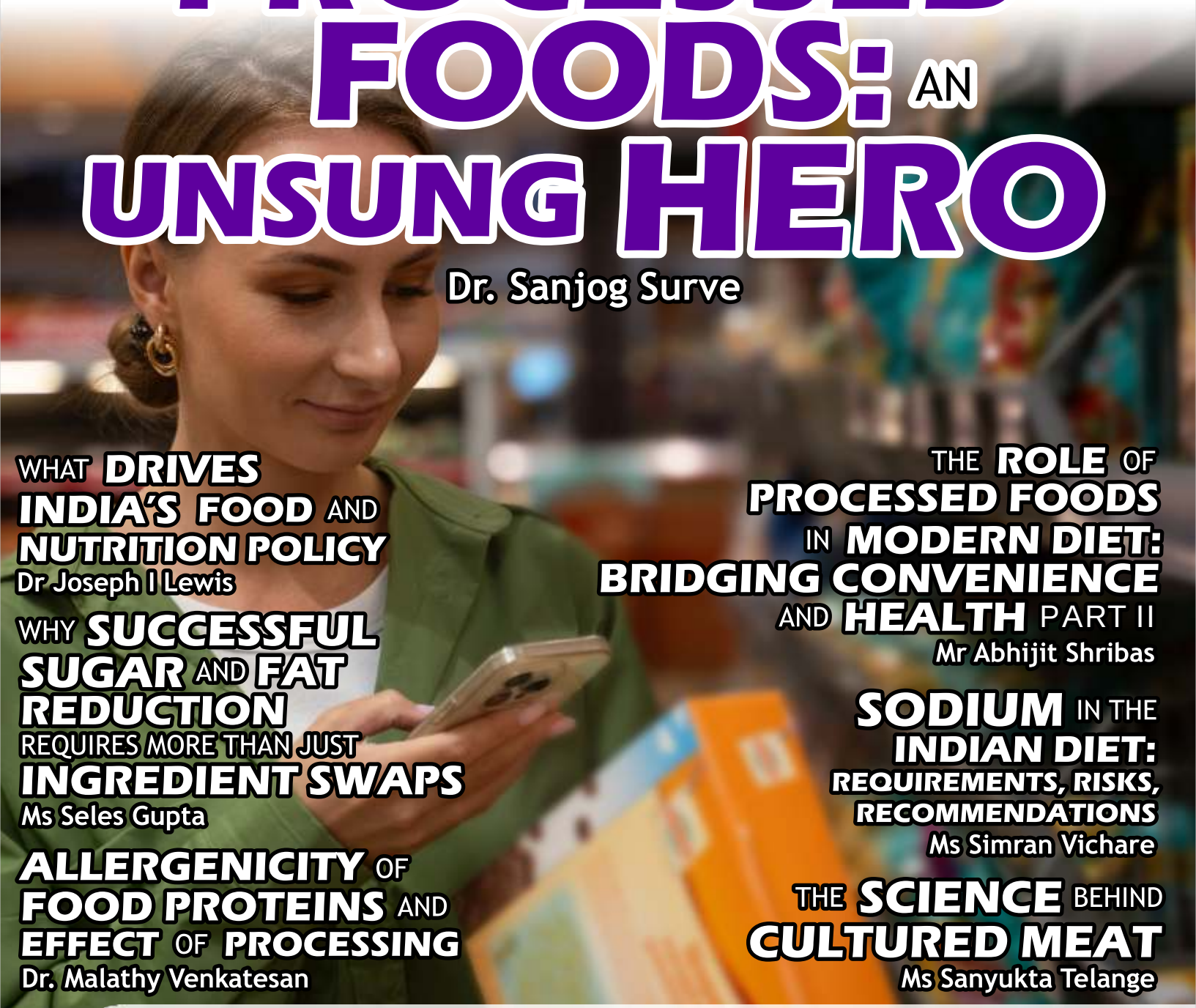
PFNDAI

FOOD, NUTRITION & SAFETY MAGAZINE

BULLETIN AUG 2025

PROCESSED FOODS: AN UNSUNG HERO

Dr. Sanjog Surve



WHAT DRIVES INDIA'S FOOD AND NUTRITION POLICY

Dr Joseph I Lewis

WHY SUCCESSFUL SUGAR AND FAT REDUCTION REQUIRES MORE THAN JUST INGREDIENT SWAPS

Ms Seles Gupta

ALLERGENICITY OF FOOD PROTEINS AND EFFECT OF PROCESSING

Dr. Malathy Venkatesan

THE ROLE OF PROCESSED FOODS IN MODERN DIET: BRIDGING CONVENIENCE AND HEALTH PART II

Mr Abhijit Shribas

SODIUM IN THE INDIAN DIET: REQUIREMENTS, RISKS, RECOMMENDATIONS

Ms Simran Vichare

THE SCIENCE BEHIND CULTURED MEAT

Ms Sanyukta Telange

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2nd Floor, Mahalaxmi Chambers, 22 Bhulabhai Desai Rd., Mumbai - 26 (India)
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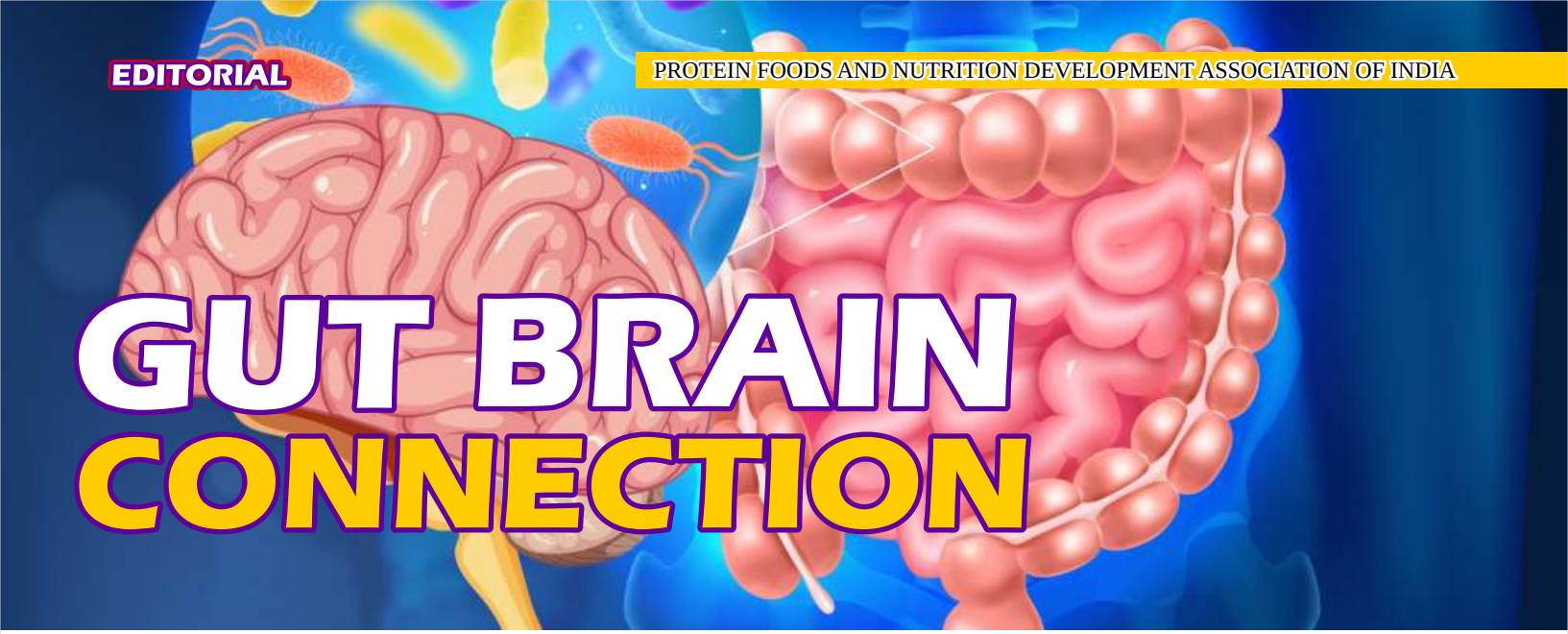
FOOD, NUTRITION & SAFETY MAGAZINE
Editor: Dr. J. S. Pai

INDEX

Cover Design & Layout by Ms. Leena Shanbhag



GUT BRAIN CONNECTION

It has been known that probiotics have a large role in gut health. It is now being established that gut has a direct connection with brain through vagus nerve, which transmits signals between the brain and the gut.

Thus, among other things that affect the gut, microbiota of gut would also be affecting the gut and consequently the brain. It is known that gut microbes produce many neurotransmitters such as serotonin, GABA and dopamine, which affect mood, cognition and behaviour. Thus, gut microbes play a fairly important role in our mental health and many of our behaviours.

Earlier, we were only concerned about microbes with either food-related illnesses or wastage due to microbial spoilage. We now know that there are good microbes and there are undesirable ones.

The latter may not just be responsible for keeping us mentally healthy, but if there is an imbalance, we may experience psychological symptoms as well as physical ones such irritable bowel syndrome.

Thus, microbes have become quite important to our gut health and in consequence to our mental health. We must not just avoid pathogens, but at the same time nurture good microbes that would help us keep our health.

There are quite a few probiotic fortified foods now in the market touting to provide all kinds of health benefits. We also know that there are many fermented foods containing good bacteria which would help us keep the gut environment healthy.

Such foods like fermented milk products such as curd or yoghurt, cheese, etc., fermented legumes including soya natto, miso, etc., fermented Indian foods such as idli, dosa, dhokla, sol kadhi etc. and some fermented fish as well as meats such as sausages are quite important in keeping the balance of gut microbiota.

Besides probiotics, it is also important to provide gut microbes some food so they would thrive and carry-on providing health benefits. This is where prebiotics come in.

It is very important that we consume dietary fibre especially the soluble fibre, which escape the digestion and absorption by our gut, so only dietary fibre can reach the microbes in colon.

Only soluble fibre can be used by microbes so our diet must have these fibres that promote growth of gut microbes. It is also known that right type of fibre would induce the growth of health promoting microbes.

Thus, as our knowledge of nutrition and health evolves, with more of the fascinating science of food and how it is digested and how its components affect not only our physical health but also our mental health.

Knowing this to be so, we need to plan the way we eat more methodically so we not only enjoy food but also nourish our body and mind.

Prof Jagadish Pai, Editor, PFNDAI

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WHERE IS INDIA EATING?

AUTHOR

Dr Joseph I Lewis,

Chairman, Scientific Advisory Committee, PFNDAI

Indian diets are traditionally centred around home-cooked meals made from whole foods, with grains contributing 49-65% of daily energy, but lower in fruit, vegetables, legumes, and pulses.

They are served and enjoyed with the family. Ready-to-heat and eat foods are considered 'ultraprocessed' as they are prepared in industrial kitchens rather than home kitchens. Where India is eating relates to whether it is home-cooked or industrially prepared and cooked foods.

They may be served and eaten at home or elsewhere. The debate now is of assessing dietary quality by the traditional nutrient-centric metric (HFSS, RDA) or whether it is inadequate and needs to be replaced by another nutritional dimension based on 'degree of processing' (UPF).

Nova UPF classification proposes four categories, which are debated for lacking in scientific rigour and discernible criteria. The main concept is that UPFs are characterised as being industrially produced, supplied in ready-to-eat or heat-it-yourself formats, made appealing with multiple additives and largely lacking whole foods. They are expected to follow a steeper growth trajectory than before; however, they are not new, except that their nutritional value is being expressed differently. UPFs, such as biscuits, snacks, bread, and beverages, have been consumed for decades. Most dietary shifts go unnoticed until they can no longer be ignored.

For any food that presents a health risk, its exposure through consumption matters more than its market presence. Often, narratives shape opinion on the latter. Per capita consumption of salted snacks remains low in urban India (1.1 kg, 2017) compared to the US and the UK, where it reaches 9.5 kg and 7 kg, respectively (IFT, 2016).

Similarly, the level of sweet biscuit purchases is higher in Western Europe and the US (5.9 kg and 6.3 kg per capita, respectively, in 2017) than in urban India (1.9 kg in 2017).

The wealthiest 10% of Indian households consume more than 3,000 kcal per person per day, while the poorest 10% consume only 1,645 kcal per person per day.

Despite the average total calorie intake being 2200 kcal, approximately 12% lower than the EAT-Lancet recommended level, the increase in obesity rates is perplexing.

Euromonitor volume sales data of ultraprocessed foods and drinks (UPFD) were highest in Western Europe, North America, and Australasia. In Europe, UPFDs contributed an average of 25% of total dietary energy.

A study on US dietary changes from 2001 to 2018 (NHANES data) noted a decrease in the percentage of total energy of minimally processed foods from 32.7% to 27.4%, while the percentage of total energy of UPFs increased from 53.5% to 57.0%.

The obvious concern is that meals prepared from minimally processed foods in high-income countries (HIC) are yielding to away-from-home prepared or cooked foods: the largest increases were observed for ready-to-eat/heat meals.

Indian surveys indicate that 12% (263 kcal) of daily energy comes from 'processed foods,' which includes a range of foods from suji, rice products, besan, and other gram-based items to biscuits, pickles, sauces, ice cream, and chocolates.

It is unclear whether 'outside cooked meals' are replacing traditional home-cooked meals. Snacks and savouries are indulgent foods, while adding extra calories, they do not interfere with the dietary characteristics of main meals.

Foods cooked away from home—ultra-processed foods—have been suggested as a risk factor for increased obesity and heart disease. The degree of processing (UPF) introduces a new aspect to diet quality beyond traditional nutrient-focused metrics.

Which health indicator would apply when diets are traditional, ultraprocessed, or somewhere in between? Would this depend on which of the two kitchens provides most of our meals?

PROCESSED FOODS: AN UNSUNG HERO

AUTHOR
Dr Sanjog Surve,
Independent Consultant

A misplaced terminology has tarnished great achievements of Food Processing

Introduction

Processed foods, often subject to criticism and scepticism, are in fact one of the most overwhelming achievements of modern food science and technology. Far from being merely a necessary convenience of the fast-paced, urbanized 21st century, processed foods represent ingenuity, progress, and the democratization of nourishment. They have enabled societies to thrive, minimized food waste, and revolutionized the way we eat, cook, and live.

Many a well-meaning article have been written, highlighting with examples the contributions of Food Processing and its Industry. However, they do not address the criticism at its root and a defence based on examples is not comprehensive enough to give a wholesome perspective. The criticism and misperception I refer here is that processed foods are “unhealthy”. They directly imply that processing is the culprit. This viewpoint has a danger of percolating through the regulatory thought process. Any regulatory action must find the underlying cause of the narrative, gather right information or scientific evidence, and then direct its powers to influence the change with measured initiatives. So, the intention is to provide a pro-active clarification.

In this document, we will skip the myriad virtues of processed foods which delve into their role in global food security, nutrition, safety, culinary variety, economic growth, and social well-being. Instead, directly enquire and assess the principles Food Processing to elucidate their intended purpose and then try to understand why its image gets tainted.

Recently Facebook propped up an interesting quote, attributed to the venerable Gautam Buddha, “What is Poison: Anything beyond what we need is poison. It can be power, laziness, food, vanity, fear, ego, ambition, anger or whatever.”

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

The importance of this profound statement seems to have been lost when it comes to food, not only with the ignorant, but also with the intelligent. They do not see that the converse is also true.

Processing of Foods is Innocuous and Necessary

First, I ask what is the alternative to Processed Foods? Is it Raw or Uncooked Foods. Yes, raw foods have merits and are also beneficial when it comes to consumption of fruits. Vegetables can also be consume draw as salads, juices, soups etc. But for large populations in a country like India the limitations of this choice as alternate diets become obvious. As both fruits and uncooked vegetables can only be eaten as a part of the diet and cannot constitute the diet itself.

Home cooked foods are commonly considered as alternative to processed foods, in the minds of those who oppose Food Processing. Let us take a look if there is a fundamental difference between the two – Home Cooked and Processed Foods, to merit a distinction between them. Most food technologist know that the processing of foods falls in three categories: Physical, Biological and Chemical.

Table below examines and explains the nature of physical food processing in the industries and at home. One finds that there is a significant overlap between the fundamentals of processing foods in a factory and home cooking. It would be safe to say that home cooking is a subset of processes employed in the industry. There is not a single step employed by the food industry that is designed to cause harm or justifies being labelled as unhealthy. On the other hand, there are several benefits.

- Industrial Processes operate on a large scale and are based on well-established scientific principles.
- Industrial processes have precise controls which help optimize outcomes. They help retain maximum possible nutrient levels while destroying harmful bacteria.
- Industrial processes are energy efficient.
- Industrial processes generate less waste.

