding of dietary needs, supports sustainable eating patterns, and encourages health routines that benefit long-term well-being. Fitspiration taps into the human desire for self-improvement, but when channelled toward narrow, appearance-based ideals, it can distort motivation and harm everyday health.

<https://www.nutritioninsight.com/news/fitspiration-youth-body-image-unhealthy-eating.html>

How Probiotics and Holistic Health Innovations Revolutionize Stress and Sleep Solutions

The article explores how probiotics and holistic health innovations are reshaping approaches to stress and sleep management by focusing on the gut-brain axis and interconnected biological

systems.

Advances in neuroscience, microbiome science, and systems biology are driving a shift from symptom-focused

solutions, such as melatonin or valerian root, toward mechanism-driven interventions that target stress physiology, inflammatory signalling, and microbial metabolite production.

Psychobiotics, live microorganisms with demonstrated mental health benefits, are highlighted as promising tools for improving resilience and emotional regulation.

Experts emphasize that bifidobacteria play a key role in regulating cortisol and neurotransmitters like GABA, serotonin, and melatonin, which directly influence stress and sleep quality. Ingredients that selectively nourish these bacteria, such as galacto-oligosaccharides, have shown clinical evidence of reducing cortisol and improving sleep outcomes. Similarly, precision probiotics like *Bifidobacterium longum* 1714 are backed by human trials demonstrating

enhanced stress resilience and sleep quality, underscoring the importance of strain specificity and transparent formulation.

Botanical innovations are also gaining attention. Vanizem, derived from *Aframomum melegueta* seeds, acts on the endocannabinoid system to restore anandamide levels, thereby reducing stress and improving mood and sleep without sedation. ThymoQuin, a standardized black seed oil, has been shown to rebalance cortisol and DHEA levels, improving stress resilience and sleep quality. Adaptogens such as *Ashwagandha* are being studied for their ability to regulate cortisol and promote restorative sleep, with particular focus on women's health, where stress and sleep challenges are more pronounced.

The role of cortisol is central, as chronic stress elevates its levels, disrupting circadian rhythms and impairing sleep.

Innovations that reduce cortisol while supporting melatonin balance are seen as critical for long-term well-being.

Probiotics and postbiotics, such as *L. plantarum* HEAL9, are emerging as tools to regulate inflammation, cortisol, and emotional health, with clinical evidence showing improvements in mood, memory, and sleep.

The article concludes that the convergence of microbiome science, botanical actives, and digital health technologies is paving the way for personalized, multi-pathway solutions. These innovations aim not only to provide temporary relief but to deliver sustainable improvements in stress resilience, emotional balance, and sleep quality, marking a significant evolution in the field of holistic health.

<https://www.nutritioninsight.com/news/sleep-stress-probiotics-gut-botanicals-cortisol.html>

Egg Consumption Is Associated with a Lower Risk of Alzheimer's Disease

Researchers at Loma Linda University Health have found that egg consumption is linked to a reduced risk of Alzheimer's disease among adults aged 65 and older.

The study, published in the *Journal of Nutrition*, analysed data from more than 40,000 participants in the Adventist Health Study-2 cohort, with an average follow-up period of over 15 years. Results showed that eating one egg per day at least five times per week lowered the risk of Alzheimer's

diagnosis by up to 27%. Even less frequent consumption had protective effects: eating eggs 1 to 3 times per month reduced risk by 17%, while 2 to 4 times per week lowered risk by 20%.

The researchers emphasized that eggs provide several nutrients beneficial for brain health. Choline, found in eggs, is a precursor to acetylcholine and phosphatidylcholine, both essential for memory and synaptic function.

Eggs also contain lutein and zeaxanthin, carotenoids that accumulate in brain tissue and are associated with improved

cognitive performance and reduced oxidative stress. Additionally, egg yolks are rich in phospholipids, which play a critical role in neurotransmitter receptor function, and they provide omega-3 fatty acids important for brain health.

The study accounted for both visible egg consumption, such as scrambled or boiled eggs, and hidden sources, like baked goods. Alzheimer's cases were identified through Medicare records, ensuring physician-confirmed diagnoses. While the findings highlight the potential benefits of moderate egg consumption, the researchers stressed that eggs should be part of a balanced diet.

They noted that the Adventist population studied generally follows healthier dietary

patterns than the broader public, which may influence outcomes.

<https://news.illu.edu/research/study-egg-consumption-associated-lower-risk-alzheimers-disease>

Could Melatonin and Caffeine Work Together for Performance?

A recent study published in *Nutrients* explored how melatonin taken before sleep and caffeine consumed in the morning might work together to enhance athletic performance.

Researchers from Tunisia, Spain, and Norway tested 14 trained male participants in a randomized, double blind, placebo controlled crossover design. The participants underwent four conditions: placebo only, caffeine only, melatonin only, and melatonin

combined with caffeine.

The exercise protocol involved repeated shuttle sprints, with performance, exertion, heart rate, and blood markers of muscle damage and inflammation measured. Results showed that all active conditions improved total distance compared to placebo, but the combination of melatonin and caffeine produced particularly favourable outcomes, including lower markers of muscle damage and inflammation. Interestingly, melatonin did not significantly alter sleep quality or quantity, but it appeared to support next day high intensity

performance and reduce physiological strain.

The researchers suggested that melatonin's chronobiotic and antioxidant properties may complement caffeine's well established stimulant effects, potentially balancing autonomic responses and aiding recovery. They cautioned, however, that the small sample size limits generalization, and future studies should explore different dosages and broader populations to confirm these findings.

<https://www.nutraingredients.com/Article/2026/05/07/melatonin-and-caffeine-improve-workouts/>

Beta-Glucan Oligosaccharides Could Lower Cholesterol Levels

A 12 week randomized, placebo controlled study in Thailand investigated the effects of β glucan oligosaccharides and polysaccharides on cholesterol levels.

Ninety six healthy adults aged 20 to 55 were assigned to one of three groups: oligosaccharides, polysaccharides, or placebo, consuming 2000 mg daily. Both β glucan forms significantly reduced total cholesterol after 12 weeks, but only the oligosaccharide group maintained lower levels two weeks after supplementation ended.

LDL cholesterol was also reduced in the oligosaccharide group, with the effect persisting post intervention, while no change was observed in the polysaccharide group.

Safety assessments showed no adverse effects on body weight, liver or kidney function, blood counts, glucose, or cardiovascular markers. The main side effects were mild changes in defecation patterns, more frequent in the polysaccharide group, ranging from improved bowel movements to occasional constipation or loose stools.

Researchers concluded that oligosaccharides were associated with fewer adverse events and superior lipid lowering efficacy compared to polysaccharides.

The study suggests that β

glucan oligosaccharides may lower cholesterol by binding bile acids, increasing intestinal viscosity, and enhancing bile acid excretion, which forces the body to draw cholesterol from the blood to synthesize new bile acids.

These findings provide baseline data for establishing acceptable daily intake levels of fungal β glucan oligosaccharides, which currently lack formal safety limits, unlike yeast derived polysaccharides.

The results indicate that 2000 mg per day is safe and effective, warranting further clinical trials to explore their potential in consumer products.

<https://www.nutraingredients.com/Article/2026/05/07/beta-glucan-oligosaccharides-could-lower-cholesterol-levels-thai-study/>

Gut Health Champions: Tribiotic Supplements, Sweetening Fibres & Ultra-Stable Postbiotics

FOOD SCIENCE & INDUSTRY NEWS

The article highlights how the gut health market is rapidly evolving with innovations that go beyond traditional probiotics.

A major development is the rise of “tribiotic” formulations, which combine prebiotics, probiotics, and postbiotics into single products to deliver more comprehensive digestive and systemic benefits. Companies are focusing on closing the global fibre gap and expanding applications into everyday formats such as beverages, gummies, and nutritional snacks. Some emphasize consumer demand for fibre-rich products, offering solutions like scFOS and resistant starches that maintain taste and texture. Others advancing functional drinks and postbiotic applications, or expanding chicory root and agave inulin

fibres, backed by decades of clinical research.

Postbiotics are emerging as a key innovation because they are non-living and heat-stable, making them suitable for challenging formats like syrups, powders, and gummies. *Lactobacillus gasseri* postbiotics are being studied for benefits ranging from allergy support to improved emotional well-being and sleep quality, reflecting the growing focus on gut-organ axes such as gut-brain and gut-metabolic pathways. Evidence-based prebiotics are important that meet ISAPP definitions and regulatory frameworks like Health Canada’s Prebiotic Monograph as examples of stricter standards shaping the market.

The global fibre gap remains a central driver, with strong

demand in North America and Europe and rising awareness in Asia-Pacific. Convenient supplement formats are expanding, and research continues to link prebiotics to broader health outcomes, including mental and metabolic wellness.

Looking forward, multifunctional fibres that also reduce sugar and improve texture are expected to gain traction, alongside products tailored to individuals using GLP-1 therapies. Overall, the category is shifting from trend-driven messaging toward scientifically substantiated, multifunctional gut health solutions that position the microbiome as a hub for whole-body wellness.