Variable	Level	Home Cooking	Processing	Purpose
Separation		Sifters, Cutters	Various techniques	Inedible portion
Pressure	High	Pressure cooking	Retorts, Extrusion	Time
	Low	Not much	Vacuum	Oxidative changes
Temperature	High	Heating, Tandoor, Oven	Drying, Heating, Evaporation, Steam	Microbes Tenderization
	Low	Water, Ice	Refrigeration, Chilling, Freezing	Microbes Chem. Rxn
Volume (Size)/ Density		Various Techniques	Various Techniques	Organoleptic
Mixing/ Emulsification		Mixers, Hand mixing	Homogenization, Mixing	Organoleptic
Packaging		Not much	Various techniques	Create barriers

The contrarians are likely to argue about the well-known effects of some treatments such as elevated temperatures and their association with health hazards. But they must also be aware that similar situations occur in home cooking with processes like direct flame cooking and tandoor for example. Food scientists have methodically studied, understood the science behind anti-nutrient factors generated during processing and conscientiously ensure that such conditions are avoided during processing. Global food regulators diligently evaluate every technology and there is none in practice today that can be challenged.

Biological processes such as fermentation and pickling in food have been hailed beneficial by all. Since these tend to be on a small scale they go on without resistance or objection from consumers and activists. Additionally, the food Industry employs techniques termed as maturation (e.g. in cheeses, wines) and uses enzymes to bring about targeted changes, but these are mostly classified as natural and therefore are not a part of the health debate.

Chemical Processing at the superficial level has extremely negative connotations, primarily because of the synthetic nature of the chemicals which are juxtaposed against the term “natural”. The entire chemical industry is concerned about the exaggerated negative sentiment, despite the great strides and its immeasurable impact. Specifically with respect to foods, most chemicals used fall under Food Additives.

Those familiar with Food Processing will know that addition of chemicals during processing is not ad hoc. The Food Standards and Safety Authority of India (FSSAI) controls it. And in its definition section 3.1.1.it articulates terms like acceptable daily intake (ADI) and maximum usage level but more importantly the sub section (7), titled Justification, states, that “the use of food additives is justified only when such use has an advantage, does not present an appreciable health risk to consumers…” Therefore, all products licensed by the FSSAI must comply with the above criteria, yet it is usually an alarming situation when the mention of food additives is made.

In India, the science of risk assessment is rigorously applied to individual Food Additives under the aegis of FSSAI. These principles determine the levels of additives for usage in Foods. Whenever any doubt is raised anywhere in the world, the FSSAI has the authority and responsibility to act.

Some people question the need for food additives in foods. If home cooking can be done without them, then why does the industry need them? To answer that, let us get deeper. Additives have two major roles. First as preservatives, without which the food wastage would be much higher and/or the food less safe. I also think that a shorter shelf life without preservatives will incentivize faster consumption and may lead to over consumption. The second role of food additives is as organoleptic enhancers. India is blessed with a cuisine that includes spices to enhance the hedonic levels of a food. Food flavours and emulsifiers however take organoleptic experience to levels far beyond normal home cooking. This is probably where they contribute to overconsumption, we will discuss this in a later section.

The underlying cost advantage delivered by food additives plays an important role in democratizing the taste experience. As Auguste Escoffier has quoted, "Good food is the foundation of genuine happiness."

Two areas of chemical processing that are well known but ignored in the scheme of things.

a. Enhance Nutrition: examples include, Food Supplementation, Food Fortification, Infant Foods, Special Requirement foods, Nutraceuticals.

b. Enhance Safety – Detoxification/Purification: Whereby chemicals are removed through various processes called as purification or refining. They also lead to a reduction of heavy metals, pesticides, toxins, allergens and anti-nutritional factors.

The above benefits are not in the realm of home cooking.

Given the above discussion, one should ask whether the term unhealthy resonates with any aspect of food processing directly. I get the answer as emphatic No. Then why do so many people, even with scientific background tend to believe in the contrarian view. As we see in the next section, it is possibly due to a misappropriation of the verb "processing" and even extension of that to "ultra processing ". Let us now look deeper at the adjective "unhealthy".

Health is multidimensional, affected by multiple risk factors.

One of the key challenges, globally and in India is the increasing levels of Non communicable Chronic Diseases (NCD). These include obesity, cardiovascular diseases, cancer and diabetes. Mental disorders and respiratory diseases are often clubbed under NCD. There are various risk factors which are associated with these diseases. The controllable risk factors are tobacco, alcohol, food and exercise. While age, gender and genetics fall under uncontrollable category.

When it comes to food, research findings for most diseases are mostly indirect, based on correlations. Very few conclusive statements can be made. Most of you may be familiar with cholesterol intake and cardiovascular diseases. The research has been meticulous but not subject to much regulatory action because the complex relationship has led to multitude of interpretation. Actions were rightfully limited to caution only. Similarly for other diseases the role of food or specific components of food is an ongoing topic of research.

The gravity of NCD and their impact on productivity or healthcare costs is of great concern all around the world. To this end, the role of overconsumption of food becomes a factor of great importance. Akin to what Gautam Buddha has said long time ago. Over consumption of food, makes it harmful. The first sign of which is obesity. The relationship of obesity with high intake of fat and sugar is well known from our understanding of biochemistry and other biological processes.

An important point in the debate on food and health is that all foods, processed or home cooked or raw, elicit similar response based on the calorific content. There is no conclusive evidence that single processed food or the entire class of processed foods because of their processing render food unhealthy properties. The issue with food processing is that the vast knowledge of food science lends itself to manipulate the formulations of foods and develop compositions that have significantly different levels of nutrients than natural ones.

Nutrient density of some processed foods tends to be higher and that can theoretically lead to higher intake of calories. However, there are enough and many alternatives in home cooked foods that can replace processed foods in terms of calorie density. An interesting example is that of Chile. In Chile, the government introduced harsh measures to curb processed food. Then after 10 years what was the outcome? Processed food consumption decreased but obesity increased. People shifted the foods but notthe calorie intake.

In terms of the adjective "unhealthy", I would say there is a strong need to address health issues. Food does play a role but singling out Processed foods in general will not serve any purpose. Particularly in a country like India where the intake levels are not alarming or even comparable to levels in USA or Canada, twenty years ago. The associated verb with the adjective "unhealthy" should be "over consumption" and not processing.

Food and Diet: Balancing the View

It is important to note that not all processed foods are created equal. The term "processed" covers a vast spectrum, from minimally processed items like frozen vegetables and pasteurized milk, to more complex formulations such as breakfast cereals and plant-based burgers. So now, let us understand the noun, "Food".

Unfortunately, the jargon for food is very loose. The terms are used interchangeably and the concepts related to them get trapped in the words. Specifically, food is something referred to a product on a shelf or a dish in home cooking. Multiple foods make a meal. Several meals over about couple of weeks will become your diet. If you go further, institutions like FAO and WHO work on Population Nutrient Goals (PNG).

What is disturbing is that today regulators and health institutes are borrowing PNG standards and applying to individual food. The simplistic approach of meeting an average goal by expecting every individual food to be at the average is not compatible with the socio- cultural aspects of food. Celebrations, festivals apart, a daily dose of Happiness through food is something not easily given up by many. This is evident from the increasing obesity worldwide despite its obvious discomforts.

A balanced solution based on robust principles is needed to save the day. The solution ought to not label or reject any food as unhealthy unless specifically proven to be so. To the contrary include all foods and give them their rightful place in the food pyramid by specifying the quantum to be consumed. This will address the verb "over consumption "and the noun "diet". Lack of data is the biggest impediment in implementing such approach in India, substantial initiatives are urgently warranted.

Food Industry has toiled hard in a country like India providing service to the masses and now is transforming itself into a new paradigm. FOOD TO FORK TO FITNESS through Processing.

WHAT DRIVES INDIA'S FOOD AND NUTRITION POLICY

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

National surveys are valuable sources of large-scale data collected from households on food consumption, nutrient intake, and livelihood characteristics, including expenditures for food and non-food essentials. They are essential for monitoring a country's nutrient deficiencies and addressing them through effective policy measures.

However, datasets used solely to confirm existing diet-disease correlations may ignore significant causative factors that directly affect access to better nutrition. Repeatedly selecting data to support a predetermined conclusion, already established, creates a popular narrative but distracts from developing effective policy measures. There is an opportunity to engage with a new framework on food security defined by the FAO, based on four pillars (see box). The framework promotes explorations into multifactorial interactions that affect food, nutrition, and health outcomes. Setting aside the privilege of a single interpretation—not dismissing it, but allowing researchers and scholars to re-analyse the same dataset through the lens of FAO's food security—may lead to better policy directions.

For clarity, the four pillars have the following meanings.

- Food availability: emphasises the 'supply side' of food and is influenced by food production, stock levels, surplus, and trade.
- Food access: refers to a household's ability to buy enough food to meet recommended nutrient needs.

The FAO defines food security as "*when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life*"(1).

The definition is built on four pillars: availability, access, utilisation, and stability. It shifts policy from the shortcomings of economic and agricultural considerations to being more "nutrition-sensitive" to households' and their needs for better health

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It is not just about access to food groups, but about their collective capacity to provide nutritious food. It also involves ensuring physical access for everyone, including dispersed and diverse socioeconomic groups: tribal, rural, and urban.

- Food utilisation: pertains to the biological availability of nutrients, including the nutritional needs of each individual within a household. It acknowledges that there is no single diet that fits all needs.

- Food stability: is consistently meeting the previous three dimensions. This pillar embodies resilience to sudden shocks or cyclical events affecting availability, access, and utilisation.

Taken together, these four pillars provide a framework for analysing survey data. Nutrient-disease correlations, used for monitoring prevalence, fall short in providing strategic inputs for policy interventions to uphold population nutrition and public health.

Two challenges arise from the definition in reanalyses of survey data: (a) 'what' should now be measured, and (b) how. The 'what' relates to the choice of appropriate indicators for the four pillars (access, availability, utilisation, and stability) and their qualifying components (quantity, quality, safety, and cultural acceptability). The 'how' question refers to methodology, models, weightage and multifactorial correlations involved. Choice and validation of these indicators/ methods are based on three paradigm shifts: (a) from global and national to the household and the individual; (b) from a food-first perspective to a livelihood perspective; and (c) from objective indicators to subjective perception.

From global and national to household and the individual

There is recognition that economic and physical food supply at the national or international level does not guarantee food security at the household level. Earlier, governments defined food security as the availability of a country's and the world's food supply to offset fluctuations in production and cost. Some governments still do. As a result, food access for all (304 million Indian households of 4.4 individuals) was not considered a problem of food supply. Amartya Sen is credited with initiating the paradigm shift that moved the focus from supply to access for all. The focal point now is on the household and individual's access at all times, despite calamities and uncertainties.

It is well known that food availability (production) can coexist with widespread inadequacy in household consumption. India's milk production is pegged at 216 MMT (2), with a per capita availability of 491g/day; however, urban households consume 185g/day, while rural areas consume 146g/day.

NNMB pooled time trends (1975-2012) range from 116 (g/CU/day) to 95 (g/CU/day), against a

Three paradigm shifts are necessary when reviewing survey data through the lens of food security:

- From global and national to household and the individual.
- From a food-first perspective to a livelihood perspective.
- From objective indicators to subjective perceptions

recommended intake of 150g/day, revised to 300g/day. While there is a sufficient supply, it remains economically inaccessible to households.

Providing households with "safe, nutritious food that meets their dietary needs and food preferences" at all times requires efficient supply chains with strong infrastructure. The Food Safety Management System (FSSA, 2006), is a risk-based supply chain for delivering safe food to households. Likewise, food security depends on similar agricultural productive infrastructures to ensure economic access at the household level. The persistent belief among governments that food security is not about food supply must change.

From a food-first perspective to a livelihood perspective

The two pillars of food security, 'utility' and 'stability', define the quantity and quality aspects of access. It should be sufficient, safe, and nutritious. Food utilisation refers to household needs and how the body processes food energy and nutrient requirements for an individual's age, gender, and physiological status. Stability means ensuring there is no decline in nutritional status despite climate or economic challenges, including unemployment. These pillars imply basic livelihood requirements.

Livelihood encompasses all capabilities, assets, and income required to secure safe and nutritious food, including shelter, education and other needs. It includes the special needs of all individuals, including infants, young children, pregnant and lactating women, the elderly and the sick residing in a household. The food-first perspective generally aggregates survey data, subduing these disparities. A livelihood perspective disaggregates data to unravel realistic solutions arising from a multifactorial impact analysis.

Socioeconomically stronger households (Table 1) (3), characterised by per capita income (Rs 900 per month), occupation, house type, have a significantly higher prevalence of hypertension, overweight/ obesity, waist circumference, and diabetes compared to weaker households. Conversely, the distribution percentage of households (Table 2) (3) with poor nutritional status among children (< 5 years)

Table 1: Prevalence (%) adult men by household socioeconomic variables*

Socioeconomic particulars	Category	Hypertension	Overweight Obesity (BMI≥23)	Waist Circumference (≥90)	Diabetes
Occupation	Labourers	17.8	14.5	8.3	5.3
	Service/Business	27.7	28.2	20.1	16.6
Per capita Income	Rs/m < 300	20.4	9.5	5.8	5.8
	Rs/m ≥ 900	23.6	27.5	18.9	10.5
Family size	≤ 4	23.6	27.5	18.9	10.5
	≥ 8	21.2	21.3	14.8	8.6
House Type	Kutcha	19.0	10.5	6.1	4.2
	Pucca	24.8	31.9	21.9	11.5
Literacy status	Literate	23.5	10.9	15.8	7.2
	Illiterate	21.8	23.3	7.0	8.5

Adapted: NNMB (2011-12): Table 81.1

is significantly higher for underweight (weight for age), stunting (height for age), and wasting (weight for height) in weaker segments. However, these disparities suggest that livelihoods are significantly associated with health, but underrated in a food-first perspective (Box 2).

Table 2: Distribution (%) household: Children <5year nutritional status

Socioeconomic Demographic factors	Category	Underweight (Wt. for age)	Stunting (Ht. for Age)	Wasting (Wt. for Ht.)
Occupation	Landless	44.5	42.9	24.4
	Labourers	46.8	47.4	24.1
	Business	29.0	34.3	17.4
Per capita income	< 300	53.2	54.1	26.6
	≥ 900	31.7	34.3	17.6
House Type	Kutcha	48.6	50.6	23.9
	Pucca	29.5	31.9	17.4
Literacy Status of Mother	Illiterate	47.8	50.3	23.7
	9-12 Std.	31.1	32.6	17.4
	College	22.5	24.5	18.5
Sanitary latrines	Absent	47.0	48.2	23.9
	Present & used	28.9	30.8	17.6

Adapted: NNMB (2011-12): Table 57

Livelihoods are not simple budgetary allocations (HCES) but rather their capability to secure all needs.When36-49% of total expenditure is spent on food, households become vulnerable to inflation and unforeseen expenses compared to high-income countries (HIC), spending about 8-20% of total income.

These disparities underscore that livelihood characteristics captured in surveys are not proportionately factored for assessing household nutrition. The focus is food-first quantities, not nutrition first.

Three kinds of households are identified as being food secure: (a) enduring households, which are secure continuously; (b) resilient households, which suffer shocks but recover; and (c) fragile households that increasingly become insecure. HCES (2022-23) provides the total average monthly food and non-food expenditure. The pressing need is to set MPCE threshold levels based on recommended nutrient intake, through balanced and varied diets. At what point (MPCE) do livelihoods, as classified (see box 3), become fragile when food expenditure takes a disproportionate share of total income?

From objective indicators to subjective perception.

Objective measures compare food and nutrient intake obtained in surveys with recommended targets, such as percentage of daily energy (%E) and recommended dietary allowances (RDA).

These measures indicate how far an individual is from meeting nutritional recommendations or public health goals. Objective indicators monitor food-disease prevalence but rarely capture a household's insecure conditions of well-being.

Box 2. Children, less than 5 years of age, with poor nutrition status (underweight, stunting and wasting) are significantly higher in weaker socioeconomic households; however, the distribution percentage among other segments is also concerning. The causal impact of fragile livelihoods on health and nutrition outcomes extends beyond monthly expenditure to include sustainable incomes.

Box 3.Three kinds of households are identified as being food secure: (a) enduring households, which are secure continuously; (b) resilient households, which suffer shocks but recover; and (c) fragile households that increasingly become insecure.

At what point (MPCE) do livelihoods become fragile when food expenditure takes a disproportionate share of total income?

Early onset of food insecurity in households can be assessed by two indicators: experience-based and coping strategies

Early signs of food insecurity manifest through household behaviour and the remedies sought; these are experience-based or coping strategies. Experience-based indicators, such as the Household Food Insecurity Access Scale (HFIAS), assess experiences and expressions of deprivation, as well as the self-esteem of adults, children, or the household respondent.

They reflect long-term uncertainty, immediate concerns about insufficient quantities (such as running out of food or not eating enough), and issues related to food quality (nutrition, special needs). Other indicators include the Prevalence of Undernourishment, Household Hunger Scale (HHS), and the Global Food Security Index (GFSI), which evaluate food quantity, access, shortages, and hunger experiences.

Food-influenced self-esteem is expressed in socioeconomic attitudes. Extruded soy nuggets and granules, a high-protein product (~ 50%), were considered inappropriate for high-income households. On the contrary, a low-income household will put up with some hardship for chocolates, chips and cookies, if these are affordably priced (Rs 5-10). The term bottom of the pyramid (BoP), coined by C.K. Prahalad, describes subsistence markets that serve populations' desire for social equity.

When livelihoods are fragile, households resort to coping strategies to surmount adverse situations. These may be short-term, such as sacrificing certain expenses to meet compelling needs or enlisting in intervention schemes. Although temporary, they become vital lifelines when household vulnerabilities persist and recovery is distant.

The public distribution system (PDS), midday meal scheme (MDMS), and Integrated Child Development Scheme (ICDS) are coping strategies to address food insecurity. The National Food Security Act (NFSA) 2013 established a legal right for households to access food. In part, its objectives align with the FAO's definition; however, it serves a different purpose.

Targeted distribution of food grains/meals is not the same as access to sufficient, safe, and nutritious food. Fortification is perhaps the only nutrition-sensitive measure for affordable diets. While these are necessary, they are coping strategies.

Policy shifts for India are overdue

Indian food policy has been slow to transition from food grain self-sufficiency to one of promoting a nutritionally balanced food system (4). Part of the reason for the slowness is that the paradigm of food security is still based on hunger alleviation through the provision of a staple food and a calorie-rich diet. Policy fixation with staple grains limits the ability of agriculture to diversify into other crops.

There is strong evidence of diverse food combinations and proportions across states and regions, significantly affecting health and disease. Researchers and practitioners must engage with the complex and multidimensional factors of real-life environments rather than dismissing them as confounding factors in current food-nutrient-disease approaches. Life rarely cooperates with clinical protocols.

India's food policy requires an overhaul from an obsessive focus on salt, fat, sugar, and now processed foods to a systems approach of securing nutritious food based on the four pillars: availability, access, utilisation, and stability. based on the four pillars: availability, access, utilisation, and stability.

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WHY SUCCESSFUL SUGAR AND FAT REDUCTION REQUIRES MORE THAN JUST INGREDIENT SWAPS

AUTHOR
Ms Seles Gupta,
Application Scientist I, Sensient Flavors & Extracts
Bilton Road, Bletchley, Milton Keynes, MK1 1HP, UK
Office: +44 (0) 1908 360538 | seles.gupta@sensient.com
www.sensientflavorsandextracts.com

Introduction: The Evolving Nutritional Imperative

The global food industry is at a pivotal juncture. As rising rates of obesity, diabetes, and metabolic disorders place a great burden on public health systems, food and beverage companies are facing both regulatory pressure and consumer demands to reduce sugar and fat content- especially in indulgent categories like bakery goods, beverages, and frozen desserts- are particularly scrutinised.

Yet reformulation is not a simple matter of swapping sugar for stevia or fat for starch. Sugar and fat not only deliver indulgence but also provide essential functionality, such as mouthfeel, texture, and structure that can't be replicated with single ingredient substitutes. Truly successful reformulation requires a multidisciplinary approach that integrates regulatory awareness, sensory science, and flavour innovation to preserve both nutritional integrity and pleasure.

Regulation and Reformulation: Policy as a Catalyst for Innovation

Regulations around sugar and fat content—whether through direct taxation or marketing restrictions—are increasingly shaping how food and beverage companies innovate. These policies serve not only as deterrents but also as drivers of reformulation, encouraging manufacturers to develop alternatives that meet both compliance standards and consumer expectations.

In the UK, the Soft Drinks Industry Levy (SDIL) applies a tiered tax on beverages containing more than 5g of sugar per 100 ml, pushing manufacturers to reduce sugar levels or reformulate with non-nutritive sweeteners.

Complementing this, HFSS (high fat, salt, and sugar) regulations limit promotional visibility—particularly online and at high-traffic retail zones—further nudging brands toward reformulation.

France has adopted a dual deterrent approach: sugary drinks are already taxed by sugar content, and starting January 2026, a new tax will be levied on beverages containing synthetic sweeteners, with rates tied to concentration. In the Middle East, the UAE and neighbouring GCC nations apply some of the world's most stringent policies: a 50% excise tax on all beverages containing added sugars, or sweeteners and 100% tax on energy drinks.

By contrast, India currently imposes a flat 40% tax on carbonated soft drinks (through GST and compensation cess), irrespective of sugar content. While this discourages overall consumption of carbonated beverages, it offers no specific reformulation incentive. However, with rising NCD (non-communicable diseases) rates, policy shifts similar to the UK or Gulf models are under discussion.

These evolving frameworks have already catalysed visible innovation in global markets. Brands are launching HFSS-compliant snacks, low-fat and low-sugar ice creams, and even unsweetened carbonated drinks with no added sweeteners—focusing on clean-label appeal, minimalism, and natural flavour enhancement. In this way, regulation is no longer just a compliance hurdle, but a springboard for strategic product reinvention.

Why Ingredient Swaps Fail Without Structural and Sensory Engineering

Sugar and fat are multidimensional ingredients that can't be replaced on a 1:1 basis. Attempting to do so often results in product failure-underscoring why ingredient swaps alone are inadequate.

Beyond sweetness and richness, sugar and fat contribute to mouthfeel, moisture retention, aeration, flavour release, and even product structure-particularly in baked goods and frozen desserts. Simply reducing or removing these ingredients often leads to flat taste, compromised texture and structural instability.

To overcome these hurdles, food and beverage companies are adopting hybrid approaches. For beverages, this often means combining sweeteners such as stevia, sucralose, aspartame, or acesulfame-K with bulking agents like polyols or dietary fibres to maintain texture and viscosity. Another increasingly common strategy—especially in countries with tiered sugar tax systems—is blending small amounts of sugar with high-potency sweeteners. This approach helps brands stay below regulatory thresholds while preserving a sugar-like taste and mouthfeel, reducing off-notes and enhancing consumer acceptance.

In bakery products, fat reduction is typically achieved using starch-based fat replacers, protein concentrates, or emulsification systems that mimic the creaminess of full-fat versions. In frozen desserts like ice cream, reducing both fat and sugar poses unique challenges because these ingredients contribute to creaminess, freezing point depression, scoopability, and flavour release.

Their removal can cause icy textures, weak body, and rapid flavour loss. To counter this, companies use carefully balanced combinations of fibres, hydrocolloids, and milk proteins to replicate creamy mouthfeel and stabilize the product.

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Polyols such as erythritol or sorbitol help retain smooth texture and freezing properties, while natural sweeteners like stevia or monk fruit provide sweetness without added calories.

Rebuilding Flavour: Science Behind Reformulated Success

The technical substitutions with sweeteners and functional ingredients often come with sensory limitations. High-potency sweeteners like acesulfame-K can introduce metallic or bitter off-notes. Aspartame, though closer to sugar in taste, requires a phenylalanine warning on-pack, which can deter some consumers.

Functional ingredients like starches, fibres and proteins can introduce their own sensory challenges: certain fibres may impart earthy, bitter, or grainy notes; starches can cause pasty or gummy textures if overused; and proteins, especially plant-based, might add beany or bitter undertones. These ingredients can alter mouthfeel, sometimes leading to perceptions on chalkiness, grittiness and astringency. These challenges are not just technical—they are perceptual and psychological. Consumers often associate health claims with compromised taste, and subtle cues like thin mouthfeel or missing sugar aroma can reinforce these biases.

To overcome these complex sensory and functional challenges, flavour experts play an increasingly strategic role. Flavouring with Modified Properties (FMPs)—as defined under EU and FSSAI regulations—are specialized flavouring substances that enhance certain sensory attributes. These flavour tools aren't merely enhancements- they are critical to salvaging sensory quality in reformulated products especially where consumer tolerance for trade-offs is low. When formulated correctly, they can amplify sweetness, round off bitterness, and restore the full-bodied flavour experience of traditional high-sugar, high-fat products—without the need for additional sweeteners.

These tools are particularly valuable in products where bulk and flavour interplay are critical—such as low-fat ice creams or no-sugar-added beverages. FMPs and optimized flavouring systems help:

- Rebuild mouthfeel
- Mask bitterness or chemical off-notes
- Reinforce baked, caramel, or dairy notes
- Enhance aroma release and flavour persistence

By using sensory panels and data-driven flavour mapping, flavour houses are helping manufacturers fine-tune reformulations that meet clean-label and compliance standards—while still delighting consumers. This multi-layered approach, combining ingredient innovation with sophisticated flavour design, is essential for delivering reformulated snacks and beverages that satisfy both regulatory demands and consumer preferences.

Winning Consumers: Its not just what you remove- it's what you recreate

The push to reduce sugar and fat content spans the entire value chain- from global taxation policies to granular ingredient functionality. Sugar and fat contribute far more than just calories; they shape texture, emotion and experience. Ingredient swaps may lower numbers on a nutritional label, but they often fail to preserve the qualities that makes snacks desirable.Even the most technically sound reformulations can falter if they fail to meet consumer expectations for taste, texture, and overall enjoyment.

Delivering satisfaction in reduced sugar and fat products depends on more than ingredient swaps. It requires a nuanced understanding of how people perceive and emotionally respond to food. Products that replicate the multi-sensory experience of full-sugar or full-fat originals—through creamy mouthfeel, familiar sweetness, and rich flavour notes—stand a far better chance of winning over sceptical consumers.

In this context, flavour and sensory science, hybrid systems and transparent communication become the cornerstone of innovation. The future of healthier snacking will be defined not by what we remove but how artfully we rebuild. As policy frameworks evolve toward nutrient-based taxation, the industry must respond with proactive portfolio strategies that privilege both well-being and delight.

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ALLERGENICITY OF FOOD PROTEINS AND EFFECT OF PROCESSING

AUTHOR
Dr.Malathy Venkatesan,
Consultant, Mumbai

Introduction:

Allergies are immune-mediated hypersensitivity reactions that can affect various organs, most commonly the skin, airways, and the gut. Food allergies occur when the body's immune system reacts to consumption of certain proteins in food. Food allergic reactions vary in severity from mild symptoms involving hives and lip swelling to severe life-threatening symptoms, often called anaphylaxis, that may involve fatal respiratory problems and shock.

These reactions are triggered by specific proteins found in various foods. The immune system mistakenly identifies these proteins as harmful, leading to an allergic reaction. Common food allergens include proteins in peanuts, tree nuts, milk, eggs, fish, shellfish, soy, and wheat. Food allergy is one of the major health concerns worldwide affecting 1-3% of adults and 4-6% of children. (1)

Foods are processed in diverse ways before consumption in order to improve functional, nutritional and sensory attributes, as well as for preservation. Commonly applied processing techniques include thermal (high temperature or cooling), high pressure, dehydration and fermentation. Different processing methods alter the structure of food proteins in different ways and possible structural modifications include unfolding, aggregation, cross-linking between the ingredients and chemical modifications such as oxidation and glycosylation.

Processing induced physico-chemical changes of food proteins may result in changes to digestibility, absorption, and conformation thereby influence their allergenicity. However, the degree of structural alteration and allergenicity depends on the processing method used, extent and exposure time, and presence of other ingredients for example salt, sugar etc.

Selection of appropriate method for processing a particular allergenic protein is important to alter the structure of the food protein and the subsequent gastrointestinal digestibility.

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Allergenicity of food proteins

The "big 8" are those foods that account for 90% of all IgE-mediated food allergies, and include cow's milk, eggs, fish, crustaceans, peanuts, soybeans, tree nuts, and wheat.

The allergenic proteins in animal food include casein, β-lactoglobulin, α-lactalbumin from milk, ovomucoid, ovalbumin, conalbumin, lysozyme in eggs, parvalbumin in fish, and tropomyosin from shell fish (Table 1).

Legumes have a high nutritional value (high-value proteins and oils) but also account for a high incidence and severity of allergic reactions. Some of the most potent and prevalent allergenic foods belong to the legume family, including peanut and soybean. Other legumes known to cause food allergy include chickpea, lentils, mung bean and peas.Soybean and its products are widely used in foodstuff, not only as a food (e.g. tofu) but also as a technological aid (e.g. emulsifiers, texturizer). Soy allergy is much less prevalent than peanut allergy.

Proteins associated with legume allergy belong predominantly to the family of seed storage proteins (albumins, globulins, prolamins). They are often found in high abundance and retain their allergenicity after heating.

Although rare, allergic reactions may also occur due to cross-reactivity between similar allergens. Several anaphylaxis cases indicating cross-reactivity between peas and peanut because IgE antibodies to pea vicilin reacted with peanut vicilin.

Peanuts, tree nuts, fish, and shellfish are likely to cause childhood allergies that persist as an individual matures. Other food allergies in children, such as those from milk, soy, egg, and wheat, could be transient.

Wheat gluten proteins are characterized by high contents of glutamine and other amino acids (proline, glycine, phenylalanine).

Table 1: Food allergy: proteins and symptoms (1)

Food material	Allergenic proteins	Effects/symptoms
Milk	Casein, β-lactoglobulin, α-lactalbumin	Stomach cramps, diarrhea, skin itching
Egg	ovomucoid, ovalbumin, conalbumin, lysozyme	Skin inflammation, Digestive symptoms
Fish	parvalbumin	Skin itching, eczema, or skin rashes, Gastrointestinal, respiratory
Shell fish	tropomyosin	Skin reactions like hives and itching, as well as respiratory issues such as wheezing, difficulty breathing, and coughing
Wheat	Gluten (albumin - globulin, gliadin and glutenin fractions), α-amylase inhibitors	Celiac disease Bakers' asthma
Peanut	Vicilin, Conglutin, Glycinin	Itching and swelling in skin, respiratory discomfort
Soybean	Glycinin, vicilin-like glycoproteins, P34	Anaphylaxis (respiratory,cutaneous, cardio vascular, and gastrointestinal symptoms)
Tree nuts (walnut, hazel nuts)	Vicilin, profilin	Anaphylaxis (respiratory,gastrointestinal symptoms)

Gluten proteins are responsible for triggering coeliac disease and other intolerances in susceptible individuals.

Other proteins with allergenicity in cereals were present in albumin - globulin, gliadin and glutenin fractions. Alpha amylase inhibition action of protein was identified also contributing to allergenicity e.g. Bakers' asthma.

The allergenic proteins in animal food include casein, β-lactoglobulin, α-lactalbumin from milk, ovomucoid, ovalbumin, conalbumin, lysozyme in eggs, parvalbumin in fish, and tropomyosin from shell fish.

Effect of processing on allergenicity of proteins

1. Effect of thermal treatments

Thermal treatment is the conventional and most commonly used processing technique for many foods in order to enhance taste, reduce their pathogen load, increase shelf life and improve quality. It includes boiling, cooking, baking, roasting, frying, grilling, pasteurization and sterilization.

Thermal treatment not only affects the allergenicity of food proteins through conformational changes, but also by influencing their interactions with other food ingredients. One such interaction is Maillard reaction which results in condensation of amino acid residues (lysine) in protein with the carbonyl group of reducing sugars to form glycosamine. In addition, heating can also alter the gastrointestinal digestion of proteins and their absorption through mucosa and thereby modulate their allergenic potential. One example is heat-induced changes of beta lactoglobulin, a major cow milk allergen.

Heating up to above 100°C causes unfolding of the molecule, enhanced susceptibility to proteolysis by peptic enzymes resulting in reduced allergenicity. Heating of egg white at 100 and 120°C resulted in denaturation and aggregation of ovalbumin, thus increasing the size of the protein so that it is too large to enter the intestinal membrane.(2)

Although many food allergens are sensitive to heat and their allergenicity is changed accordingly, some are stable to heat denaturation and digestion, consequently their allergenicity remains unaltered or can be reduced only when exposed to extreme temperatures combined with alterations in pH. Tropomyosin, a major allergen in crustacean food is such an example.

Dry vs moist heat

Stability and allergenic potential of allergens can also be affected by type of heat i.e. dry or moist heat. For example, allergenicity of seed storage globular protein found in peanuts is enhanced by dry roasting but diminished after boiling in water.

Baking, another form of dry heat application can alter conformation, digestibility as well as allergenicity of potential wheat flour allergens. α-amylase inhibitor protein (responsible for wheat flour inhalation allergy called "baker's asthma") disappeared in digested bread crumb and crust although this protein remained in bread dough even after pancreatic digestion.