<https://www.nutritioninsight.com/news/gut-health-adm-sensus-royal-cosun-ingredion.html>

Bulking, Modulation and Mouthfeel: Why Bakery Sugar Reduction Needs More Than a Sweetener Swap

Sugar reduction in bakery products presents unique challenges because sugar plays multiple roles beyond sweetness.

It contributes to crumb structure, moisture retention,

browning, and shelf life, and in yeast-raised goods it is essential for fermentation. Removing sugar disrupts these functions, meaning reformulation requires integrated systems rather than simple sweetener substitution. Ingredient suppliers are addressing this with combinations of bulking agents, enzymes, antimicrobials, flavour modulators, and high-intensity sweeteners.

In yeast-raised bakery, only partial sugar reduction is possible since yeast

metabolism depends on fermentable sugars. Enzyme systems can help manage moisture and texture, while naturally fermented antimicrobials support preservation. Chemically leavened sweet goods, however, require complete structural and sensory rebuilding because sugar’s role is purely functional. Here, bulking agents such as fibres, allulose, agave, and sugar alcohols are used to replace lost volume and texture, while flavour modulators mask off-notes and restore sweetness perception.

Systems approach combines stevia, allulose, agave, and starches to maintain functionality, while fibre helps rebuild binding and structure. Ready-to-use blends pairing allulose with flavour modulators and fibre-based solutions to simplify reformulation.

Sensory quality is another critical challenge. Reduced-sugar baked goods often suffer from bitterness, lingering sweetness, or muted flavour cues. Flavour modulation

technologies are used to neutralize off-notes and rebuild mouthfeel, ensuring that key flavour notes like cocoa, vanilla, and butter remain prominent. Shelf life is also affected, as sugar reduces water activity and slows microbial growth. To address this, naturally fermented antimicrobials are increasingly used to maintain stability while meeting clean label expectations.

The consensus among industry experts is that successful sugar

reduction in bakery requires a holistic, integrated approach. Rather than relying on one-for-one sweetener swaps, modern reformulation combines bulking, flavour modulation, enzyme systems, and preservation strategies to deliver products that meet consumer expectations for taste, texture, and shelf life while achieving meaningful reductions in sugar content.

<https://www.foodingredientsfirst.com/news/bakery-sugar-reduction-kerry-adm-samyang.html>

Clean Sweetness, Higher Protein and Nutrient Density in Smaller Portions

The rapid rise in the use of GLP-1 receptor agonists is reshaping food and beverage formulation strategies, particularly around sugar reduction.

These medications alter taste perception, increasing sensitivity to sweetness and reducing tolerance for overly sweet products. As a result, reformulation is no longer about simply cutting sugar but about designing products that meet the needs of consumers who eat less, prefer smaller portions, and demand higher nutritional density.

Research from Kerry shows that GLP-1 users seek foods richer in protein and lower in sugar and carbohydrates, which introduces new masking challenges since added protein

and functional ingredients often carry off-notes. Sweetness quality, rather than intensity, is now the priority, and forthcoming study aims to define ideal sweetness profiles across different markets. Portion control and nutritional value have become more important for consumers on these medications, with many closely examining product labels to ensure nutrient density in smaller servings.

Sugar reduction is part of a broader nutrient-density strategy, noting that indulgence has not disappeared but has shifted toward smaller, higher-quality portions. Allulose-based systems address the full GLP-1 brief, combining sugar reduction with protein, fibre, and functional benefits, supported by AI-driven recipe design and sensory optimization. Across all companies, the consensus is that reduced sugar must be paired with higher protein, fibre, and functional ingredients, requiring

integrated systems that manage both sweetness calibration and off-note masking.

Cost discipline is another factor, as GLP-1 consumers are not uniformly premium-oriented. While some accept higher prices for natural sweeteners like stevia or monk fruit, many rely on cost-efficient artificial sweeteners such as sucralose. This creates a challenge for formulators to balance affordability with clean sweetness and nutritional fortification.

The implications extend beyond sugar reduction into managing side effects of GLP-1 medications, such as slowed gastric emptying and reduced fibre intake. Functional ingredients like prebiotic fibres and polyols are being explored to mitigate these issues while supporting satiety and metabolic health.

<https://www.foodingredientsfirst.com/news/kerry-adm-samyang-cargill-glp-1-sugar-reduction.html>

Plant-Based Trends: Striking the Balance Between Targeted Nutrition and Sensory Appeal

The plant-based food sector is undergoing a significant transformation, moving beyond

novelty products and meat substitutes toward targeted nutrition and sensory appeal.

The focus is increasingly on delivering functional benefits such as gut health, weight management, and satiety, supported by ingredients like prebiotic fibres and diverse protein sources. Companies highlight that consumers are shifting from generic nutrition to personalized solutions, with digestive health emerging as a key area. Chicory root fibre, for example, is recognized for its prebiotic benefits, supporting mineral absorption and satiety, while fava bean protein is being positioned to help maintain muscle mass and manage appetite, particularly relevant for those using GLP-1 therapies.

The next breakthroughs in plant-based innovation are expected to focus on multi-ingredient systems where proteins, fibres, sweeteners, and fats are designed to work together to deliver balanced

nutrition, taste, and functionality. Hybrid formulations combining soy, pea, and mycoprotein are gaining traction, offering improved texture and nutritional profiles. Clean label requirements remain central, ensuring that functional benefits are delivered in familiar, accessible formats. Snacks and ready meals are emerging as prime categories for nutrient-dense, protein-rich, and fibre-enriched options that cater to convenience and health simultaneously.

Smaller, more nutrient-dense servings are becoming a defining trend, driven by changing consumer behaviour and the rise of GLP-1 medications, which encourage portion control and higher nutritional value per bite. Soy protein continues to capture attention for its role in muscle

support and fat reduction, while blended protein systems are helping manufacturers balance taste, cost efficiency, and nutritional relevance.

Despite rapid growth, challenges remain around taste, texture, and affordability. Consumers expect plant-based products to match conventional foods in sensory appeal while delivering added health benefits. Companies are addressing these hurdles through integrated ingredient systems and innovations that enhance flavour and mouthfeel. Cost efficiency is also critical, with hybrid protein approaches offering a way to manage expenses while maintaining quality.

<https://www.foodingredientsfirst.com/news/plant-based-trends-targeted-nutrition-taste-texture.html>

Pleasure With Purpose: How Enjoyment and Functional Nutrition Are Redefining the Future of Food

The concept of “Pleasure with Purpose” reflects a fundamental shift in the food and beverage industry, where indulgence and functionality are no longer seen as opposing forces but as complementary drivers of innovation.

Consumers increasingly demand products that deliver both sensory enjoyment and meaningful health benefits, and brands are responding by creating offerings that combine taste, texture, visual appeal, and nutritional value. Research shows that taste remains the

most important attribute in active nutrition products, yet health and wellness are also top spending priorities, with many consumers adopting proactive approaches to their wellbeing.

Indulgence is now defined by multisensory experiences, where flavour, texture, and visual design converge to elevate enjoyment. Rich flavours, crunchy textures, and creaminess are leading purchase drivers, while colourful inclusions, coatings, and seasonal limited-time offerings enhance appeal and social shareability. In the era of Instagram-driven discovery, visually striking foods such as matcha, pumpkin spice, hibiscus, and ube have gained massive traction, reinforcing the importance of aesthetics in functional nutrition.

Snacking has become the dominant format for functional foods, with consumers seeking products that deliver indulgence alongside benefits like protein, fibre, probiotics, and omega-3s. However, taste and texture remain barriers, underscoring the need for innovation that balances nutrition with sensory satisfaction. High-protein bakery items, fortified cereals, and plant-based bars are expanding rapidly, with protein continuing to be the most sought-after nutrient. Alternative sources such as pea, soy, and pulse proteins are driving growth in environmentally conscious formats, while ingredient technologies like extruded bites, edible glitter, and advanced protein solutions enable brands to meet consumer expectations for both delight and purpose.

This framework is redefining the future of food by setting a new standard: products must lead with indulgence, deliver legitimate functional benefits, embrace multisensory design,

and align with clean-label and plant-based trends. The result is a landscape where foods are not only nourishment but also lifestyle expressions, offering enjoyment, health, and

shareability in equal measure.

<https://www.foodnavigator-usa.com/News/Promotional-features/how-enjoyment-and-functional-nutrition-is-redefining-future-food/>

Why Is Plant-Based Dairy Doing So Much Better Than Plant-Based Meat?

Plant-based dairy has achieved far greater success than plant-based meat because it integrates more seamlessly into everyday routines, offers clearer ingredient transparency, and innovates beyond simple substitution.

Plant-based milk, for instance, has become a fixture in coffee culture and breakfast rituals, making it a convenient choice that consumers encounter daily in cafés, supermarkets, and even office canteens. This habitual use has helped normalize plant-based dairy in a way that plant-based meat has struggled to replicate.