This could explain why patients suffering from baker's asthma do not show allergic reaction upon ingestion of baked products like bread.(2)

2. High pressure treatment

High pressure is an emerging non-thermal technique in food industries to inhibit the growth of microorganism as well as increase the shelf life of food without affecting its organoleptic properties. Egg ovalbumin treated at 400 MPa and Gly 1 allergen in soybean whey at 200-300 MPa showed enhanced peptic digestion and significantly lower in vitro reactivity. Pressure treatment of squid tropomyosin up to 400 MPa caused unfolding of protein resulting in exposure of target residues for enzymatic hydrolysis consequently increasing proteolysis and reducing allergenicity. (3)

3. Fermentation

Fermentation is one of the traditional techniques for processing and preservation of food. Microbial enzymatic hydrolysis of food proteins during fermentation produces some bioactive peptides with potential health benefits while destroying some antigenic epitopes resulting in decreased allergenicity. Lactic acid bacteria can potentially reduce the antigenic response of α and β-lactoglobulin by 70% in sweet whey and more than 90% in skim milk compared to unfermented milk. Lactobacillus fermentation of sourdough caused acidification and reduction of disulphide bonds of gluten resulting in increased activity of cereal proteases, which improved the digestibility of gluten.(4)

4. Enzyme treatments to reduce allergenicity of proteins

Enzymatic process assists in the modification of biological properties of allergenic proteins, including solubility, ligand binding, digestibility, antigenicity, and IgE binding potential.

Two types of enzymatic methods have been studied to reduce the allergenic potential of food allergens. One is the hydrolysis of food allergens via proteolytic enzymes to breakdown proteins into peptides/fragments; the second is crosslinking of food allergens via crosslinking enzymes to alter the epitopes.

One of the common characteristics of food allergen is their resistance to gastrointestinal digestion; therefore, pre-hydrolysis with enzymes is one of the most effective methods of modifying immune reactivity of food proteins. Whey protein hydrolysate prepared with alkaline protease enzyme significantly lowered immune reactivity of and -lactoglobulin

The effect can be maximized by controlling pH, temperature and enzyme-substrate ratio.

Enzymatic hydrolysis of soy proteins has been successfully proven in different studies as a more effective approach to reduce the allergenicity. The sensory and techno-functional properties can be improved depending on the proteases used.(5)

Papain enzyme has been reported to be the most appropriate protease for improving the techno-functionality and sensory characteristics, while effectively decreasing the molecular weight of soy bean isolate.

Enzymatic cross-linking has the potential to alter the primary, secondary, and tertiary structure of food allergens by site-specific modification of certain amino acid residues, resulting in high molecular weight polymerized allergens. Enzymatic crosslinking via tyrosinase, laccase, peroxidase,and transglutaminase modifies the structural and biochemical properties of food allergens.(6)

Enzymatic protein hydrolysates constitute an alternative to intact proteins in the development of special formulations designed to provide nutritional support to specific population groups with different needs, such as infants, elderly, and food-allergic patient.

Enzymatic hydrolysis seems to be the most appropriate method for preparation of tailor- made peptides, not only because of their large-scale commercial availability and moderate cost, but also because of the high quality of such products. Besides, protein hydrolysates show technological advantages such as improved solubility, heat stability and relatively high resistance to precipitation by many agents, such as pH or metal ions.(5)

5. Effect of extrusion on allergenicity of proteins

Food extrusion has become a very important process in the manufacture of cereals and snacks. Soy protein and corn meal are the main ingredients of extrusion processing to produce snacks, pet foods and feedstuff because of their nutritional balance and special flavour.

Compared with other processing methods, it is unique because the ingredients are subjected to high pressure while being heated. Thus, it can completely change the structure of food molecules and improve the functional ingredients of food. In one study, extrusion process proved to effective in reduction of the allergenicity of proteins in both soy protein isolate-corn as well as soy flour-corn products. Low moisture (20%) of the mixture was most efficient in decreased allergenicity of the proteins. (7)

Extrusion has been reported to denature undesirable enzymes and inactivate some antinutritional factors (lipoxygenase, hemagglutinins, saponin and urease), leading to increased protein and starch digestibility, sterilization of the finished product and retention of the original colour and flavour.

Summary

Hypoallergenic food products are increasingly important within the food industry, and several recent patents have sought to reduce allergenicity in plant-based food processing.

Even though thermal technologies have shown a potential to reduce the allergenicity of foods, non-thermal technologies such as enzyme processing are preferred since they minimal deleterious effect on nutritional value and food quality attributes than thermal technologies. Furthermore, non-thermal processing allows for retaining the maximum concentration of bioactive compounds and natural flavours. The possible reason is that non-thermal processing generally affects non-covalent bonds, whilst thermal processing affects both covalent and non-covalent bonds. Integration of two or more technologies is the way forward to reduce allergenicity of food proteins. Increased understanding of the impact of various processing on structure, digestibility and allergenicity of food allergens could be applied at industrial level to develop novel processing strategies aimed at reducing the prevalence of food allergies.

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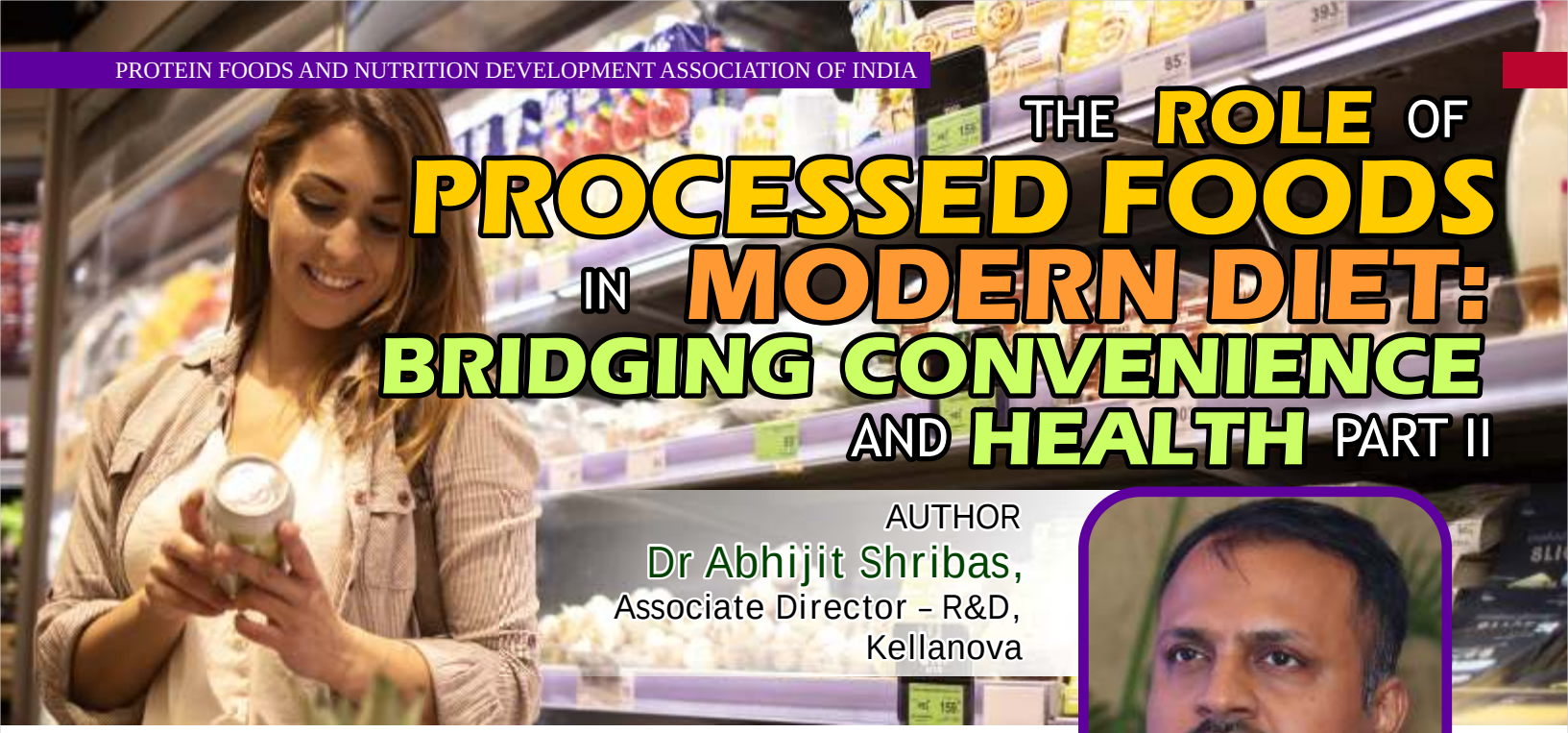

THE ROLE OF PROCESSED FOODS IN MODERN DIET: BRIDGING CONVENIENCE AND HEALTH PART II

AUTHOR
Dr Abhijit Shribas,
Associate Director – R&D,
Kellanova

Industry's Response: Technology, Innovation, and Reformulation

The Indian food industry recognizes its crucial role in addressing the nutrition gaps highlighted above, while still delivering the convenience modern consumer's demand. There is a clear shift towards "healthy convenience" – making processed foods that are enriched with nutrients, lower in harmful ingredients, and tailored to India's dietary needs. Several strategies illustrate how the industry is bridging convenience and health through technology and innovation:

- Leveraging Advanced Technology: Companies are adopting cutting-edge technologies to enhance food safety, nutrition, and shelf life. Automation and AI-driven controls monitor processing conditions in real time to ensure consistent quality and reduce contamination risks. For example, IoT sensors in factories track temperatures and humidity for optimal cereal drying or dairy pasteurization, and machine vision systems detect product defects or adulterants to bolster safety. Biotechnology is yielding healthier ingredients – e.g. using enzymes to reduce sugar in fruit juices without losing sweetness, or probiotic cultures to enrich yogurts. Smart packaging is another frontier: innovative packages extend freshness (such as oxygen-absorbing sachets in snack packs) or even signal if food has spoiled via time–temperature indicator labels. Embracing such tech not only makes processed foods safer and more nutritious but also helps reduce waste (better cold-chain monitoring means less spoilage) and can lower costs over time, making healthy products more affordable.
- Product Reformulation for Health: A significant trend is reformulating existing food products to improve their nutritional profile without compromising taste. Many leading companies have pledged to gradually reduce added sugar, salt, and unhealthy fats in their portfolios. For instance, some breakfast cereal makers have cut sugar content and introduced whole grains; snack manufacturers have switched from palm oil to healthier rice bran or sunflower oil and are adding millets or pulses into chips and biscuits to boost fibre and protein. Importantly, reformulation is done carefully to retain the flavours consumers love – sudden drastic changes could turn buyers away.

Companies are using natural sweeteners, herbs, and spices, as well as food science techniques, to create "better-for-you" versions of popular foods that still satisfy Indian palates. In parallel, many are eliminating or replacing artificial additives where possible.

Clean-label products (with no synthetic colours or preservatives) are on the rise, using natural alternatives and advanced preservation methods like high-pressure processing to maintain shelf life. Such reformulation efforts help reduce risks of obesity and hypertension among consumers, and they also begin to change the perception of processed foods – from guilty indulgences to potentially acceptable components of a daily diet.

- Fortification and Enrichment: Food fortification is one of the most direct ways the industry is addressing micronutrient deficiencies. By adding vitamins and minerals to widely consumed foods, companies can improve public health at scale. Today, many packaged staples in India are fortified: milk and edible oils with Vitamin A & D, salt with iodine (and now iron in double-fortified salt), wheat flour (atta) and rice with iron, folic acid, and vitamin B12. These standards have been driven in part by the Food Safety and Standards Authority of India's fortification regulations (introduced in 2016 and tightened in 2018) and the use of the FSSAI's "+F" fortification logo to identify fortified foods. Additionally, many processed products targeted at specific groups carry extra fortification – e.g. infant cereals enriched with iron and omega-3, malt-based health drinks with added vitamins, biscuits fortified with calcium and vitamin D. Fortification is extremely cost-effective (adding only a few paise to production costs) and does not require consumers to change behaviour, since it builds nutrients into foods people already eat. The industry, in partnership with government, is actively expanding fortification coverage. For example, under Mission Poshan 2.0 the government has mandated fortified rice to be distributed in social safety net programs (like the Public Distribution System and school meals) – and food processors are key suppliers of this nutritionally enriched rice. The processed food sector essentially provides the vehicles (widely consumed products) to deliver micronutrients at scale. Through fortification, processed foods are directly contributing to reducing anaemia and other deficiencies, validating that convenience foods can carry a health benefit.

- Product Innovation and Diversification: Companies are also widening their product portfolios to introduce entirely new categories of healthier or specialized foods that align with emerging nutrition trends. One major focus is high-protein products, given India's protein gap. We now see protein-rich breakfast cereals, lentil-based pastas, protein bars, and shakes in the market – reflecting growing consumer awareness of the need for protein. There has also been an explosion of millet-based products, especially after the UN declared 2023 as the International Year of Millets and the Indian government launched initiatives to promote these nutrient-rich, climate-resilient grains. Food companies have rolled out millet breakfast flakes, millet cookies, instant millet dosa mixes, and even ready-to-eat millet bowls – marrying traditional staples with modern convenience. Millets are rich in iron, calcium, and fibre, so their

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incorporation helps address nutrition while also supporting sustainable local agriculture. Similarly, the industry is developing low-glycemic (low-GI) and diabetic-friendly foods (e.g. brown rice or quinoa noodles, multigrain breads with seeds, baked snacks with no added sugar) to cater to health-conscious consumers and those managing conditions like diabetes. Plant-based and special-diet options are also growing – for example, lactose-free alternatives (soy milk or almond milk fortified with calcium and protein) for the lactose-intolerant, and plant-protein snacks that provide vegetarian protein sources. By diversifying into these niches, the processed food sector is providing consumers with choices that simply did not exist a generation ago. This "portfolio of choice" approach – offering products ranging from indulgent treats to wellness-oriented foods – means consumers can find options suited to their taste, convenience needs, and health goals. Notably, even the indulgent products are being made a bit healthier (with reduced trans-fats, smaller portion packs, etc.), while the healthiest offerings are made tasty and affordable, so that nutrition and enjoyment can go hand-in-hand.

- Focus on Safety and Quality: Alongside nutrition, the industry continues to elevate food safety and quality standards – an essential foundation for consumer trust. India has adopted many harmonized standards from Codex (international food standards) for additives and processing aids, and FSSAI strictly monitors contaminants in the food supply. Food processors now routinely conduct laboratory tests for hazards like aflatoxins, pesticide residues, and microbial contamination, especially for products destined for export and increasingly for domestic markets too. End-to-end traceability systems are being put in place: for instance, some brands print QR codes on packages that let consumers scan and see the farm source of the ingredients (common for premium milk, spices, etc.). This not only assures quality and safety but also educates consumers about the food's journey. The principle of "food safety from farm to plate" is emphasized, with larger manufacturers often helping their upstream suppliers (farmers) adopt better agricultural practices to ensure high-quality raw materials. For example, a baby food company might work closely with its contract farmers to ensure they grow pesticide-free vegetables, providing guidance and regularly testing soil and water to meet safety standards. Thanks to this integrated approach, processed foods can actually be safer than loosely sold foods in some cases, as they undergo stringent checks and controls. By prioritizing safety and quality, the industry addresses one of the main consumer concerns around processed foods and builds trust in these products as part of a healthy diet.

Through these multi-pronged efforts – technology adoption, reformulation, fortification, innovation, and strict quality control – India's food industry is gradually repositioning processed foods not as part of the problem, but as part of the solution to malnutrition. Early success stories are already visible. For instance, iodine deficiency disorders in the population have drastically reduced ever since iodized (processed) salt became universal decades ago. More recently, pilot programs introducing iron-fortified rice in school lunches have shown promising results in lowering anaemia among children in those districts.

On the product front, items like baked millet puffs or high-protein drinks – things unheard of a generation ago – are now available, each helping to chip away at nutrition gaps. The remaining challenge is scale and inclusion: making sure these healthier options are produced in large enough quantity, are affordable, and are embraced by consumers across all socio-economic strata.

That is where supportive policy, consumer education, and public-private collaboration become vital to sustain momentum.

The environment in India is becoming increasingly favourable for leveraging processed foods for public good. Strong policies are nudging the industry toward nutrition and quality, educated consumers are starting to pull demand for healthier options, and collaborative efforts are aligning diverse players toward common goals. Nonetheless, challenges remain in implementation and inclusion – for instance, ensuring that small and medium enterprises (SMEs) in the food sector also comply with fortification standards and labelling laws, or making sure the benefits of these innovations reach the last-mile consumers in rural and low-income areas who are often outside the formal market. Continued vigilance and support are needed to sustain the momentum. Industry associations like PFNDAI and similar bodies have a key role to play here – by continuing the dialogue between industry, academia, and regulators, highlighting best practices, providing training, and recognizing companies making healthy strides, they can encourage a "race to the top" in the food industry. In essence, India's experience so far shows that when government, industry, and consumers all work in tandem, processed foods can be transformed into a force for positive change in the national diet.

Future Outlook: Processed Foods for Nutrition and Sustainability

As India looks ahead to achieving its 2030 nutrition targets and the Sustainable Development Goals (SDGs), processed foods will undeniably play a pivotal role. The key is to steer the sector in a direction that synergizes with nutritional well-being and environmental sustainability. Looking to the future, several trends and possibilities emerge:

- **Meeting Nutritional Needs at Scale:** With India's large and growing population, ensuring affordable access to nutrition is paramount. Processed foods provide an efficient vehicle to reach millions, so by 2030 we can expect a much larger share of staples and daily foods to be fortified and customized to address regional nutrient deficiencies. For example, food companies might develop area-specific products (iron and folate-fortified foods for states with high anaemia, or vitamin D-enriched foods for northern regions with low winter sunshine). Closer coordination between industry and government will likely yield specialized supplementary foods to combat malnutrition in the poorest communities – such as energy-dense nutrition bars, therapeutic pastes for severely malnourished children, or protein-fortified biscuits distributed through anganwadi centres. Innovation can also elevate traditional foods into nutrition solutions (imagine convenient ready-to-eat khichdi packs enriched with vitamins, or millet cookies used in nutrition programs). By leveraging processing and fortification, India has the opportunity to drastically reduce stunting and eliminate severe deficiencies in the coming decade, ensuring that the convenience foods of the future come with a strong nutrition punch.

- Sustainable Food Systems and Waste Reduction: The future of food processing must also be environmentally conscious. One major benefit of food processing is its potential to reduce food waste. Currently, lack of processing and storage leads to massive waste of perishables; by 2030, a more distributed network of processing units (including at community or cooperative levels) could transform what would have been farm surplus or waste into valuable products. For example, during gluts, excess tomatoes might be dried or made into paste, surplus milk could be converted to milk powder or cheese, and "ugly" or overripe fruits could be turned into juices or jams rather than discarded. This would not only cut down waste (supporting SDG 12.3 on halving food waste) but also stabilize farmer incomes and consumer prices. A circular economy approach will gain traction – processing by-products will be repurposed instead of wasted: fruit peels can be processed into pectin or animal feed, whey from dairy into protein supplements, rice bran into edible oil, etc., maximizing resource use. Moreover, the industry is likely to increasingly adopt green technologies: for instance, using solar energy to power food dryers and cold stores, or generating biogas from food factory waste to fuel operations. We are already seeing early examples (solar dryers for spices, biogas units at food parks). By scaling up such practices, processed food companies can significantly shrink their carbon footprint and help India meet its climate commitments. Sustainable packaging will also be a critical focus – we can expect a shift toward recyclable and biodegradable packaging materials to tackle the plastic waste issue associated with packaged foods. In fact, some brands have started using compostable bags for snacks and paper-based cartons instead of multilayer plastics. Stricter regulations and consumer pressure will likely accelerate this trend, ensuring that the convenience of packaged foods does not come at the cost of the planet.

- Embracing Indigenous Crops and Dietary Diversity: The coming years will see processed foods drawing more from India's rich agricultural biodiversity. There is enormous potential in under-utilized indigenous crops – millets, sorghum, amaranth, jackfruit, regional tubers, and pulses – which are both nutritious and climate-resilient. By processing these into modern, convenient formats, the industry can both support dietary diversity and boost farmer livelihoods in different regions. We are already witnessing a millet renaissance (boosted by government promotions and global recognition), and this is likely to expand to other traditional foods. Likewise, plant-based meat alternatives and dairy substitutes derived from local ingredients (like pea protein or coconut milk) will become more mainstream, providing protein with a lower environmental footprint and catering to vegetarians or the lactose-intolerant. By innovating with indigenous and plant-based ingredients, food processors can create products that are healthy for consumers and sustainable for the environment. For example, snacks made from roasted legumes (chickpeas, moong dal) or fusion products that blend traditional wisdom with modern science – such as turmeric or ginger incorporated into ready-to-drink beverages – can deliver health benefits while preserving culinary heritage. In essence, the future processed food basket could be both uniquely Indian and cutting-edge, marrying local superfoods with global food technology.

Looking further ahead, technology may enable even more personalized and transparent food systems. Wearable health devices and apps could allow individuals to track their nutritional status in real time, and the food industry might respond with personalized nutrition – for instance, subscription services for meal kits or snacks fortified to an individual's needs (imagine an anaemic person subscribing to weekly iron-rich snacks tailored for them). Packaging might integrate with smartphones to provide augmented reality overlays, showing consumers the farm-to-fork journey, nutrition facts, or suggesting healthy recipes using that product. Such innovations can enhance engagement and trust, making nutrition a more interactive experience.

Crucially, for all these possibilities to materialize, continued alignment between policy and industry will be essential. We will likely see nutrition standards tightened further – possibly limits on added sugars or mandatory fortification of more staples – and companies that stay ahead of the curve by innovating early will thrive. Public-private collaboration will also expand to tackle emerging issues, be it adolescent obesity or elderly malnutrition, with specialized processed foods (e.g. low-calorie high-protein snacks for weight management, or easy-to-eat fortified foods for seniors). Professional bodies and journals like PFNDAI will remain important for disseminating research, sharing success stories, and monitoring progress. Ultimately, a "whole-of-society" approach is needed: government providing stewardship and an enabling environment, industry providing innovation and scale, and consumers and civil society providing informed demand and feedback. This collective effort can drive the processed food sector to contribute strongly to both national nutrition targets and sustainability goals.

In conclusion, the journey of processed foods in India is at an inflection point. What started primarily to preserve food and offer convenience is now evolving into a comprehensive solution space for the country's nutritional challenges and sustainable development needs. The guiding mantra for the future is one of balanced innovation – balancing taste with health, convenience with sustainability, and profit with purpose. By uniting the advantages of food processing (efficiency, scale, shelf life) with public health objectives (better nutrition for all) and environmental responsibility, the food industry can ensure that modern Indian diets are not only easy and enjoyable but also nourishing and ecologically sound.

Achieving this balance will allow processed foods to truly fulfil their role in the modern diet: bridging the gap between convenience and health. With momentum building in India's food processing sector, the outlook is optimistic that we can "cook up" a future where no one is left undernourished, even as our food systems thrive in harmony with nature.

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SODIUM IN THE INDIAN DIET: REQUIREMENTS, RISKS, RECOMMENDATIONS

AUTHOR
Ms Simran Vichare,
Nutritionist, PFNDAI

Sodium is an essential nutrient that supports various bodily functions.

However, excessive sodium intake can be a contributor to serious health issues, including hypertension and cardiovascular diseases. However, the development of CVD is multifactorial, influenced by factors like genetics, lifestyle habits, etc. On the contrary, one might think having less sodium is going to be beneficial, but consuming less than the required sodium intake is also linked to health issues ranging from mild to severe problems like nausea, fatigue, muscle weakness, to seizures. Hence, in the Indian context, where dietary habits, climate, and physical activity levels vary widely across regions and populations, understanding sodium requirements becomes especially important. A critical approach to sodium intake is needed, both to prevent non-communicable diseases and to support evidence-based public health strategies that are specially tailored to India's unique cultural and environmental landscape.

Functions of sodium in the human body:

Sodium is the most important extracellular cation in the body, required as an essential nutrient in several physiological processes, and is tightly regulated by many processes (renal, biochemical, endocrine, immune, and neural) to maintain blood sodium within a normal range. It is vital for maintaining plasma volume, ensuring acid-base balance, facilitating the transmission of nerve impulses, and supporting normal cell function.

In healthy individuals, nearly 100% of ingested sodium is absorbed during the digestive process. Sodium is rapidly absorbed from the gastrointestinal tract, and a positive balance is achieved on intakes just above minimal requirements. This absorption primarily occurs in the small intestine and colon. The primary mechanism for regulating sodium balance is through urinary excretion. In the majority of people with normal kidney function and blood pressure (BP), the kidney is sufficiently able to deal with wide variations in

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sodium intake, without eliciting increases in BP. However, in some individuals, moderate changes in sodium intake can result in marked increases in BP, a concept called salt sensitivity or salt-sensitive hypertension(1).

Dietary sources of sodium:

Salt, which is composed of sodium (40%) and chloride (60%), has historically been an essential ingredient in food, enhancing flavour and acting as a preservative. 1 tsp of table salt (5 g) gives 2,300 mg of sodium.

While all food substances naturally contain sodium, added salt is the major dietary source. Remarkably, humans possess powerful physiological mechanisms that help maintain blood pressure levels even with minimal sodium intake.

Beyond table salt, sodium can be found in various other forms. Dietary sources and sodium consumption patterns vary significantly depending on cultural contexts and individual dietary habits. Cereals, pulses, vegetables, milk, animal and sea foods are the major sources of sodium in the diet.

However, foods like bread, crackers, processed meats, and snack foods tend to be particularly high in sodium due to the addition of salt during production. Condiments such as ketchup, soy sauce, and pickles also contribute significantly to sodium intake.

While determining a precise minimum intake level for sodium is challenging, estimates suggest that the body requires between 500 to 600 mg/day for optimal functioning (3).

Sodium Requirement and Recommendation:

The World Health Organization (WHO) and the Food and Agriculture Organization (FAO) have

Approximate amount of sodium content in various food groups (2)

Food group	Sodium content mg/100 g
Table salt, baking soda, baking powder	38,000
Bouillon cubes, powdered broths, soups, gravies	20,000
Soy sauce	7,000
Snack foods (e.g. pretzels, cheese puffs, popcorn)	1,500
Bacon	1,500
Sauces and spreads	1,200
Cheese, hard	800
Processed vegetables	600
Butter/margarine	500
Cheese, soft	400
Processed fish	400
Cereals and cereal products (e.g. bread, breakfast cereals, biscuits, cakes, pastries)	250
Fish, raw or frozen	100
Eggs	80
Milk and cream	50
Vegetables, fresh or frozen	10
Fruits, fresh or frozen	5

issued expert guidelines recommending a daily sodium limit of 2,300 mg, which is equivalent to 5 g of salt. This guideline aligns with the recommendations from the National Institute of Nutrition (NIN) in India and serves as a global standard aimed at reducing the prevalence of non-communicable diseases (6). To further reduce health risk, especially of already hypertensive individuals, both the WHO and the American Heart Association (AHA) suggest a more stringent goal of reducing sodium intake to less than 2 g per day. They also emphasize the importance of using iodized salt for cooking, essential for preventing deficiencies that can impact overall health. Lower sodium consumption has been linked to significant benefits, such as reduced blood pressure and a decreased risk of cardiovascular disease, stroke, and coronary heart disease among adults.

It's important to tailor sodium intake recommendations to both individual and population needs. Research on sodium requirements across different climatic conditions in India remains limited. Factors like humidity, dry temperatures, and cold temperatures could significantly affect the sodium needs of individuals. Therefore, it would be beneficial to study sodium recommendations tailored to regional climates. Additionally, individual sodium needs can vary widely based on physical activity levels. For instance, athletes who engage in prolonged physical training may require higher sodium intake compared to individuals with sedentary jobs, such as those in clerical positions. If hydration is done only with water, especially post-exercise, it can not only impact their performance but also cause physiological issues like muscle cramps and hyponatremia. Marathon runners and endurance athletes are mostly at risk if they are not replenishing their sodium losses.

Comparative studies between rural labourers, who may exert more physical effort, and urban office workers can provide a better understanding of the sodium needs of different population segments. There is also a need for longitudinal studies and Randomized Control Trials (RCTs) on sodium needs across India's varied climatic zones and lifestyle patterns is necessary.

Sodium Consumption Patterns:

Data from various global studies indicate that average sodium consumption across populations often far exceeds these minimal physiological needs. Indian data indicate that per capita consumption of salt ranges from less than 5g to 30g/day across different States, with nearly 40% of the population consuming approximately 10g/day. (NIN guidelines 2024). A large South Indian study (n≈6,800) found average sodium consumption of 3.2g/day for women, 4.1g/day for men which is well above recommendations (4). The National NCD Monitoring Survey in India included 2266 adults aged 18 to 69 years. The weighted mean dietary salt intake was found to be over 5g per day (5)

Special Considerations:

Sodium requirements depend on its losses through urine, faeces and sweat. The loss varies according to climatic conditions, a person’s physical condition, activity levels, and diet. The guidelines given by NIN are a preventive, population-level guidance, not individualized for high-exertion scenarios.

Strenuous work or sports activities in a hot environment can cause significant loss of body fluids and salt loss due to excessive sweating. Acclimation to heat occurs rapidly; thus, within a few days of exposure to hot and humid conditions, individuals lose only small amounts of sodium through sweat. Under conditions of extreme heat and intense physical activity that result in high sweat production, sodium losses in sweat are increased; nonetheless, most individuals can replace the necessary sodium through food consumption, with a few dietary alterations, supplements or specially formulated products.

Farmers hold a majority of the population in India, and long continuous physical labour under the sun can cause a lot of fluid and electrolyte losses. Here, replacing salt and other electrolytes lost in sweat is important for maintaining hydration. Unfortunately, India lacks sufficient population-specific studies that can quantify actual sodium needs based on regional climate, activity levels, occupation, and dietary habits.

Depending on acclimatization, people who work in moderately hot temperatures for 10 hours on average may lose between 4.8 and 6 g of sodium (Na), which is equal to 12 to 15 g of salt (NaCl). However, due to the large interindividual variation in sweat rate and salt concentration, individual losses may be much higher. It is crucial to replenish this sodium electrolyte and prevent fluid imbalances (7).

For example, replacement of sodium loss in sweat is recommended when the duration of exercise is longer than 2 h, when the climate is hot or during intense Na+ loss in sweat (e.g., >3–4 g Na+ (8).Here, a sports drink can be very beneficial. A sports drink containing sodium in the range of 10–30 mmol/L (230–690 mg/L) results in optimal absorption and prevention of hyponatremia. This concentration is typically found in commercial sports drinks. The American College of Sports Medicine (ACSM) recommendations for sodium intake are 300–600 mg/h (1.7–2.9 g salt) during prolonged exercise. According to Grozenski and Kiel's review (12), drinking beverages with 20–50 mEq/L of sodium or eating small amounts of salted snacks can increase thirst, aid in fluid reabsorption, and ultimately promote osmotic balance during endurance sports.

Health risk with excessive sodium:

There is a strong association between salt intake and blood pressure. Populations that consume less than 3 grams of salt per day tend to have a lower prevalence of hypertension. Additionally, the usual increase in blood pressure that occurs with age is not observed in these groups. The amount of salt consumed can be measured through urinary sodium levels. Significant reduction of dietary salt lowers the risk of hypertension; however, this effect varies, as only 20-30% of the population is considered salt-sensitive (9).

Foods rich in potassium, such as fresh vegetables and fruits, can help decrease blood pressure. In fact, the ratio of sodium to potassium in the diet is crucial for overall health. An intake of more than 8 grams of salt per day is recognized as a risk factor for hypertension. Besides raising blood pressure, excessive salt consumption may damage the stomach lining and lead to conditions like atrophic gastritis and gastric cancer. Increased sodium intake also results in higher calcium excretion, which may reduce bone density.

Current studies show that high salt intake negatively impacts blood vessels, blood pressure, bone health, and the gastrointestinal tract. In our population, salt consumption generally exceeds the recommended levels, which should not be more than 6 grams per day.

Cultural Dietary Patterns & Hidden Sodium

Approximately 80 percent of the salt consumed in India comes from home-cooked meals or added table salt (10).

The average daily intake of salt is influenced by cultural customs and culinary preferences, particularly in northern regions. Salt consumption is significantly increased by common foods such as pickles, papads, chutneys, and salad dressings. The remaining salt intake comes from packaged goods, street food, and restaurant meals. One major source of excessive sodium intake is hidden salts present in packaged foods, like biscuits, sauces, and condiments, which are often consumed daily or with multiple meals. However, these can be enjoyed occasionally as part of a balanced diet.

Traditional Indian diets, while rich in flavour, can also contain hidden sodium. For instance, North Indians typically eat pickles with every meal and enjoy snacks like chaat and namkeens. South Indians often have rasam and sambar as staples in their diet. Many people who consume fermented or dried fish and smoked meats may also encounter high salt content. In Western India, snack items like farsan and sev, along with meals that feature pickles and chutneys, can contribute to higher sodium levels.

There is a common belief that home-cooked meals are low in salt, but traditional foods can be just as high in sodium. It is important to be mindful of cultural eating habits and hidden sources of sodium to maintain a healthier diet.

WHO Public health interventions (11): The WHO has published interventions for sodium reduction and tackling NCD. The food industry must also play a role by adopting the World Health Organization's "best buy" strategies.