The simplicity of its ingredients also plays a crucial role. Oat, soy, almond, and coconut are familiar foods with straightforward origins, and consumers can easily understand what they are drinking. This clarity fosters

trust, especially in an era when many are wary of ultra-processed foods and hidden additives. Plant-based meat, by contrast, often relies on complex formulations involving protein isolates, stabilizers, and flavour enhancers, which can feel opaque or artificial to the average shopper. As a result, dairy alternatives are perceived as more natural and transparent, while meat substitutes face scepticism about their authenticity and healthfulness.

Another factor is the way plant-based dairy has moved beyond mimicry. While it began as a substitute for cow's milk, the category has evolved into a diverse range of products offering unique flavours, nutritional benefits, and functional innovations. From barista-style milks designed to foam perfectly in lattes to protein-enriched shakes and meal-replacement beverages, plant-based dairy has carved out new reasons for consumption that go beyond simply replacing animal milk. Plant-based meat, however, remains largely tethered to imitation—burgers, sausages,

nuggets—where success depends on how closely the product resembles its animal counterpart. This leaves it vulnerable to unfavourable comparisons with traditional meat, which many consumers still view as superior in taste and texture.

The divergence in consumer perception and product development explains the market gap. Plant-based dairy now commands around one-fifth of the plant-based food market in Europe, while meat alternatives hover at just a fraction of that share. Dairy's ability to embed itself into daily life, reassure consumers with recognizable ingredients, and innovate in ways that feel fresh and functional has allowed it to sustain growth and cultural relevance. Meat alternatives, by contrast, face the dual challenge of overcoming scepticism about processing and escaping the shadow of the products they are designed to mimic.

<https://www.foodnavigator.com/Article/2026/05/07/plant-based-dairy-performs-better-than-plant-based-meat-why/>

Protein In India: Market Opportunities Plenty Despite More Competition

India's protein market is expanding rapidly, with opportunities remain strong despite rising competition.

Protein has become a dominant theme in the country's nutrition sector, appearing in formats ranging from powders and bars to ice cream, flour, and ready-to-drink shakes. The growth is driven by a gap in the typical Indian diet, which remains heavily cereal-based and often lacks adequate, high-quality protein from diverse sources.

Surveys show that cereals account for the majority of protein intake in both rural and urban areas, while consumption of milk, eggs, fish, and meat proteins is relatively low. Although average daily protein intake has risen in recent years, many Indians still fall short of recommended levels,

Food For Seniors: Empathy And Food Safety Gaps Hinder Innovation

The article highlights how the growing elderly population is driving interest in safer, more appealing foods for seniors with swallowing difficulties, but innovation is hindered by gaps in empathy, research, and industry awareness.

Experts emphasize that nutrition for older adults must evolve beyond survival to focus on dignity and enjoyment. Empathy-driven design thinking is seen as crucial, yet often overlooked, as companies assume they understand consumer needs without engaging directly with seniors. Dr Verena Tan of the Singapore Institute of Technology leads the DIGNIFIED programme, which develops dysphagia-

friendly foods such as a sorbet that melts into a safer consistency, allowing seniors to enjoy familiar treats without the risks of choking or aspiration. Despite its promise, commercialization faces barriers due to limited industry interest and institutional constraints.

Globally, dysphagia-friendly foods are more established in markets like the US, Europe, and Japan. American companies provide IDDSI-compliant purées and transitional snacks, while UK firms deliver texture-modified meals to homes and care facilities. Japan integrates swallowing-friendly foods into mainstream retail and foodservice, but much of Asia remains limited to basic thickening powders. Texture-modified foods are altered to make swallowing safer, while transitional foods dissolve quickly in the mouth, offering familiar textures with reduced risk. Research remains scarce,

with studies showing variability in product safety and efficiency, and healthcare professionals expressing uncertainty about best practices.

Industry voices stress that empathy must drive innovation, ensuring seniors can age with dignity and continue to enjoy food as part of life rather than merely as sustenance. Parry Zhang Quan of NTUC Health Co-Operative underscores the need to normalize texture-modified foods and remove stigma, pointing out that older adults retain preferences and deserve enjoyable dining experiences. Bridging empathy and food safety gaps is essential for advancing elderly nutrition, creating opportunities for both improved quality of life and new business models in diverse food markets.

<https://www.foodnavigator.com/Article/2026/05/19/empathy-and-food-safety-gaps-hinder-dysphagia-innovation/>

Why Thinking Like an AI Agent Matters to Marketing

The article examines how the rise of AI agents such as ChatGPT is reshaping marketing strategies through generative engine optimization (GEO). Unlike traditional search engine optimization, which focuses on ranking across multiple pages of results, GEO is about securing visibility within a single AI-generated answer.

This shift creates a new “third shelf” where brands must compete not for clicks but for inclusion in the one response consumers receive. The stakes

are higher, as visibility is narrower and authority signals carry more weight.

Joseph Levi of Noise Media Group explains that GEO involves two main behaviours: direct brand queries and category-based discovery. For direct queries, brands must ensure AI systems interpret them correctly by providing structured data, schema, and clear information on their websites. For category-based discovery, credibility and authority are crucial, requiring brands to build presence through high-quality content, press coverage, guest blogs, podcasts, and consumer reviews. AI agents prioritize third-party

validation over self-promotion, aggregating data from multiple sources to deliver the most reliable answer.

Smaller brands may benefit from GEO's early stage, as niche positioning can help them stand out in specific categories. Larger brands retain advantages through established authority and review volume, but consistent, transparent content creation allows smaller players to compete. Measuring success in GEO differs from SEO, with visibility in AI-generated answers becoming the key metric. Tools like vudo.ai offer ways to track this, but even simple tests—asking AI agents about a brand—can reveal gaps and opportunities.

particularly when relying on lower-quality cereal proteins.

Industry sees this as an opportunity to expand awareness and accessibility by incorporating protein into familiar food formats rather than asking consumers to change their eating habits. Examples include High Protein Atta for rotis, Breakfast Smoothies for on-the-go consumption, and range of

protein shakes, powders, and snacks. There are also products tailored to consumers in their forties, focusing on healthy ageing through protein-enriched oats, snacks, and cookies.

A key challenge remains consumer perception, as protein is still widely associated with athletes, children, or performance-focused individuals rather than

everyday health needs like immunity, metabolism, and tissue repair. By embedding protein into daily staples and educating consumers about its broader benefits, industry aims to drive uptake and strengthen its position in India's fast-growing protein sector.

<https://www.nutraingredients.com/Article/2026/05/11/protein-market-in-india-still-room-for-growth-despite-more-competition-etc/>



The Gen Z's eating habits are transforming the foundations of food retail and sparking new waves of product innovation.

This generation is dismantling long-standing distinctions between meals, snacks, and eating occasions, which traditionally shaped how food categories were organized and marketed. Instead of adhering to rigid structures such as breakfast, lunch, and dinner, Gen Z embraces fluid consumption patterns that prioritize convenience, personalization, and multifunctionality.

Their approach reflects a lifestyle where food is not simply nourishment but also an extension of identity, mood, and social experience. As a result, the conventional boundaries between bakery, snacks, beverages, and even meal replacements are

dissolving, compelling brands to rethink how products are conceived, packaged, and displayed.

Health and wellness remain central to Gen Z's choices, but their interpretation is broader and more integrated than that of previous generations. They gravitate toward functional foods that deliver tangible benefits—protein enrichment, reduced sugar, gut health support, or plant-based formulations—and expect these attributes across all product categories rather than confined to niche segments.

Transparency is a non-negotiable value, fuelling demand for allergen-free, clean-label, and “Free From” products that align with modern wellness ideals. Yet health alone is not enough; flavour innovation and sensory appeal are equally vital.

Gen Z seeks variety, bold experimentation, and experiences that resonate with their adventurous and digitally influenced lifestyles, where food discovery often happens through social media trends and peer recommendations.

Retailers and manufacturers are adapting by shifting away from rigid aisle-based organization toward more fluid, occasion-driven strategies. This includes cross-category product placement, hybrid offerings that blur traditional lines, and branding that emphasizes flexibility, authenticity, and cultural relevance.

Food is increasingly marketed not just as a product but as part of a broader narrative—whether tied to sustainability, ethical sourcing, or lifestyle identity. The article highlights that Gen Z's influence is not only reshaping product portfolios but also redefining the very architecture of food retail.

The industry is being pushed toward a consumer-centric model that integrates health, convenience, and experiential value, where adaptability and innovation are essential to remain relevant in a marketplace shaped by the expectations of a generation that refuses to be confined by old categories.

<https://www.foodnavigator.com/Article/2026/05/19/gen-z-eating-habits-are-reshaping-food-retail-and-product-innovation/>

Looking ahead, GEO will extend beyond recommendations to automated purchases, concentrating decision-making power into a single AI-driven choice. This evolution underscores the importance of

consistent, credible marketing practices. Brands that already invest in storytelling, PR, and consumer trust are well positioned, but the difference now is that all of this work is distilled into one answer, which

increasingly defines consumer engagement and purchasing decisions.