There are 4 best buys for sodium reduction:

- Reformulate food products that are low in sodium and set target levels for the amount of sodium in foods and meals;
- Establish a supportive environment in public institutions such as hospitals, schools, workplaces and nursing homes to provide lower sodium options;
- Implement front-of-pack labelling; and
- Apply behaviour change communication and mass media campaigns.

The development, implementation, monitoring, and evaluation of sodium reduction policies should be government-led and safeguarded against possible conflicts of interest.

Conclusion

Sodium, though an essential nutrient, but its' over or underconsumption may pose a significant public health challenge. While global guidelines suggest a baseline for recommended intake, the country's diverse dietary patterns and climate require specific research and interventions.

One of the major issues to address is the hidden sodium found in traditional and processed foods; spreading awareness and behaviour change is necessary.

Implementing clean labelling and educational campaigns can help consumers select foods with a better nutritional profile. Since the taste for salt is acquired, its consumption could be restricted right from an early age.

By promoting collaboration among government, health organizations, the food industry, and consumers, India can take meaningful steps toward reducing sodium intake, preventing non-communicable diseases, and ensuring a healthier future for its population.

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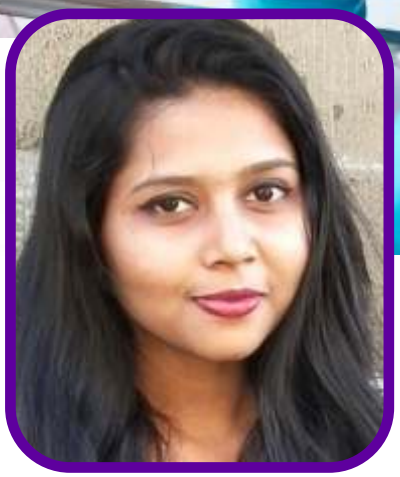
THE SCIENCE BEHIND CULTURED MEAT

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



Introduction

Meat has been a part of the human diet for nearly two million years, dating back to the emergence of the Homo genus. Fossil evidence from that era reveals cut marks on animal bones, indicating that early humans actively processed and consumed meat using sharpened tools (1). Today, science offers an innovative approach to meat production. Cultivated meat, also referred to as cultured or lab-grown meat, is real animal meat developed by growing animal cells in controlled laboratory conditions. In 2013, the world's first cultivated meat burger was introduced on live television. Since then, the sector has rapidly expanded. As of 2024, over 175 companies operate across six continents (2). These organizations are innovating across the cultivated meat value chain from cell lines to bioreactors, and the market is valued at approximately USD 272 million.

Production of cultured meat

The first step in the manufacturing process of culturing meat is to obtain the right type of stem cells. Two main options are pluripotent stem cells (like embryonic or induced pluripotent stem cells), which can grow quickly and divide indefinitely, but require complex steps to turn into muscle or fat. The other option is adult stem cells (such as satellite or mesenchymal stem cells), which are easier to guide into specific tissues but grow more slowly and may stop dividing over time. There is no single "best" cell type yet; companies choose based on what fits their product and process. A nutrient-rich basal media is then used for cell growth.

Cultivated meat production depends on precise bioprocess design, with bioreactors playing a central role. These systems must carefully control temperature, oxygen levels, pH, and mechanical forces to support the growth and differentiation of animal cells at a large scale. Unlike small lab setups, large bioreactors (hundreds to thousands of litres) need to balance cell health with efficiency and cost. Various bioreactors and microcarriers are used to cultivate the cells at high densities and volumes.

Microcarriers are tiny beads made from materials like dextran, cellulose, gelatin, that provide surfaces for cells to grow in suspension. These can be solid or porous, depending on the cell type and culture purpose. After cell growth, cells are separated from microcarriers using enzymes or mechanical methods. Biodegradable and edible microcarriers simplify harvesting and support satellite cell growth in suspension. To form structured tissue, scaffolds made from hydrogels or edible polymers mimic the extracellular matrix (ECM), providing the necessary support and environment for muscle or fat cell development. These scaffolds can be made from animal, plant, or microbial materials and are either seeded with cells or created through 3D printing using cell-laden bioinks. Depending on the type of meat being grown, this process should take two to eight weeks (2,3,4).

Differences from conventional meat

There are differences in conventional meat and cultured meat in some aspects, such as their structure, development process, etc.

In conventional meat, post-mortem metabolism plays a vital role in developing meat characteristics. This involves anaerobic glycolysis, resulting in a drop in intracellular pH. This change triggers muscle contraction and the formation of actomyosin complexes, which impact meat tenderness and water-holding capacity. However, post-harvest changes are less studied for cultured meat. The expression of actin and myosin isoforms in cultured meat may influence its response to post-mortem biochemical changes.

When it comes to structure, high-quality hamburgers are traditionally made by grinding meat, maintaining some tissue integrity. As mentioned above, the world's first cultivated burger patty was composed of 10,000 strips of myotubes engineered within a hydrogel matrix with fibres approximately 1 mm in diameter. To bind these smaller fragments and achieve the desired texture, additional ingredients such as breadcrumbs and egg white powder were required. As a result, the texture more closely resembled industrially processed burgers rather than fresh burgers.

In other meat products like cooked sausages, the meat is minced so finely that no cell structure remains intact. Cultured meat can be easily produced for such products. Though cultured meat has similar muscle fibres to regular meat, current methods mostly produce immature (embryonic or neonatal) proteins. Electrical or mechanical stimulation can improve protein content and structure, but it's unclear if this can be done at scale or a reasonable cost. If not, extra ingredients like starch or hydrocolloids may be needed.

Meat has a distinct red colour primarily due to the presence of myoglobin, a heme-containing protein. Cultured muscle tissues typically have a pale colour due to the absence of myoglobin. To increase myoglobin content in cultured meat, the muscle fibres can be cultured under low oxygen conditions, as it is suppressed at ambient oxygen conditions. However, more research is needed to determine if hypoxic conditions alone are sufficient and the impact of low oxygen conditions on culturing efficiency. The presence of sufficient amounts of iron in the cell is required for colour development.

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Myoglobin can be directly added to the medium. However, failure to incorporate sufficient amounts of myoglobin in cultured cells would require external addition of myoglobin or other colourants at a later stage in the production process.

Another important characteristic of meat is its flavour. Fresh, uncooked meat has little flavour due to its high iron content. Compounds contributing to the taste include lactate and inosine 5'-monophosphate, formed during post-mortem metabolism. Upon heating, complex thermally induced reactions result in the formation of volatiles, some of which contribute to the typical meat flavour. Reactions like the Maillard reaction and lipid degradation also contribute to these volatiles and affect the overall flavour of the meat. In cultured meat, the adipocytes can be co-cultured with the muscle cells, or cultured fat or plant-based fat can be added at the end of the culture process. Artificial flavour compounds like those used in plant-based meat substitutes might be an option to further enhance the flavour if necessary.

Meat is considered a nutritious product due to its highly digestible proteins, amino acid composition, vitamins, and minerals. Cultured meat is engineered to have similar protein content and quality to conventional meat, but exact values can vary depending on the production method, tissue maturity, and added ingredients. In tissue engineering, scaffolds made of polymers are used to organize cells in a 3D environment, affecting the macronutrient composition of the overall product. Meat is a dietary source of B12 vitamin, minerals like iron, zinc, and selenium, which require supplementation in cultured meat(5).

Benefits &Technological Challenges

Cultured meat offers an alternative to traditional meat. It uses significantly less water, land, feed, and energy. Cultured meat prices have dropped in recent years and can be further reduced with more research and development. It generates less waste, as only edible parts are grown, unlike whole animal carcasses.

Livestock farming contributes heavily to water pollution, land use, and greenhouse gas emissions. Producing 1kg of beef requires around 15,495L of water, most of which goes toward growing feed. In contrast, cultured meat uses 82–96% less water. However, it consumes approximately 4 times more energy, mostly for cell culture processes and sterilization, etc. Even so, cultured meat could substantially reduce greenhouse gas emissions. About 56 billion animals are slaughtered yearly for meat, raising serious ethical concerns. Cultured meat provides a humane alternative by reducing the need for animal slaughter. It appeals to vegetarians, vegans, and others who avoid meat for ethical reasons.

Although cultured meat is supported for its environmental and ethical benefits, it also has challenges. Cultured meat currently struggles to match conventional meat in terms of texture, colour, and appearance. The challenge of creating an appealing texture in cultured meat mimicking fresh meat is greater than for ground or finely minced meat products. The production of full-sized cultured products like steak is challenging.

Thicker meat pieces require a system to distribute nutrients and oxygen throughout the tissue. Traditional meat texture depends on myofibrillar structure, connective tissue, and fat composition. Co-culturing myoblasts with fibroblasts and adipocytes is technically challenging, but connective tissue structures can be created using an edible non-cellular matrix. Ground cultured meat products, like hamburgers, are more feasible, as demonstrated by a 2013 cultured meat prototype.

The high cost of cultured meat is also a significant hurdle. While prices are expected to fall with mass production and scale, current methods are expensive. For cultured meat to be viable, the process must become cost-effective and match the quality of traditional meat. However, adoption of this technology could heavily impact the economies reliant on meat exports and traditional agriculture(6,3).

Industry Development

Between 2011 and 2017, numerous cultured meat startups were launched to commercialize cultured meat and seafood, reducing costs and increasing competition. In 2018, a Dutch startup successfully grew meat using pluripotent stem cells from animal umbilical cords. To support industry growth, five U.S. startups allied in 2019 to work with regulators on cultured meat and seafood approval. Similarly, in 2021, 13 companies across Europe and Israel came together to create a unified platform to represent the cultured meat industry and engage with consumers and regulators. Since 2020, the cultured meat industry has grown rapidly with new startups, government support, and regulatory approvals. China called for a national strategy, and Belgium funded a project to develop cultured foie gras. In India, Animal Welfare organisation Humane Society International (HSI) India and the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad are working together to develop lab-grown meat. Singapore became the first country to approve cultured meat for sale in 2020 and has since allowed several products. Israel, the U.S., and the U.K. have also granted approvals for cultured meat, including beef and seafood. In 2025, the first pet food with cultivated meat also entered the market, showing how the technology is expanding into different sectors (7).

Consumers Perception

Despite the potential benefits of cultured meat for animal welfare and the environment, its commercial success depends heavily on how consumers perceive it. Cultured meat is often viewed as unnatural or artificial. Many consumers may associate cultured meat with synthetic products, reducing its value. Like with genetically modified foods, people may hesitate if they don't have enough information. How cultured meat is framed positively or negatively can affect people's attitudes and willingness to try or buy it. So, sharing accurate, positive information with the public is important. Cultured meat could reduce animal suffering and appeal to those who do not consume meat for ethical reasons, like vegetarians and vegans. It might also lower carbon footprints. But people still worry about its unnaturalness, food safety, and whether it will only be available to the rich, making food inequality worse. Clear regulations also help build consumer trust by ensuring safety and nutrition.

While the U.S. and EU have begun working on rules, it remains challenging to develop detailed regulations due to the limited information and developments of cultured meat technology.

Currently, cultured meat companies are focusing mostly on beef (25%), poultry (22%), pork (19%), seafood (19%), and some exotic meats like mouse, kangaroo, and horse (15%). These companies are mainly in North America, Asia, and Europe.

Over the past five years, about $320 million has gone into research, mainly for beef, pork, and seafood (3,6).

Conclusion

Cultured meat presents an innovative solution to many pressing global issues, including animal welfare, environmental sustainability, and food security.

By eliminating the need to raise and slaughter animals, it has the potential to be an alternative to traditional meat production. However, despite its promise, cultured meat must face several challenges before it can become a mainstream option.

Nonetheless, going forward, advances in cell culture technology will be key to making cultivated meat more scalable, stable, and cost-effective. As the science matures and public understanding improves, cultured meat could become a viable and sustainable alternative that complements or even reshapes the future of meat consumption.

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REGULATORY ROUND UP

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

Dear Readers,

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

Validity Order of FSSAI notified Food Testing laboratories as on 1st July 2025 : This order provides the latest list of FSSAI-approved laboratories with validity of their accreditation as on 01.07.2025.

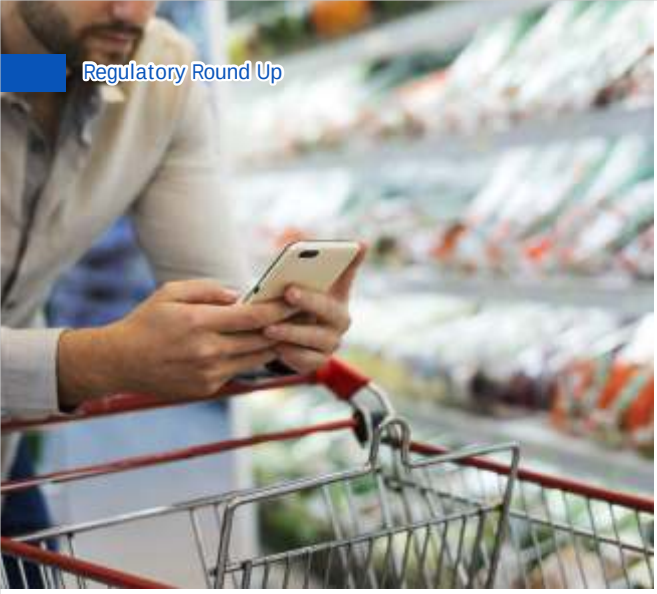
Scrutiny of Annual Returns submitted by FBOs by Concerned Licensing Authorities : To verify the credibility of annual returns by FBOs, a process has been initiated by the licensing authorities to scrutinise the annual returns of eligible FBOs under their jurisdiction. Provisions are available for the FBOs to revise the annual return online within the stipulated time.

Extension of Enrolment of Non-Food Production (NFP) Units for Collection of Used Cooking Oil (UCO) from Food Business Operators (FBOs) : This order extends the validity of provisional enrolment of NFP units (given in Annexure I),involved in the collection of used cooking oil,till 31.07.2026. This is subject to inspection or till the registration mechanism in the State / UT gets devised as per the clause xiv, Gazette notification issued by the Ministry of Oil and Natural Gas for Biodiesel manufacturing.

These NFP units must comply with SOPs, orders, and guidelines issued by FSSAI and are liable to cancellation of the enrolment in case of non-compliance.

Ayurveda Aahara covered under the Food Safety and Standards (Ayurveda Aahara) Regulations, 2022 : Schedule B of FFS (Ayurveda Ahara) Regulations 2022 specifies that the Food Authority may provide the list of Ayurveda Ahara covered under Category A. This order provides such list that will facilitate the FBOs for manufacturing Ayurveda Ahara.

If the products are not mentioned in the list, FBOs can request the Food Authority for inclusion by submitting the relevant literature from the list of books mentioned in Schedule A.



Display of Food Safety Connect Mobile App QR Code/Download Link at Food Premises : Food authorities have developed a QR code/link of the Food Safety Connect App. All FBOs, including Restaurants, Dhabas, Cafes, Eateries, and other food establishments, are advised to display the Licence/ Registration copy containing QR code to download the Food Safety Connect App at a prominent place visible to customers. In case of online ordering platforms, the QR code/ link is to be placed on their websites.

This user-friendly App will help consumers in various ways: To lodge complaints. Report misleading claims of the products. To access the basic information about the licensed/ registered FBOs. OR They can be informed about Food safety initiatives.

When the complaint is lodged through this app, it is automatically routed to the concerned authority of the food business, and there will be prompt redressal of the grievances.

This is a very good initiative by the Food authorities for surveillance and empowerment of the consumers.

FSS (Food Products Standards and Food Additives) First Amendment Regulations, 2025 relating to standards for Refractive Index range for Palm oil, Palmolein, Palm kernel oil and Palm Superolein; Meat sausage; Dehydrated tarragon; PDW; Food colors; Appendix A and Appendix C : FSS(Food Standards and Food additives) Regulations 2011 is amended vide this final Gazette notification.

The amendments include changes in the existing products and the introduction of new products as follows.

1) Refractive index range of Palm oil, Palm Kernel oil, Palm Superolein.

2)Meat sausages

3) Dehydrated tarragon

4) Packaged drinking water

5) Food colours

6) Appendix A and Appendix C

Overlooked Supplement Helps Think Sharper And Age Better

Creatine, the supplement popular with athletes for its ability to help build strength and power, is increasingly being recognized for its broad health benefits.

The compound's usefulness extends well beyond the gym, according to Dr. Richard Kreider, professor and director of the Exercise & Sport Nutrition Lab at Texas A&M University. Kreider has spent more than 30 years investigating the effects of creatine, a naturally occurring compound stored in the muscle that combines with phosphate to form creatine phosphate, which is needed for cellular energy.

Creatine is increasingly recognized as more than just an athletic performance supplement—it plays a vital role in cellular energy production, cognitive support, and healthy aging. According to Dr. Kreider, creatine phosphate helps maintain cellular energy during physical or metabolic stress, offering protection beyond muscles. While the body naturally produces about a gram daily, most people don't get enough through diet alone—particularly vegetarians and vegans—since rich sources like red meat and fish provide limited amounts per calorie. Supplementation is often necessary, with athletes typically starting with a "loading" phase of 5 grams taken four times daily for a week, followed by 5–10 grams daily to maintain muscle and brain creatine levels.

Importantly, creatine's benefits extend to cognitive function and muscle preservation across the lifespan, with low dietary intake in adolescents linked to slower development and higher body fat. In older adults, it supports memory and counters age-related muscle loss. Despite long-standing misconceptions around side effects like bloating or cramping, an analysis of 685 clinical trials revealed no significant differences between creatine and placebo groups. In fact, creatine may aid hydration and prevent cramping. Experts, including Kreider, emphasize that creatine is a safe, evidence-backed tool for wellness and advocate for its broader acceptance in public health initiatives.

https://www.sciencedaily.com/releases/2025/06/250610004101.htm

Sugar Switch That Protects Your Brain From Alzheimer's

Scientists have uncovered a surprising sugar-related mechanism inside brain cells that could transform how we fight Alzheimer's and other dementias.

It turns out neurons don't just store sugar for fuel—they reroute it to power antioxidant defences.A new study from scientists at the Buck Institute for Research on Aging has revealed a surprising player in the battle against Alzheimer's disease and other forms of dementia: brain sugar metabolism. Published in Nature Metabolism, the research uncovers how breaking down glycogen -- a stored form of glucose -- in neurons may protect the brain from toxic protein buildup and degeneration.

This study introduces a compelling new lens for Alzheimer's prevention by spotlighting a previously overlooked sugar-clearing mechanism in neurons. Scientists at the Buck Institute found that brain cells don't just use glycogen for energy; they can redirect it toward antioxidant defence—but only if an enzyme called GlyP is active. When tau proteins bind to glycogen, they block its breakdown, leading to harmful oxidative stress and brain degeneration.

By reactivating GlyP, researchers were able to reroute sugar into the pentose phosphate pathway, increasing NADPH and glutathione—both crucial in detoxifying oxidative damage.

This sugar switch appears to mitigate tauopathy damage in fruit flies and human-derived neurons, with dietary restriction naturally boosting GlyP activity.

Intriguingly, the study also links these mechanisms to the benefits of GLP-1 drugs, suggesting they may mimic dietary restriction effects, offering potential protection against dementia. The findings not only expand our understanding of glycogen's role in neurodegeneration but also highlight new therapeutic targets for combating aging-related cognitive decline.

https://www.sciencedaily.com/releases/2025/06/250630073442.htm

Vitamin C's Role In Cellular Skin Regeneration

New research illuminates the skin-regenerating properties of vitamin C, finding that it promotes epidermal thickening.

Due to a decline in cell production, the skin naturally becomes thinner and more fragile with age, losing its protective properties. The researchers suggest vitamin C may help prevent age-related skin thinning and support healthier, firmer skin in aging individuals.

A new study from Japan's Tokyo Metropolitan Institute for Geriatrics and Gerontology reveals that vitamin C plays a powerful role in skin regeneration, particularly in combating age-related thinning. Using a 3D human skin model, researchers found that vitamin C triggers cell growth through DNA demethylation— a process that reactivates silenced genes. It does this by sustaining the activity of TET enzymes, which regulate gene expression by modifying DNA methylation marks. Vitamin C assists this process by maintaining iron in its active form, essentially recharging the enzymes so they can continue driving cell renewal.

After two weeks of topical vitamin C exposure, lab-grown skin showed a thicker inner epidermal layer and increased activity of keratinocytes— cells responsible for forming the skin's protective barrier. These findings suggest that vitamin C promotes firmer, healthier skin in older adults by stimulating new cell formation and reducing oxidative stress. Over 10,000 DNA regions showed reduced methylation, with 12 key growth-related genes significantly activated. In short, vitamin C doesn't just brighten the skin—it works deep within cells to boost their regenerative capabilities.

https://www.nutritioninsight.com/news/vitamin-c-skin-care-dermatology-beauty-anti-aging.html

ATP Boosts Muscular Performance And Prevents Fatigue

A recent study sheds light on a potential breakthrough in exercise performance and recovery, suggesting that oral intake of adenosine triphosphate (ATP) could be a game-changer in preventing exercise-induced declines in ATP, which is the body's primary energy currency.

The multi-patented Peak ATP is a clinically validated form of adenosine 5'-triphosphate (ATP) disodium, identical in structure to the ATP produced and used by the human body, and an energy source shown to improve muscle strength and blood flow. It is also a non-stimulant energy source.Furthermore, the study found that this intervention improves peak power and muscular excitability. Muscular excitability, an important indicator of muscle function, is defined as the ratio of power output to muscle activation.

The study highlights oral ATP supplementation—specifically a patented form called Peak ATP—as a promising tool to improve exercise performance, muscle strength, and recovery. Conducted at the University of Tampa, the double-blind, placebo-controlled trial showed that Peak ATP, taken at 400 mg daily for two weeks, prevented post-exercise declines in ATP and related energy molecules (ADP and AMP). It also boosted peak power during later workouts and increased muscular excitability, which refers to a muscle's ability to maintain strong contractions under stress.

Peak ATP is chemically identical to naturally occurring ATP in the human body and functions as a non-stimulant energy source.

It directly supports ATP stores rather than relying on precursors, making it unique among sports nutrition ingredients. Notably, this compound is the first shown to increase muscular excitability, allowing athletes to sustain high-intensity performance with less fatigue. The research joins other studies demonstrating enhanced strength and repetition capacity through ATP supplementation, and Peak ATP has been awarded Informed Ingredient certification for quality assurance and safety in sports contexts.

https://www.nutritioninsight.com/news/atp-adenosine-triphosphate-supplements-sports-nutrition.html

Early, Targeted Nutrition can Fight Double Burden of Malnutrition among South Asian Women

New UNICEF-led reviews highlight wide gaps in preconception nutrition across South Asia, urging tailored, early interventions to tackle malnutrition and improve maternal-child health outcomes, regardless of whether the adolescent or adult wishes to get pregnant.

"Undernutrition among reproductive-age women, low birth weight, small for gestational age, and preterm birth present significant health burdens in South Asia, which interventions in pregnancy alone have not resolved. Effectiveness of preconception nutrition interventions is not well-documented," reads a review published in The Lancet Regional Health.

The reviews emphasize that malnutrition among women in South Asia—particularly in preconception stages—remains a major public health challenge. The region faces a "double burden," where rates of overweight now rival underweight, and nearly half of women and girls of reproductive age are anemic. Despite this, nutrition interventions during pregnancy alone have not sufficiently improved outcomes like low birth weight or small-for-gestational-age births.

Emerging evidence suggests that interventions starting 90 days before conception—especially those combining food supplements, multiple micronutrients, psychosocial care, and WASH support—can significantly improve maternal and newborn health. A 24% reduction in low birth weight was noted when these were applied before and during pregnancy. Supplementation alone wasn't enough; underweight women may require extra macronutrients to metabolize nutrients effectively, highlighting the importance of BMI and energy balance.

Epigenetic mechanisms are also involved—vitamin-rich preconception nutrition may trigger DNA methylation changes that improve placental function and fetal development. However, gaps remain in research, especially around food fortification, exercise promotion, and chronic disease screening.

Experts call for life-stage–specific and gender-responsive strategies, starting in adolescence, and recommend integrating these efforts into existing public health systems like India's ICDS. Engagement with private sector partners and community groups could also enhance the reach and sustainability of nutrition programs.

https://www.nutritioninsight.com/news/preconception-nutrition-gaps-south-asia-maternal-health.html

Low Fibre Linked to Higher Blood Clot and Heart Attack Risk

A new study has found that low fibre consumption is linked to the presence of unstable or high-risk plaque in coronary arteries — the type of plaque that can trigger blood clots and cause heart attacks. The multi-centre study led by researchers at Lund University, Sweden, also links dietary patterns to the composition of the plaques, or how potentially dangerous they are.

Using advanced cardiac imaging, namely computed tomography, the researchers examined the presence and type of plaque and showed that dietary patterns affect atherosclerosis (the atherosclerotic plaques) in the coronary arteries.Moreover, diet was related to the appearance of the plaques, reflecting their composition.

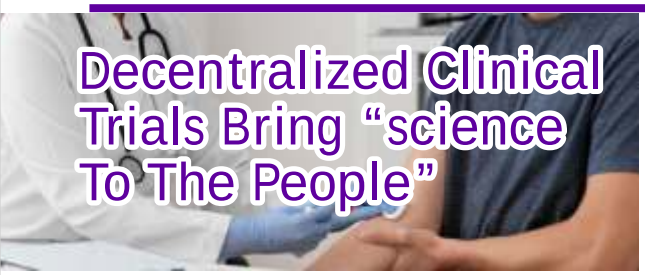
Participants in the study had no symptoms of heart disease and no known or diagnosed cardiovascular disease at the start of the study.

This new study out of Lund University makes an important connection: low fibre intake isn't just about sluggish digestion—it could quietly escalate cardiovascular risks. Using advanced heart imaging in a cohort of over 24,000 middle-aged participants, researchers found that unhealthy dietary patterns were associated with more atherosclerotic plaque in coronary arteries, especially unstable, high-risk plaques linked to blood clots and heart attacks.

Those consuming less fibre, fruits, vegetables, and whole grains—and more red meat, crisps, and sugary beverages—had significantly higher rates of coronary changes. High-risk plaque was 1.6 times more common in that group. The study also linked poor diets with abdominal obesity, high blood pressure, and elevated triglycerides, suggesting that fibre's cardioprotective role might be deeply intertwined with metabolic health.

Lead cardiologist Isabel Goncalves and nutritionist Ingrid Larsson stress the importance of overall dietary patterns over individual food items. The findings align with global guidelines promoting plant-based, fibre-rich foods like oats, fruits, nuts, and healthy oils. Yet many still fall short of the recommended 25 grams of fibre daily—a shortfall that might carry more consequences than previously thought.

https://www.nutritioninsight.com/news/fiber-diet-cardiovascular-disease-heart-attack-health.html



Decentralized Clinical Trials Bring "science To The People"

Decentralized clinical trials offer time and cost savings as participants join a trial from home instead of a research centre.

In addition, US-based People Science says that its innovative clinical trials allow more people to participate and ask questions, aiming to "democratize science" with its tools.Through the mobile app, nutraceutical companies can conduct rigorous clinical trials more affordably. Trial participants receive a product and testing equipment at home, and track their progress.

People Science is reimagining clinical trials allowing participants to engage from their homes using a mobile app called Chloe, which is designed to be accessible, secure, and rigorously compliant with FDA and EMA standards. Founded by physician-scientists Noah Craft and Belinda Tan, the company aims to "democratize science" by making high-quality trials affordable and inclusive, especially in the nutraceutical space, where rigorous research has traditionally lagged.

Rather than testing in sterile labs, the platform invites participants to experience and report product use in real-world conditions. This generates data that reflects everyday behaviours, potentially increasing trust and relevance. The app emphasizes data transparency, participant ownership, and audit trails for regulatory credibility.

Participants receive personalized visualizations of their own data and access to study outcomes—an empowering touch that aligns with the company's community-centric ethos.

Craft argues that pharmaceutical trials often assume control equals quality, while real-life data, even if imperfect, may be more meaningful. This approach encourages honesty ("Did you take it today?") and acknowledges that people's habits can't always be policed but can be recorded reliably. The platform also enables smaller communities and clients to conduct trials affordably and ethically, challenging the dominance of large, late-stage pharma interventions.
https://www.nutritioninsight.com/news/people-science-clinical-trial-nutraceuticals-trust-data-quality.html

Eat Better, Sleep Better: "same-day" Impact Of Diet On Sleep Quality

From white noise machines to melatonin supplements and weighted blankets, the market for rest and relaxation is continually growing.

However, a new study suggests that one of the most effective solutions may already be in the kitchen: fruits and vegetables.

Researchers from the University of Chicago Medicine (UChicago), US, and Columbia University, New York, US, reveal that eating more fruits and vegetables during the day is linked to better sleep quality that same night.

According to the researchers, the peer-reviewed study offers some of the strongest evidence yet that what we eat directly influences how well we sleep — potentially opening up new avenues for tackling widespread sleep-related health issues through diet.

This study unveils an impressively direct relationship between diet and sleep quality. Rather than relying solely on external aids like melatonin or white noise machines, researchers found that consuming more fruits, vegetables, and healthy carbs during the day significantly improves sleep that same night. Specifically, eating the CDC-recommended five cups of produce was associated with a 16% enhancement in sleep quality—primarily through reduced sleep fragmentation, which means fewer interruptions and transitions between sleep stages.

The trial tracked young adults using food-logging apps and sleep-monitoring wristbands, revealing that better daytime nutrition correlated with deeper, more restorative sleep.

This flips the usual narrative: instead of poor sleep leading to unhealthy snacking, the reverse is also true—nutrient-rich diets might actively support better sleep. The findings carry intriguing potential across different age groups and health profiles, and may influence how the functional ingredient and supplement industries approach sleep wellness interventions. It's a compelling example of how lifestyle tweaks—like upping fruit and veggie intake—can create measurable biological benefits in less than 24 hours.

https://www.nutritioninsight.com/news/fruits-vegetables-diet-rest-sleep-quality-study.html

Ginger Compound Disrupts Cancer Metabolism

Researchers at Osaka Metropolitan University, Japan, have identified a novel energy pathway in cancer cells that can be inhibited by a natural compound found in kencur ginger, offering new insights into cancer metabolism and potential therapeutic targets.

Human cells typically produce energy (ATP) through glucose oxidation. However, cancer cells are known to predominantly utilize glycolysis, an oxygen-independent process that converts glucose into pyruvic and lactic acid, even when oxygen is available.

This phenomenon, known as the Warburg effect, is considered inefficient, leading to ongoing questions as to why cancer cells choose this energy pathway to fuel their proliferation and survival.This study uncovers a novel anticancer mechanism within kencur ginger, revealing how one of its active compounds—ethyl p-methoxycinnamate—disrupts cancer metabolism in a way that challenges long-standing assumptions.

Cancer cells typically favour glycolysis, even when oxygen is present—a phenomenon known as the Warburg effect. This shift supports rapid cell proliferation but is metabolically inefficient.Ethyl p-methoxycinnamate does not directly interfere with glycolysis. Instead, it suppresses ATP production by inhibiting de novo fatty acid synthesis and lipid metabolism, essential for cell membrane formation and energy balance.Remarkably, when this lipid-based pathway is blocked, cells ramp up glycolysis in a compensatory response—suggesting a backup survival strategy.However, the compound doesn't induce outright cell death, which implies it may hinder proliferation without being cytotoxic—possibly allowing for gentler therapeutic applications.

This insight expands the Warburg framework and points to lipogenesis as an untapped target in cancer therapy.Disruption of lipid metabolism affects energy generation, signal transduction, and membrane biosynthesis, all vital to fast-dividing tumour cells.The findings offer a route to explore combinatory strategies, pairing lipid metabolism inhibitors with glycolysis modulators to cut off both fuel lines.

https://www.nutritioninsight.com/news/cancer-research-oncology-kencur-ginger-supplements-atp.html

Fermented Legumes In Fight Against Diabetes And Inflammation

Utilizing optimal fermentation conditions for pulses can increase their antioxidant and antidiabetic properties, as well as their soluble protein content.

Food scientists at the University of Illinois Urbana-Champaign, US used the bacteria Lactiplantibacillus plantarum 299v (Lp299v) as the microorganism to ferment pulses from varying concentrations of black bean, black-eyed pea, green split pea, red lentil, and pinto bean flours.The samples had different outcomes after fermentation. However, overall, their antioxidant activity increased by up to 83%, and their capacity to regulate type 2 diabetes markers increased by up to 70%.
This study spotlights a compelling method to enhance the functional properties of legumes through targeted fermentation—positioning pulses as powerful players in the fight against diabetes and inflammation. Researchers used *Lactiplantibacillus plantarum 299v* (Lp299v) to ferment legume flours (red lentil, black bean, black-eyed pea, green split pea, and pinto bean) under optimized conditions. By manipulating flour concentration, time (8–24 hours), and microbial strains, they fine-tuned fermentation to maximize antioxidant potential, antidiabetic properties, and protein solubility.