<https://www.foodnavigator.com/Article/2026/05/18/what-is-generative-engine-optimization-geo/>

'Healthy' Has Moved On – Have Snacks?

The definition of “healthy” in snacking has shifted from reduction—less sugar, salt, and fat—to addition, experience, and sensory satisfaction.

Consumers now expect snacks to deliver positive nutrition such as fibre, protein, wholegrains, and plant-based ingredients, while still offering indulgence and enjoyment. This creates a challenge for manufacturers, as reformulation alone is insufficient to secure repeat purchases; products must also provide a satisfying sensory experience.

Texture has become a deliberate design tool,

compensating for reduced sugar and salt by enhancing crunchiness, mouthfeel, and even acoustic cues like the sound of a crisp breaking. Ingredient innovation is also reshaping the category, with ancient grains, pulses, and legumes contributing nutrition and structure, though they can introduce bitterness or earthiness that requires careful flavour masking. Flavour intensity and layered profiles are increasingly important, with bold trends such as spicy, swicy, and tangy combinations driving engagement. Beyond taste, consumers seek immersive, multi-sensory experiences that include physical sensations like cooling, heating, or tingling, which elevate better-for-you products to feel indulgent.

Technology plays a central role in balancing nutrition with enjoyment. Salt boosters, umami enhancers, sugar modulators, and masking agents help maintain flavour while reducing traditional taste drivers. Regulatory pressures on high-sugar, high-fat products are accelerating reformulation, pushing brands to innovate with nutrient-dense bases and sensory design. The next wave of healthy snacking will not be defined solely by functional ingredients but by the creation of holistic, multi-sensory experiences that bridge health and pleasure, ensuring consumers perceive better-for-you snacks as both nutritious and indulgent.

<https://www.foodnavigator.com/Article/2026/04/30/healthy-has-moved-on-have-snacks-rethinking-taste-texture-and-nutrition-in-better-for-you-snacking/>

Can Brands Cut Sugar Without Killing Taste, Texture or Trust

The article explores the evolving landscape of sugar-free reformulation, where food and beverage manufacturers are compelled to rethink sweetness as sugar increasingly shifts from a celebrated ingredient to a nutritional liability.

The traditional playbook of simply reducing sugar or replacing it with artificial

sweeteners is no longer sufficient, as consumers demand products that are both healthier and authentically enjoyable. This has led to a surge of innovation centred on rare sugars, fibres, and fermentation-driven techniques, each offering new ways to replicate the multifaceted role sugar plays in taste, texture, and consumer satisfaction.

Rare sugars such as allulose and tagatose are gaining traction because they deliver sweetness with fewer calories

and a lower glycaemic impact, while still mimicking the sensory qualities of sucrose. Fibres, including chicory root and resistant starches, are being leveraged not only for their nutritional benefits but also for their ability to contribute bulk, mouthfeel, and even subtle sweetness. Fermentation technologies are opening another frontier, enabling the creation of naturally derived sweet compounds or enhancing flavour complexity in ways that reduce the need for added sugar. These innovations reflect a broader shift toward “positive

nutrition,” where the goal is not simply subtraction but the addition of functional, health-forward ingredients that align with consumer expectations for transparency and naturalness.

The challenge is formidable. Sugar has long been more than a sweetener—it is a structural and emotional cornerstone in food and drink. It provides viscosity in beverages, browning in baked goods, and preservation in jams and sauces, while also delivering the comfort and indulgence consumers associate with sweetness. Removing or reducing it risks undermining both product performance and consumer trust. As a result, manufacturers are investing

heavily in sensory science, flavour modulation, and ingredient synergies to ensure that reduced-sugar formulations remain satisfying. This includes using flavour enhancers, natural aromas, and even acoustic cues—such as the crunch of a snack—to compensate for the absence of sugar’s traditional sensory impact.

Underlying these efforts is a recognition that consumer expectations have evolved. Shoppers are increasingly sceptical of artificial sweeteners and are looking for clean-label solutions that feel natural and credible. They want products that deliver

indulgence without guilt, and they are quick to abandon brands that fail to meet this balance. For companies, the task is not only technical but also cultural: to rebuild sweetness in a way that resonates with modern values of health, authenticity, and enjoyment. The future of sweetness lies in innovation that respects sugar’s legacy while redefining its role, ensuring that healthier products do not feel like compromises but rather like progress in taste, nutrition, and trust.

<https://www.foodnavigator.com/Article/2026/03/25/sugar-free-reformulation-how-brands-rebuild-sweetness/>

Added Fibre: Why Fortification Is Harder Than It Looks

The article explains why fortifying foods with added fibre is far more complex than it appears.

While increasing fibre intake could help address the widespread “fibre gap,” the process of incorporating fibre into products presents significant formulation challenges. Fibres differ greatly in solubility, viscosity, hydration, and molecular structure, which means that a fibre suitable for one type of product may fail in another. For example, beverages require soluble, low-viscosity fibres, while bakery or dairy applications need fibres that provide controlled thickening.

Problems intensify as fibre levels rise. Fibres that bind

water can make formulations excessively viscous, rendering them unprocessable, while hydration that continues over time can destabilize products during shelf life. These issues highlight that fibre’s functionality must be matched to the product’s requirements, not just its nutritional benefits.

The diversity of fibres stems from their molecular properties, which dictate how they interact with proteins, water, and other ingredients. Even fibres with similar compositions can behave differently in practice. Because of this complexity, trial-and-error approaches are inefficient and costly. Instead, the industry is urged to adopt predictive, knowledge-driven methods that analyse fibre behaviour at the molecular level, linking it to product performance.

Although the molecular behaviour of fibres is not fully understood, existing data on carbohydrate interactions and

supplier specifications provide a foundation for further research. Building this knowledge base would allow manufacturers to develop added-fibre products more efficiently, reduce reformulation risks, and ensure that products meet consumer expectations for taste and texture.

Fibre is increasingly recognized for its multifunctional health benefits, from supporting the microbiome and digestive health to improving satiety, blood sugar control, and even mental wellbeing. Success in fortification depends not only on nutritional outcomes but also on delivering enjoyable products, making fibre understanding both a technical necessity and a commercial advantage.

<https://www.foodnavigator.com/Article/2026/05/22/fibre-gap-reformulation-challenges-why-functional-fibre-selection-matters/>



Supplements Market Update: Consumers Seek Targeted Health Solutions

The supplements market is undergoing notable shifts as consumers increasingly seek targeted health solutions rather than broad, generalized products.

According to Nutrition Business Journal data presented at Vitafoods Europe, the global dietary supplements market is projected to reach \$214 billion in 2026, growing at 6.1%. Regional growth in 2025 was strongest in Latin America, Mexico, and India, with the US remaining the largest market at \$74.15 billion. Western Europe grew more modestly, with the UK and Spain leading performance.

Within the US, vitamins remain the largest category but are growing slowly, while speciality supplements such as fibre,

probiotics, collagen, omega-3s, and digestive enzymes are expanding at 10% annually. This reflects consumer demand for products addressing specific health concerns. Examples include probiotic blends for gut health, fish-free omega supplements for brain and heart health, and practitioner-branded GLP-1 support fibres. Practitioner recommendations are becoming increasingly influential, as consumers navigate an overwhelming marketplace by turning to doctors for guidance.

Sustainability and science-based credibility are also gaining importance, particularly among younger consumers who value ingredient sourcing transparency, even if adoption of tools like QR codes remains limited.

Sports nutrition continues to thrive, with clear protein powders, collagen shots, and creatine chews driving innovation. Clear protein formats are especially popular, extending into beverages like

sodas. Creatine products are diversifying into gummies and chews, while collagen shots are being reformulated to deliver complete amino acid profiles.

Herbs and botanicals are another growth area, with turmeric, ashwagandha, gotu kola, and mushrooms leading the way. Mushrooms are especially versatile, with varieties like lion's mane and cordyceps linked to cognitive and immune benefits. Products such as herbal blends for mental alertness and mushroom-based longevity supplements illustrate how brands are positioning botanicals for specific health outcomes.

Overall, the market is evolving toward personalization, practitioner-driven trust, and innovative formats, with consumers prioritizing both efficacy and transparency in their supplement choices.

<https://www.ingredientnetwork.com/supplements-market-update-consumers-seek-targeted-news129395.html>



Processed Foods Aren't Going Away, But They Are Evolving

The processed foods remain a central part of diets, though their role is evolving.

Research from the International Food Information Council shows that while consumers aspire to eat less processed food, convenience, cost, and time constraints keep these products in daily use. The lack of a clear definition of "ultra-processed foods" adds to the confusion, with fragmented policies and

voluntary seals creating mixed signals. The Dietary Guidelines for Americans recommend limiting highly processed foods, and many consumers say they want to eat more fruits and vegetables while cutting back on processed items. However, behaviour often diverges from belief, as most people admit they eat less healthfully than intended.

Perceptions of processed foods shift depending on context. On their own, items like boxed pasta or packaged snacks are seen as unhealthy, but when combined with

vegetables or protein, they are viewed more positively. This suggests consumers see processed foods on a spectrum rather than as inherently bad. Some products, such as frozen vegetables or plain yogurt, are considered closer to "real" foods, while pizza and packaged snacks are seen as highly processed. Protein bars and milk are examples of processed foods perceived as healthier due to their nutrient content.

For food brands, the opportunity lies in positioning processed products within balanced meals, maintaining

convenience and affordability, and highlighting nutritional benefits. Consumers are not rejecting processed foods outright but are scrutinizing them more carefully, reassessing their value when

paired with other nutritious options. The evolving expectations show that processed foods can remain relevant if they align with how people actually eat, rather than how they ideally intend to

eat.

<https://www.foodnavigator.com/Article/2026/05/26/processed-foods-still-have-a-place-theyre-part-of-a-balanced-meal/>

Has The 'Better-For-You' Boom Gone Too Far in Kids' Snacks?

The children's snack category has undergone a major transformation, shifting from products once criticized for sugar and artificial additives to ones marketed as "better-for-you" with claims around gut health, fibre, protein, and reduced sugar.

Yet this boom in wellness messaging is now facing scepticism from parents. Many are no longer swayed by front-of-pack claims and instead scrutinize ingredient lists, questioning whether functional benefits truly match what is inside the product. Concerns about ultra-processed foods, additives, and engineered

formulations have pushed transparency and simplicity higher on the agenda.

Industry experts, such as Dr Dionne Laslo-Baker of DeeBee's Organics, note that parents are more educated and critical than ever, often turning packages over to check labels rather than relying on marketing. The crowded landscape of claims—digestive support, immune benefits, added nutrients—has created a credibility problem, with parents increasingly valuing shorter, more recognizable ingredient lists over complex formulations. While gut health has become a major driver, with prebiotics and probiotics entering children's snacks, the sheer volume of functional claims risks confusing consumers and undermining trust.

This tension highlights a contradiction: innovation has focused on adding more functionality, but many parents now want fewer ingredients and less processing. Simplicity itself has become a selling point, with real, natural foods seen as more trustworthy than engineered products. The next phase of the category may therefore be defined less by new functional claims and more by transparency, trust, and proof that "better-for-you" messaging genuinely reflects the product's contents. Reformulating without artificial inputs remains technically challenging, but brands that succeed in delivering simplicity alongside taste, convenience, and affordability are likely to resonate most with parents. <https://www.foodnavigator.com/Article/2026/05/27/have-better-for-you-kids-snacks-gone-too-far/>

Resealable cans shake up California's beverage market

Resealable cans are emerging as a notable innovation in California's beverage market, with L.A. Libations introducing what it claims is the first fully recyclable, resealable aluminium can.

The design, called Re:Lid, allows consumers to open and close the can up to 14 times without compromising the seal. Unlike earlier attempts at resealable formats, this version is compatible with existing

manufacturing infrastructure, using standard aluminium can shells and a simple three-component mechanism.

The technology is engineered for cold-fill, low-carbonated beverages, ensuring pressure stability while maintaining resealability. This compatibility with high-speed production lines makes it easier to scale across categories such as water, energy drinks, and canned cocktails. Although the cans currently carry a premium price, the company expects costs to decrease as production expands, eventually approaching the level of standard can ends.

The innovation addresses long-standing barriers to resealable cans, particularly manufacturing complexity and recyclability. By offering a convenient, sustainable option that fits within established production systems, Re:Lid positions itself as a potential game-changer in the beverage industry, especially in markets like California where packaging innovation and sustainability are strong consumer priorities.

<https://www.foodnavigator.com/Article/2026/04/30/resealable-beverage-cans-launch-in-gelsons-markets/>

Can Infant Formula Catch Up to Breast Milk?

The infant formula innovation is moving beyond basic nutrition toward replicating the biological complexity of breast milk, but faces significant regulatory and safety challenges.

Traditional formula has been designed to support growth and development, yet breast milk contains bioactive components that influence immunity, metabolism, and long-term health. One of the most important proteins is lactoferrin, abundant in human milk but only available in bovine form in current formulas. Companies such as Helaina are using precision

fermentation to produce human-identical lactoferrin, aiming to close this gap.

This new wave of bioactive ingredients raises questions about oversight. Recent contamination incidents have heightened scrutiny, and the FDA has launched initiatives like Operation Stork Speed to improve recall processes. Experts argue that novel ingredients for vulnerable populations, such as pre-term infants, should be tested with rigor comparable to pharmaceuticals. While industry leaders emphasize that regulatory pathways already require extensive validation, concerns remain about whether current frameworks are sufficient for increasingly complex formulations.

The incremental approach to innovation—adding one

bioactive ingredient at a time—reflects both technical challenges and regulatory constraints. Past advances introduced omega-3 fatty acids and human milk oligosaccharides, but the overall structure of formula has changed little in decades. As biotechnology enables replication of more human milk components, the definition of a “successful” formula may shift from simply supporting growth to enhancing immune function and reducing long-term disease risk. The debate underscores both the promise and responsibility of making formula more biologically aligned with breast milk, balancing innovation with safety for the most fragile consumers.

<https://www.foodnavigator.com/Article/2026/05/28/can-infant-formula-catch-up-to-breast-milk/>

How Brands Can Formulate For GLP-1 Food Cravings

GLP 1 agonists, widely used for type 2 diabetes and obesity, are reshaping consumer food preferences rather than eliminating cravings altogether.

Research shows that while appetite suppression occurs, users continue to seek familiar flavours and comfort foods, often in smaller portions or new formats. Studies highlight that GLP 1 medications can alter taste perception across all five basic taste qualities, though the mechanisms remain unclear. This sensory shift has important implications for food formulation, as taste remains central to consumer choice.

Purchasing behaviour among GLP 1 users demonstrates a marked increase in protein consumption alongside reductions in calories, sugars, saturated fats, carbohydrates, and ultra processed foods. Willingness to pay more for protein rich products has been documented, reinforcing the opportunity for manufacturers to prioritise nutrient dense, high protein offerings. Ready to drink shakes, functional beverages, and protein fortified snacks have gained traction, while indulgent foods in smaller portion sizes help balance physiological needs with emotional satisfaction.

Formulation challenges include managing off notes and astringency in high

protein products, prompting innovation in masking solutions, mouthfeel enhancement, and sugar and sodium reduction technologies. Looking ahead, product launches are expected to emphasise nutrient density and functional benefits, particularly protein, fibre, and gut health. Manufacturers are also exploring satiety enhancing formulations to support former GLP 1 users as they manage returning hunger and “food noise.” The future direction points toward high protein dairy, fibre rich snacks, and portion controlled formats that deliver both nutrition and enjoyment, ensuring every bite carries value.

<https://www.ingredientsnetwork.com/how-brands-can-formulate-for-glp-1-food-cravings-news129249.html>



REGULATORY NEWS

Nutri-Score's Colourful Labelling Draws Attention but Doesn't Influence Healthier Choices

The study published in *Food Quality and Preference* examined how Nutri-Score's colourful traffic-light labels affect consumer behaviour.

Using eye-tracking technology on 199 German shoppers in a simulated supermarket, researchers found that the multi-coloured labels attracted significantly more visual attention compared to grey-scale versions or no labels at all. Shoppers fixated longer on the dark green A, yellow C, and red E labels, showing that colour coding makes nutritional information more noticeable and easier to compare across products. However, this heightened visibility did not

translate into healthier purchasing decisions. Consumers continued to select products based on personal preferences, dietary choices, and brand recognition rather than the health rating. For instance, items labelled C or E, such as vegan gyro or ravioli, were chosen more often than a meat steak labelled A.

The findings highlight that while colour catches the eye, it does not override ingrained habits or taste preferences. The red E label failed to act as a deterrent, with many shoppers still placing those products in their baskets. Researchers concluded that Nutri-Score's effectiveness lies in its potential as part of a broader public health strategy rather than as a standalone tool. They recommend mandatory implementation across processed food categories and

consistent use on both packaging and electronic shelf labels. Alongside this, consumer education is seen as essential to help people understand and act on the information over time. The study also suggests that widespread adoption could encourage manufacturers to reformulate products to achieve better scores.

These results arrive amid rising obesity and diet-related illnesses, particularly among vulnerable populations. Critics of Nutri-Score argue that its category-based scoring system can be misleading, as it does not allow comparisons across different food groups. For example, Spanish researchers have pointed out that cocoa products with beneficial bioactive compounds sometimes score worse than highly processed alternatives with added sugar. Overall, the study underscores that while Nutri-Score enhances visibility and awareness, its influence on actual food choices remains limited without systemic changes and education.

<https://www.nutritioninsight.com/news/nutri-score-colorful-labels-eye-catching.html>



HER Report Spotlights the Complexity of UPFs, Arguing Not All Are Unhealthy

The Healthy Eating Research (HER) report examines the complexity of ultra-processed foods (UPFs), emphasizing that they should not all be treated as equally harmful in food policy.

It distinguishes between plant-based UPFs, such as cereals, breads, and meat alternatives,

which can provide health benefits, and animal-based UPFs and sugary drinks, which are consistently linked to negative health outcomes. The Physicians Committee for Responsible Medicine supports this nuanced view, noting that processed meats should be avoided, while some plant-based UPFs can contribute positively to health. At the same time, the report acknowledges that UPFs overall have been associated with obesity, cardiovascular disease, diabetes, depression, poor sleep, kidney disease, and higher mortality.

The US consumes some of the highest levels of UPFs globally, with more than half of adult calories and nearly two-thirds of youth calories coming from these foods. Baby foods are also heavily represented in the UPF category, raising concerns about early exposure. The report comes as the US Department of Agriculture works toward a federal definition of UPFs, which could influence taxation, advertising restrictions, and food standards in programs like the National School Lunch Program.

Current inconsistencies in classification mean that nutrient-rich foods such as tempeh are sometimes categorized as UPFs despite lacking evidence of harm.

The report also warns against “health halo” marketing, where products fortified with protein isolates, vitamins, or non-sugar sweeteners are promoted as

healthy despite being ultra-processed. It stresses that processing level alone cannot determine healthfulness, as some products may contain beneficial ingredients but still undergo methods that degrade their natural food structure. Instead, the report argues that processing-based frameworks should complement traditional nutrient and food group approaches, offering an

additional metric for assessing diet quality. Overall, HER calls for science-based policies that recognize the diversity within UPFs, discourage harmful products, and avoid penalizing those that can contribute to healthier diets.

<https://www.nutritioninsight.com/news/healthy-vs-unhealthy-upfs-report.html>

New Global WHO Sodium Reduction Guidelines Urge Industry to Follow Public Health Policy

The World Health Organization has released the second edition of its sodium reduction package, SHAKE the Salt Habit, aimed at helping governments implement stronger, mandatory measures to cut salt intake worldwide.

The SHAKE framework—standing for Surveillance, Harness industry, Adopt standards, Knowledge, and Environment—provides step-by-step guidance on reformulation, labelling, marketing restrictions, procurement policies, and taxation to reduce sodium consumption. It explicitly warns that food industry influence should be excluded from public health policy and offers strategies to counter opposition from industry stakeholders.

Excess sodium intake remains a major global health threat, with average consumption estimated at more than twice the recommended limit of 2,000 mg per day, contributing to 1.7 million deaths in 2023.

The WHO stresses that high sodium intake is a leading dietary risk factor for hypertension and cardiovascular disease, and that mandatory policies are among the most cost-effective interventions available. Recommended measures include setting maximum sodium limits in packaged foods, front-of-pack labelling, restricting marketing to children, and encouraging the use of lower-sodium salt substitutes such as potassium salt.

Despite these

recommendations, global progress is lagging. Only 28% of the world's population currently lives in countries with mandatory sodium reduction policies, leaving the 2030 target of a 30% reduction off track. The updated SHAKE package consolidates proven approaches and provides detailed annexes on enforcement, data collection, and countering common industry arguments.

WHO officials emphasize that culturally tailored strategies are essential, as salt consumption patterns vary across regions and populations. The report underscores that decisive, government-led action is needed to reduce persistently high salt intake and prevent millions of deaths each year.

<https://www.nutritioninsight.com/news/who-shake-the-salt-habit-sodium-reduction.html>

Coffee Safety: EFSA Positive Opinion for Acrylamide-Reducing Enzyme

Kerry has received a positive scientific opinion from the European Food Safety Authority (EFSA) for Acrylase, its

amidase enzyme developed to reduce acrylamide in instant coffee and coffee substitutes.

Acrylamide, a compound formed during coffee roasting and extraction, has been linked to health risks including carcinogenicity, immunotoxicity, and genotoxicity. Reducing its

presence has long been a challenge due to limited raw material options and restrictions in production technologies.

Acrylase directly decomposes acrylamide during processing, achieving reductions of up to 90% without altering taste, aroma, yield, or workflow efficiency.

EFSA confirmed that the enzyme, produced using a genetically modified *Escherichia coli* strain by Kerry subsidiary c-LEcta, did not raise safety concerns. This marks the first EFSA scientific assessment of an amidase for hydrolysing acrylamide in coffee extracts, underscoring the EU's heightened focus on acrylamide

mitigation under Regulation 2017/2158.

The approval provides manufacturers with a safe, effective solution to meet regulatory requirements while maintaining product quality. Kerry highlights that Acrylase represents a breakthrough compared to conventional

mitigation strategies, which often rely on indirect process modifications. By integrating seamlessly into existing workflows, the enzyme allows producers to reduce acrylamide levels while preserving the sensory attributes of coffee.
<https://www.foodingredientsfirst.com/news/kerry-acrylase-efsa-approval-acrylamide-reduction-coffee.html>

Tagatose Exempt from Added Sugar Labelling In US

Tagatose, a rare sugar that occurs naturally in foods like dairy and fruits, has been granted exemption from "added sugar" labelling in the US following an FDA letter of enforcement discretion.

This decision is expected to accelerate its adoption across food and beverage categories. Tagatose is about 90% as sweet as sucrose but provides only 1.5 calories per gram, and in the EU it carries approved health claims for supporting tooth mineralisation and reducing blood glucose spikes compared to table sugar.

Company highlighted the

ingredient's versatility, noting its ability to closely mimic sugar's taste, texture, and bulking properties, making it suitable for applications such as chocolate, cereals, ice cream, and yoghurt. He emphasized that the company's proprietary enzymatic production method is scalable, cost-effective, and can be localized within US agricultural supply chains, reducing reliance on imports from China, which dominates the sugar alternatives market.

While the exemption is seen as a breakthrough for reformulation opportunities, concerns remain. Nutrition expert Marion Nestle cautioned that tagatose is poorly absorbed and may cause gastrointestinal effects when consumed in excess. She also noted that its use marks products as ultra-processed, raising questions

about long-term health implications. The Center for Science in the Public Interest has echoed these concerns, though regulatory bodies such as Health Canada, FSANZ, and WHO have not raised safety issues.

The FDA's decision positions tagatose as a promising sugar alternative, potentially enabling manufacturers to reduce sugar content while maintaining consumer-friendly taste and texture. However, its widespread use will likely reignite debates about ultra-processed foods, digestive tolerance, and the balance between innovation and health outcomes.

<https://www.ingredientsnetwork.com/tagatose-exempt-from-added-sugar-labelling-in-us-news129375.html>

Consumer Demand and Supply Chain Risks Are Reshaping Traceability

FoodChain ID is positioning traceability as a fundamental requirement rather than a premium differentiator, driven by consumer demand, regulatory pressure, and supply chain volatility.

At Vitafoods Europe 2026, the company emphasized that

transparency is now essential for ingredient suppliers navigating increasingly complex markets. Dr. Ruud A. Overbeek explained that consumer attitudes are shifting, with Gen Z and parents actively engaging with traceability information to make decisions around health, wellness, and sustainability. Products marketed as sustainable already account for over a quarter of US consumer packaged goods sales and have contributed nearly half of total growth since 2013, showing that

transparency directly influences purchasing behaviour.

The urgency around traceability is fuelled by multiple factors. Supply chains are more volatile due to climate events, geopolitical disruptions, and disease outbreaks, while retailers and private labels are adopting transparency as a competitive advantage. Regulation, such as FSMA 204 in the US, is formalizing requirements for specific

supply chains, reinforcing the trend toward traceability as a baseline expectation.

Blockchain, once seen as a potential solution, is not considered scalable or practical for complex food supply chains. Overbeek highlighted issues of cost, scalability, and data validation, noting that incorrect information entered at the farm level would be permanently recorded, undermining trust. Instead, integrated digital traceability systems combining technologies like RFID, QR codes, and

satellite imaging under distributed governance models are seen as more effective.

Ingredient fraud remains a significant concern, particularly in high-value categories such as dairy, olive oil, and seafood. Common patterns include dilution, substitution, mislabelling, and adulteration, with risks heightened by complex supply chains and high commercial value. Barriers to full traceability include structural complexity, reluctance to share commercially sensitive sourcing

data, and limited technological capacity among smallholder producers.

The direction of travel is clear: traceability is moving toward becoming table stakes for all suppliers. While full implementation remains challenging, companies are investing in integrated systems to manage risk, maintain market access, and meet consumer expectations for transparency and integrity.

<https://www.foodingredientsfirst.com/news/food-traceability-transparency-fraud-prevention.html>

Closing The Hygiene Gap in Cold-Chain Environments

Cold-chain environments present a persistent hygiene challenge because refrigeration slows microbial growth but does not eliminate it.

Facilities operate continuously, and every time doors open, warm air and moisture enter, creating condensation that circulates through the system. This allows mould and contaminants to re-establish themselves between scheduled cleaning cycles, particularly in high-humidity areas such as evaporator housings and ceiling joins. The recurring mould problem is not usually due to inadequate sanitation procedures but rather the difficulty of maintaining stable hygienic conditions in a constantly active cold

environment.

The implications extend beyond operational concerns.

Food safety is a critical factor in consumer purchasing decisions, ranking just behind cost and taste in importance. Outbreaks of foodborne illness undermine public trust and damage brand credibility, with thousands of cases reported annually in Europe alone. Manufacturers therefore face pressure to integrate hygiene standards with environmental management, combining traditional sanitation practices with measures that regulate airflow, humidity, and temperature. This holistic approach ensures product integrity and reduces contamination risks.

Technology plays a growing role in bridging the hygiene gap. IoT sensors, automated cleaning

systems, AI-driven analytics, microbial biosensors, and machine vision provide real-time monitoring and early detection of potential hygiene issues. These tools support compliance with regulatory frameworks such as the FDA's Food Traceability Rule, which requires enhanced record-keeping for fresh foods. Continuous monitoring not only strengthens consumer health protection but also reduces food waste and improves product quality. Ultimately, maintaining hygiene in cold-chain environments depends on a layered strategy that unites disciplined sanitation, environmental control, and ongoing monitoring to safeguard both production standards and consumer trust.

<https://www.ingredientsnetwork.com/closing-the-hygiene-gap-in-cold-chain-environments-news129123.html>

HMO Infant Formulas: Regulatory Developments to Drive NPD And Affordability

Regulatory approvals for human milk oligosaccharides (HMOs) are reshaping the infant formula market across Asia-Pacific, driving innovation and paving the way for more affordable products.

H&H Group recently launched its first HMO formula in Mainland China under the Biostime brand, following the implementation of new national GB standards.

The product, manufactured in France, contains six HMOs, including a high dose of 2'-fucosyllactose (2'-FL), alongside 3'-GL, 4'-GL, 6'-GL, 3'-SL, and 6'-SL. This innovation contributed to a 74.4% surge in the company's infant formula sales in China during Q1 2026, with overall infant formula revenue rising 71.8% year-on-year.

HMOs are the third-most abundant solid component in breast milk, making them central to formula innovation. In China, three HMOs—2'-FL, lacto-N-neotetraose (LNnT), and 3'-SL—are currently approved, with 3'-SL only gaining approval in early 2026.

Regulatory progress has accelerated product launches globally, with approvals accounting for nearly 28% of new formulas in 2024. Countries like Vietnam, Malaysia, and Thailand have also expanded approvals, enabling more complex formulations with five to seven HMOs that better replicate breast milk's structural diversity.

While HMOs are still concentrated in premium formula segments, experts anticipate that scaling production and regulatory maturity will bring them into mid-tier and more affordable categories. Rising parental awareness of HMOs' benefits for

gut health, immunity, and development is expected to support this transition. Industry leaders emphasize that competition will not hinge on single ingredients but on overall formulation strategies, combining HMOs with other functional components like OPO to optimize absorption, intestinal health, and immune support. Growing research into diverse HMO blends is also fostering deeper engagement with regulators, reinforcing their role in advancing infant nutrition.

<https://www.nutraingredients.com/Article/2026/05/06/hmos-in-infant-nutrition-regulatory-approvals-to-drive-npd-and-affordability/>

Nutri-Score Now More Compatible with NOVA Processed Foods Classification

Nutri-Score, the European front-of-pack nutrition label, has undergone an algorithm update that makes it more compatible with the NOVA food processing classification.

Originally developed in France in 2017, Nutri-Score rates foods from A to E using a colour-coded system based on their nutritional composition. NOVA, created in Brazil in 2009, categorizes foods into four groups according to their level of processing, with ultra-processed foods considered the least healthy.

The 2023 Nutri-Score update, implemented from January 2024 with a two-year transition period, has led to fewer ultra-processed foods receiving favourable ratings. Research

using data from nearly 130,000 French food products showed a decline in products rated A or B and an increase in those rated D or E across all NOVA categories.

Unprocessed foods were largely unaffected, while ultra-processed items such as artificially sweetened beverages, sweetened plant-based drinks, and bread products saw their ratings downgraded.

Although the two systems are distinct, they are now more coherent and complementary. Nutri-Score focuses on nutritional quality, while NOVA emphasizes the degree of processing. This means that some foods with good nutritional profiles, like diet sodas or meat substitutes, may still be classified as ultra-processed under NOVA, while items such as homemade cakes or pure fruit juice may be minimally processed but nutritionally poor.

Researchers argue that comparing the two systems is important because consumers currently only see nutritional quality on packaging. Work is underway to integrate both dimensions into a single label, with proposals such as adding a black banner to Nutri-Score to indicate ultra-processed foods. Studies suggest consumers find this approach clear and comprehensive.

Further research is needed to understand how ultra-processed foods affect health and to refine the Nutri-Score algorithm accordingly. A regulatory framework defining processed and ultra-processed foods will also be necessary before integration can occur. In the meantime, health authorities are encouraged to continue educating consumers on using Nutri-Score correctly while promoting minimally processed foods.

<https://www.ingredientsnetwork.com/nutri-score-now-more-compatible-with-nova-news129311.html>



Indian High Court Grants Interim Stay on Ashwagandha Leaf Ban

The Karnataka High Court has issued an interim stay on the Food Safety and Standards Authority of India's advisory banning the use of ashwagandha leaves in food products.

The order, delivered by Justice S R Krishna Kumar, applies only to the petitioning companies and will remain in effect until the next hearing. The stay follows a petition filed on May 8 by several dietary supplement manufacturers, who challenged the April 16 advisory that restricted ashwagandha use to roots only, citing safety

concerns over reactive withanolides in leaves.

The petitioners argue that such a prohibition cannot be imposed through advisories but requires formal amendment of the 2016 Food Safety and Standards regulations. They claim the restrictions are arbitrary, disproportionate, and unsupported by verified scientific evidence, noting that they have been producing and exporting both root and leaf extracts since 1990 under valid FSSAI licenses. The petition highlights the potential cascading legal and financial consequences of the ban, including disruption of exports, breach of contractual obligations, and reputational

damage.

The advisory itself was based on a directive from the Ministry of AYUSH, which referenced updated safety dossiers and studies suggesting possible risks associated with leaf extracts. For now, the interim relief ensures that the petitioning companies—Sami-Sabinsa Group, K Patel Phyto Extractions, SA Herbal Bioactives, Sakti Naturals, OmniActive Health Technologies, Konark Herbs & HealthCare, and Unicorn Natural Products—can continue their operations until the matter is revisited in court.

<https://www.nutraingredients.com/Article/2026/05/15/indian-high-court-grants-interim-stay-on-ashwagandha-leaf-ban/>



Less Sugar, More Pressure: Scotland's HFSS Rules Force a Food Industry Rethink

Scotland's forthcoming restrictions on high fat, salt, and sugar (HFSS) products, is scheduled to take effect in October 2026, and the mounting pressure these rules place on food manufacturers to reformulate their offerings.

The legislation is part of a wider public health initiative designed to curb obesity and diet-related illnesses by limiting the promotion, placement, and availability of HFSS foods in retail environments. This policy shift reflects a growing recognition that the food environment itself plays a critical role in shaping consumer choices, and that reducing exposure to unhealthy options can help drive long-term improvements in population health.

For manufacturers, the challenge is formidable.

Confectionery, baked goods, savoury snacks, and many convenience foods rely heavily on sugar, salt, and fat not only for flavour but also for texture, preservation, and consumer satisfaction. Reformulating these products without diminishing their appeal requires sophisticated strategies in sensory science and food technology. Companies are experimenting with natural flavour enhancers, salt replacers, and sugar alternatives such as stevia, monk fruit, and rare sugars, while also incorporating fibres, proteins, and functional ingredients to rebuild mouthfeel and satiety. Advances in fermentation and enzymatic processes are being explored to create more natural sweetness or umami notes, offering ways to replicate the indulgent qualities consumers expect.

Yet reformulation is not simply a technical exercise; it is also a commercial balancing act. Protecting brand identity and consumer loyalty is paramount, as even subtle changes in taste or texture can risk alienating long-standing customers. Manufacturers must therefore invest in consumer testing, transparent communication, and gradual reformulation strategies to ensure acceptance. At the same time, the new rules create opportunities for innovation. By rethinking indulgence in healthier terms, companies can position themselves as leaders in responsible nutrition, tapping into growing demand for products that combine enjoyment with wellness. This may involve developing hybrid categories—snacks fortified with protein or fibre, bakery items made with wholegrains, or confectionery that delivers functional benefits such as energy or gut health.

The broader implications extend beyond Scotland. Similar HFSS regulations are being considered or implemented across Europe, signalling a shift in how governments and regulators approach food policy. For the industry, this means reformulation is not a

temporary compliance measure but a long-term strategic necessity. Those who embrace the challenge may find themselves better aligned with evolving consumer expectations, where health, sustainability, and sensory pleasure are no longer competing priorities but

integrated demands. In this sense, Scotland's HFSS rules are not only a regulatory hurdle but also a catalyst for reimagining the future of food.

<https://www.foodnavigator.com/Article/2026/05/15/scotlands-hfss-rules-pile-reformulation-pressure-on-food-manufacturers/>

Artificial Sweeteners: Why the Science War is Raging On

The ongoing controversy surrounding artificial sweeteners, is highlighting how new health studies continue to fuel debate among scientists, regulators, brands, and consumers.

Despite decades of research, consensus remains elusive, with conflicting findings on whether sweeteners such as aspartame, sucralose, and saccharin pose risks related to cancer, metabolic health, or gut microbiota. Each new study reignites public concern and

media coverage, keeping the issue at the forefront of food and health discussions.

Regulatory bodies like the European Food Safety Authority and the US Food and Drug Administration maintain that approved sweeteners are safe within established limits, yet consumer scepticism persists, driven by headlines and advocacy groups. The food industry faces a difficult balancing act: reformulating products to reduce sugar while relying on sweeteners that remain under scrutiny. This tension is compounded by shifting consumer expectations for natural, clean-label solutions, which often conflict with the use of synthetic or

highly processed alternatives.

The "science war" over sweeteners is unlikely to end soon because of the complexity of nutrition research, the variability of study designs, and the influence of public perception. For manufacturers, the challenge is not only technical but reputational, as they must navigate evolving evidence while maintaining consumer trust. The debate reflects broader questions about how science, regulation, and consumer sentiment intersect in shaping the future of food and health policy.

<https://www.foodnavigator.com/Article/2026/04/13/artificial-sweeteners-why-the-science-war-wont-end/>

Can AI Really Sort the UPF Mess the Food Industry Is Facing?

The article explores the growing debate over how ultra-processed foods (UPFs) should be defined and regulated, highlighting the limitations of the widely used NOVA classification system and the emergence of AI-driven alternatives.

NOVA has been criticized for its one-size-fits-all approach, which lumps together diverse

products ranging from fortified cereals to sugary drinks under the same label, without accounting for nutritional composition, fortification, or cultural food traditions. This lack of nuance has created confusion among consumers, regulators, and manufacturers, while also fuelling scepticism about whether health risks stem from processing itself or from the high levels of fat, sugar, and salt often found in these foods.

In response, new tools are being developed to provide more refined assessments. Startups like WISEcode are introducing AI-powered applications that

classify foods along a spectrum of processing, offering more granularity than NOVA. Other initiatives include ZOE's Processed Food Risk Scale, which evaluates foods based on likely health impact, and databases such as Open Food Facts, which allow consumers to scan products and view their processing scores.

These innovations reflect a broader push to redefine UPFs in ways that are both scientifically credible and commercially useful, though the proliferation of competing systems risks adding complexity rather than clarity.

Regulatory bodies are also grappling with the issue. The UK has yet to establish an official definition, while US agencies are still working toward a federally recognized standard. California has moved ahead with its own legislation, banning certain harmful UPFs from school meals and exploring warning labels. Internationally, organizations like the World Health Organization and Pan American Health Organization are pressing for stricter rules, while

countries such as Mexico, Chile, Brazil, and Peru have already implemented dietary guidelines or labelling systems that discourage UPF consumption. These efforts underscore the growing political and public health pressure to act, even as scientific consensus remains unsettled.

The AI is likely to play a central role in shaping the future of UPF classification, given its ability to analyse ingredient lists and product data at scale. However, until science,

regulation, and commercial tools converge on a common framework, the food industry will continue to face uncertainty. The unresolved question is not only what counts as an ultra-processed food, but who gets to decide—and which definition ultimately becomes the standard.

<https://www.foodnavigator.com/Article/2026/04/08/can-ai-redefine-ultra-processed-foods-as-pressure-grows-to-move-beyond-nova/>

FSANZ Proposes Minimum Vitamin D Levels, New Labelling Rules for Toddler Milk

Food Standards Australia New Zealand (FSANZ) has proposed new regulations for toddler milk, aiming to strengthen nutritional standards and improve consumer clarity.

The proposal introduces a minimum vitamin D requirement of 0.36 µg/100 kJ, aligned with international CODEX standards, while maintaining a maximum of 0.76 µg/100 kJ. This marks a shift from the current situation where no minimum levels are prescribed. The standardized product name would become “Formulated supplementary

milk drink for young children,” printed on the front of packaging, and nutrition or health claims would be prohibited. Products must also be clearly distinguished from infant formula, follow-on formula, and other foods through text, imagery, or colour.

Protein sources are another focus. FSANZ proposes limiting them to common, established options such as cow, goat, and soy protein isolate, with sheep milk and partially hydrolysed protein also permitted. This measure is intended to reduce risks associated with novel protein sources and ensure nutritional adequacy for vulnerable consumers. The regulator’s survey found that most toddler milk in Australia and New Zealand currently uses

cow milk, with some goat, sheep, and plant-based proteins like pea, rice, and oat also present.

The changes will require reformulation and label adjustments, but FSANZ argues that the long-term benefits outweigh the short-term costs. Aligning with CODEX standards would support international harmonization, improve manufacturing efficiencies, and enhance consumer understanding. FSANZ emphasizes that toddler milk is a “special purpose food” meant to supplement diets when nutrient intake may be inadequate, not a routine dietary staple.

<https://www.nutraingredients.com/Article/2026/05/27/vitamin-d-minimum-levels-new-labelling-rules-proposed-for-toddler-milk-in-anz/>

South Korea on ‘Unfair’ Online Ads: Helping Food Firms Avoid Snags

South Korea has intensified its oversight of online food advertising by releasing a comprehensive 78 page handbook that defines what

constitutes “unfair” advertising.

The Ministry of Food and Drug Safety (MFDS) developed the guide after identifying numerous misleading practices in digital food sales, including exaggerated health claims and deceptive marketing tactics. The handbook clarifies that food products cannot be presented as health functional

foods unless they have been formally approved under the Health Functional Food Act, which requires certification for specific functions such as immunity or digestion. Misrepresenting non HFF products as certified health functional foods is now explicitly deemed unfair advertising.

The handbook also prohibits claims of unverified health benefits, such as promoting products for height growth in children or diabetes prevention. It addresses misleading strategies like using fabricated testimonials, letters of appreciation, or vague terms such as “special method” and “Korean medicine.”

Advertisements featuring endorsements from health professionals or academics are restricted unless properly

substantiated. Comparative advertising that disparages competitors without objective evidence is also banned, as are ads that incorporate gambling references or obscene language.

These measures build on earlier regulatory revisions that introduced AI driven inspections to monitor online food platforms more effectively. By tightening rules and clarifying prohibited practices, MFDS aims to protect

consumers from misleading claims and ensure that food companies understand the boundaries of acceptable advertising. The handbook is intended to serve as a clear reference point for businesses, reducing the risk of regulatory violations and enhancing consumer trust in online food sales.

<https://www.foodnavigator.com/Article/2026/05/27/south-korea-on-unfair-online-ads-helping-food-firms-avoid-snags/>



Health Canada Publishes Prebiotics Monograph

Health Canada's Natural and Non-prescription Health Products Directorate has released a prebiotics monograph that establishes a regulatory framework for health claims in Canada.

The document adopts the 2017 definition from the International Scientific Association for Probiotics and Prebiotics, describing prebiotics as substrates selectively utilized by host microorganisms to confer health benefits.

It provides a defined list of accepted ingredients, including inulin, acacia gum, fructo-

oligosaccharides, trans-galacto-oligosaccharides, xylo-oligosaccharides, and specific human milk oligosaccharides such as 2' fucosyllactose and lacto N neotetraose.

The monograph makes a clear distinction between prebiotic claims and fibre claims, emphasizing that not all fibres are prebiotics and not all prebiotics are fibres.

The initiative is intended to guide industry in preparing product licence applications and labelling for natural health product authorization.

It was developed through collaboration with the International Probiotics Association and the Global Prebiotics Association, both of which welcomed the publication as a milestone for regulatory alignment and transparency.

The IPA highlighted its active

role in providing scientific and regulatory input, while the GPA noted that the monograph does not yet include all well substantiated prebiotic ingredients and expressed its intention to continue engaging with regulators to ensure emerging science is incorporated.

Health Canada officials emphasized that while industry input was valuable, decision making authority remained with the regulatory body, ensuring independence.

The process was described as credible and transparent, reducing the research burden on internal teams and broadening the evidence base considered during development.

<https://www.nutraingredients.com/Article/2026/05/01/health-canada-publishes-prebiotics-monograph/>