Antioxidant activity increased by up to 83%. Regulation of type 2 diabetes markers improved by up to 70%. Soluble protein content rose significantly in red lentils and green split peas. Enzyme *Dipeptidyl peptidase*-IV reduced by 40–70% (enhances insulin signalling),α-*glucosidase*: reduced by 30–60% (slows carbohydrate digestion). The Lp299v strain remained active in digestion, continuing to produce absorbable peptides that are easier for the body to utilize than intact proteins.Fermented pulses generated key metabolites, including bioactive peptides and phenols, offering immune, metabolic, and anti-inflammatory benefits.This supports use in plant-based formulations like dairy-free beverages or meatsubstitutes, addressing global protein demand while boosting nutrition.
https://www.nutritioninsight.com/news/plant-protein-fermentation-gut-health-probiotics-food-science-pulses.html

Experts say Weight not the Only Measure of Better Health

A significant portion of people who adopt and stick to a healthy diet may not lose weight. However, they may still experience meaningful health benefits indicative of holistic wellness, including cardiometabolic benefits, according to a new study.

The study analysed data from 761 adults with abdominal obesity who participated in a series of high-profile, workplace-based nutrition trials in Israel. Despite following healthy diets such as low-fat, low-carbohydrate, and Mediterranean variations for up to two years, nearly 30% of participants did not lose weight — yet saw improvements in key markers of metabolic and cardiovascular health.
This study beautifully reframes diet success, shifting the spotlight from weight loss to deeper metabolic gains—particularly among those classified as “weight-loss resistant.” Their HDL cholesterol rose, leptin levels dropped, and visceral fat was reduced—all markers linked to lower cardiovascular and diabetes risk.
It’s especially compelling that each kilogram lost correlated with measurable benefits, like reductions in triglycerides, insulin, liver fat, and blood pressure. Yet even in weight-stable participants, the metabolic shifts were significant enough to challenge the notion that a diet must change the number on the scale to be considered successful. Among those who did lose weight, researchers found that every kilogram lost correlated with quantifiable benefits: a 1.44% rise in HDL, a 1.37% drop in triglycerides, and meaningful reductions in insulin, liver fat, blood pressure, and liver enzymes. These associations reinforce why tracking cardiometabolic markers may provide more useful insight than the scale alone.
“We have been conditioned to equate weight loss with health, and weight loss-resistant individuals are often labelled as failures,” says lead author Anat Yaskolka Meir, postdoctoral research fellow in the Department of Epidemiology at the Harvard T.H. Chan School of Public Health and Ben Gurion University in Israel. “Our findings reframe how we define clinical success.”
“People who do not lose weight can improve their metabolism and reduce their long-term risk for disease. That’s a message of hope, not failure.”
https://www.nutritioninsight.com/news/redefining-diet-success-experts-say-weight-not-the-only-measure-of-better-health.html

FOOD SCIENCE & INDUSTRY NEWS

Nutrition Industry Spots A Surging Demand For Gut Health Ingredients

A growing consumer focus on healthier food options drives demand for functional ingredients.

Within the space, suppliers recognize an increased interest in gut-supporting solutions, such as prebiotics, postbiotics, and probiotics, to benefit digestion and beyond, as research connects the gut to health benefits like immunity, mental health, and overall wellness.

The demand for gut health ingredients is surging, fuelled by a global shift toward health-conscious eating and growing consumer awareness of the gut's influence on overall wellness. Experts from dsm-firmenich, Clasado Biosciences, and Tirlán note that interest in biotic supplements—probiotics, prebiotics, postbiotics—is not only at an all-time high but evolving rapidly. Today's consumers seek more than digestive support; they're looking for benefits in areas like satiety, skin health, cognition, and even relaxation.

Market research reveals strong growth in supplement launches containing prebiotics and increased attention to delivery formats that are convenient and effective at low doses. Innovative formats include prebiotic snack bars, protein blends, and beverages—though maintaining scientific dosage standards remains crucial for health claims. Postbiotics in particular stand out for their stability and versatility across food and drink categories, even under heat and shelf-life constraints.

Companies are enhancing the functional food sector through fiber innovations, especially with oat beta-glucans. The competitive landscape is driving patent activity, new applications, and a sharpened focus on precision health claims supported by robust science. The gut-brain axis is emerging as a promising area, with psychobiotics showing potential in mood modulation and neurological conditions such as autism.

https://www.nutritioninsight.com/news/functional-ingredients-gut-health-fiber-prebiotics.html

Cardio-conscious Consumers Prioritize Preventative Heart Health Supplements

The heart health market is expanding beyond traditional consumer groups facing higher cardiovascular disease risks, such as older adults or people with obesity.

As a result, industry experts highlight an increased focus on preventative health, exploring natural ingredients and vitamin-based supplements.Innova Market Insights data also indicates an increasing consumer awareness and demand for products that support cardiovascular health, revealing a 7% average annual growth in supplement launches with heart or blood pressure claims from 2020 to 2024.

Tom D'Hoore, chief commercial officer at HTBA, tells Nutrition Insight this growing consumer awareness of cardiovascular health is causing a significant shift in the market to include "virtually every age bracket and demographic."

This report maps a clear shift in the heart health supplement space—from reactive treatment for aging populations to proactive, cross-generational cardiovascular wellness. What stands out is the data showing heart health as a top-three concern across all age groups, including younger consumers. This aligns with the rise of "cardio-conscious" lifestyles where diet, supplements, and exercise are integrated into everyday routines.

The article highlights several key nutraceuticals. First, citrus-derived polyphenols such as HTBA's Cardiose offer anti-inflammatory and vasodilatory effects. These compounds, particularly citrus flavonoids, support arterial flexibility and reduce stroke risk. The Mediterranean diet, rich in polyphenols and minimally processed foods, remains the evidence-based foundation for cardiovascular nutrition, as validated by landmark studies like PREDIMED.

From a micronutrient angle, folate—especially in its bioactive Quatrefolic form—is shown to modulate homocysteine levels, a known cardiovascular risk marker. Elevated homocysteine is linked to clotting and vascular dysfunction, and its reduction via folate and B vitamins appears to be therapeutically relevant. Additionally, vitamin K2 (MK-7), via Gnosis by Lesaffre's MenaQ7, emerges as a critical anti-calcification agent. Not only does it keep calcium out of arteries, but clinical studies suggest it may reverse arterial stiffness and reduce blood pressure, especially in postmenopausal populations.

https://www.nutritioninsight.com/news/preventive-heart-health-supplements-natural-ingredients.html

Ultra-processed Food Texture Can Reduce Calorie Intake

Preliminary research on ultra-processed foods sheds new light on the much-debated products.

A randomized controlled trial finds new evidence that texture-derived meal differences — such as mashed versus fried potatoes — influence energy intake from ultra-processed foods. Over 14 days, participants consuming an ultra-processed food diet with textures that reduced their eating rate, like meatballs, had an average energy intake reduction of 369 kcal daily compared to a group eating foods with textures that promoted a faster eating rate, such as sugar-sweetened yogurt. The researchers measured the eating rate in grams per minute.

The research conducted by Wageningen University, the Netherlands, found that the effect of food texture on eating rate and impact on energy intake was consistent across all participants and sustained during the intervention. "The consistency of the effect of meal texture on eating rate and intake was striking. The cumulative difference in intake on average between the two diets was over 5,000 kcals across the 14 days," says lead investigator Ciarán Forde, Ph.D., at the university's Human Nutrition and Health division. "Almost all participants adjusted their eating behaviours in response to the meal textures served, without any guidance or instructions or the need to consciously restrict their intake or compromise on food enjoyment and satisfaction."

This randomized controlled trial from Wageningen University offers a fresh lens on how ultra-processed foods—typically scrutinized for their nutritional drawbacks—may be re-evaluated through the sensory characteristic of texture. Researchers investigated the impact of food texture on energy intake by assigning 41 participants to two distinct ultra-processed diets over 14 days: one composed of items promoting slower eating (such as meatballs), and another made of foods with smoother textures that facilitated faster consumption (like sugar-sweetened yogurt). Both diets were matched for energy density, portion size, and total energy derived from ultra-processed foods under the Nova classification.

What emerged was striking. The group consuming slower-eaten foods ingested 369 fewer kilocalories per day on average compared to the faster-eating group. Across the study's duration, this amounted to over 5,000 fewer kilocalories, despite no differences reported in satisfaction or fullness. Participants naturally adjusted their intake in response to texture without any guidance, highlighting how meal structure—not just ingredients—can influence habitual energy intake.

The findings underscore a sustained pattern: meal texture significantly alters the rate of eating, which in turn affects total energy consumed, independent of hunger signals. This adds nuance to debates around ultra-processed foods by suggesting that product reformulation focused on textural complexity might mitigate overconsumption risks. It also refines our understanding of drivers behind meal size and satiety, opening doors to sensory-informed strategies for dietary interventions.
Dr. Amanda Avery, not affiliated with the study, emphasized that quick consumption may encourage overeating and long-term weight gain. She pointed out that food with less texture may bypass natural satiety checkpoints, reinforcing the benefit of meals that encourage slower, more mindful eating.

The research contributes to the larger Restructure project—an initiative exploring how meal structure and sensory dynamics influence metabolic health. It complements prior studies linking high consumption of ultra-processed foods with increased risks of hypertension, cancer, and cardiovascular disease. Notably, it challenges assumptions that all ultra-processed products impact health equally, and also critiques the limitations of the Nova classification system, ® which some experts view as overly simplistic.
https://www.nutritioninsight.com/news/ultra-processed-food-texture-energy-intake.html

Hybrid Product Innovation Increasingly Important to 'overcome Shortcomings' in APAC Nutrition

Hybrid products made from both animal and plant-based proteins have the potential to break out of the alt-protein space and play a broader role in addressing nutritional gaps.

The development of these hybrid products was previously most often considered as part of the alternative protein category, but experts now believe that the need to focus on this segment goes far beyond protein alone. "Hybrid products have a major opportunity to really stand out in terms of nutrition as well as other aspects and not just as an alternative protein, as there is room to blend and fuse things in order to overcome shortcomings of any individual ingredient," Head of Nutrition, Singapore Institute for Food and Biotechnology Innovation (SIFBI) said.

It was always considered one of the meat-like-substances of next generation after plant-based meat, a category which suffered in Asia due to price, taste and digestibility factors, but now if we recognise those weaknesses and hybridise ingredients to complement one another, the potential to move beyond this is quite clear.

This piece opens up a compelling discourse on how hybrid food products—those combining animal and plant-based ingredients—are transcending their initial categorization as mere alternatives to meat. What stands out is how researchers and innovators in APAC are now viewing them not only as protein solutions, but as vehicles to elevate overall nutritional profiles, affordability, and consumer experience.

One of the most interesting pivots is the shift away from seeing these as "next-generation meat like substitutes." Instead, they're being framed as fusion platforms—where each ingredient contributes a complementary function. This approach allows brands to tackle texture, digestibility, flavour, and nutrient deficiencies more holistically. It's essentially a move from mimicry to synergy.

Companies like Umami Bioworks exemplify this. Their efforts to replicate delicacies like eel and caviar show that some aspects—such as flavour complexity—are best retained through cultivated animal inputs, while structural or nutritional enhancements can come from plant-based scaffolds. This isn't just alternative protein anymore; it's precision-formulated indulgence.

There's also a bold invitation to explore untapped biodiversity. With only about 50 of an estimated 2,000 edible fungi characterized so far, the opportunities for nutrient-dense, sustainable ingredients are immense.

That signals a future where hybrid isn't just meat-plus-plant—it could be meat-plus-fungi, algae, or even insect protein, carefully selected based on functional and nutritional synergies.

Hybrid formats may also hold the key to personalized nutrition. As Dr. Padayachee notes, the future is layered—not just about macros like fat and protein, but micronutrient density, bioavailability, and metabolic compatibility.

If producers can tailor hybrids to regional deficiencies and genetic predispositions, they could reshape public health outcomes while keeping flavour and affordability intact.

https://www.foodnavigator-asia.com/Article/2025/04/29/hybrid-product-innovation-increasingly-important-to-overcome-shortcomings-in-apac-nutrition/

Processing Actually Make Plant-based Foods Healthier

New research out of Finland is challenging the concept that all processed plant-based foods are unhealthy. The groundbreaking study reveals that food processing methods greatly affect the health value of plant-based foods. But contrary to popular opinion, these methods could actually have a positive impact, by enhancing beneficial compounds

Positive impacts of plant-based processing Plant-based foods, including vegan burgers and tempeh, undergo varying levels of processing during the production. These processes can enhance nutritional content through fortification and improve sensory qualities like texture. However, processing of food and beverage products, particularly within the plant-based category, has become associated with negative health impacts.

This Finnish study offers a compelling counter-narrative to the blanket vilification of processed plant-based foods. Rather than treating processing as a proxy for poor health outcomes—as the NOVA classification often does—it argues for a paradigm shift: assessing nutritional value through biochemical composition and bioavailability rather than degree of industrial manipulation.

Fermentation emerges as a particularly salient example. By facilitating microbial conversion of isoflavonoids into more absorbable forms, tempeh's fermentation doesn't just preserve nutrition—it amplifies it. The research team's metabolomics approach also revealed that extrusion, typically flagged as a negative in NOVA, could retain or even enhance key phytochemicals. This nuance is critical, especially as the plant-based sector expands and consumers increasingly rely on products like vegan sausages or pea-based snacks that might otherwise be dismissed as UPFs.

What's notable is the researchers' call for a more sophisticated classification scheme—one that considers phytochemical loss and gain, matrix interactions, and functional ingredient integration (e.g. spices, fibres, microbes).

https://www.foodnavigator-usa.com/Article/2025/05/01/health-benefits-of-processed-plant-based-foods/

Meat biotechnology in Latin America with innovation that redefines animal protein

The meat industry in Latin America is undergoing a silent but forceful transformation thanks to advances in biotechnology.

From lab-grown meats to sensors for genetic traceability and precision fermentation applications, the region is beginning to adopt scientific tools that promise to revolutionize how animal protein is produced, controlled, and consumed. Share

Cultured meat, from science to the table, one of the most disruptive developments comes from the cultured meat sector, also known as in vitro meat. While the United States and Asian countries have led this trend, Latin America is not far behind. Argentina is positioned as a regional pioneer with companies such as Cell Farm Food Tech, which has developed prototypes of meat cultured from bovine stem cells.

Latin America's meat industry is undergoing a transformative phase driven by biotechnology, with countries across the region beginning to reshape how animal protein is produced, managed, and perceived. At the heart of this shift is the cultured meat sector, which, although dominated globally by the U.S. and Asia, is gathering momentum in Latin America. Argentina leads the regional effort, notably through Cell Farm Food Tech, a company developing bovine stem cell-derived meat prototypes. Supported by both the government and tech incubators, Argentina has taken the pioneering step of introducing regulations to evaluate and authorize cultured meat products—marking a regional first.

Brazil, meanwhile, sees its global meat giant JBS partnering with Spain's BioTech Foods to build a cultured meat facility with a sustainability-driven mission, aiming to reduce environmental strain from conventional livestock farming.

Chile's NotCo, primarily known for plant-based foods, is expanding into precision fermentation to mimic meat flavours and textures without animal inputs. Colombia's GFI Andes is fostering academic partnerships to advance microbial fermentation research as a means of creating functional and microbiologically safe alternatives.

Beyond meat alternatives, biotechnology is also modernizing conventional meat production. Genetic PCR testing in facilities across Mexico and Uruguay is enhancing food safety with real-time pathogen detection. Paraguay and Bolivia have begun using genetic traceability chips and agri-food blockchain systems to meet stringent export market requirements and assure provenance.

This regional progress is underpinned by multistakeholder collaboration—governments, research institutions, and private enterprise alike are converging to build regulatory frameworks and scale innovations. While countries like Brazil and Mexico are just beginning to explore formal regulations for cultured meats, Argentina's proactive stance has attracted international investment and positioned the Southern Cone as a fertile ground for next-generation protein development.

https://www.foodnewslatam.com/paises/4966-latinoam%C3%A9rica/16337-biotecnolog%C3%ADa-c%C3%A1rnica-en-latinoam%C3%A9rica-con-innovaci%C3%B3n-que-redefine-la-prote%C3%ADna-animal.html

What Eggs' Popularity Can Teach The Food And Beverage Industry About Disruption

The ubiquitous egg continues to remain a popular source of protein - despite shortages and record high prices - demonstrating how other product categories can do the same Eggs' versatility across day parts and uses as an ingredient and a main dish is a case study in category disruption and how to unlock growth, Circana shared in a recent webinar.

Nearly all households (94%) buy fresh eggs, with retail trips including eggs growing 4% for the year ending April 20, according to Circana data.

The article explores how the enduring popularity of eggs—despite economic pressures like shortages and price spikes—offers broader lessons in food and beverage innovation. According to Circana data, eggs are purchased by nearly 94% of households and are included in more frequent retail trips. Notably, shopping baskets with eggs yield significantly higher spend averages than those without, highlighting eggs' integral role in both consumer preference and commercial value.

The secret to eggs' resilience lies in their multifunctionality. Darren Seifer of Circana emphasizes that eggs have transcended their traditional status as a breakfast item and are now consumed across all dayparts, enhancing both their relevance and frequency of use. This shift illustrates how category disruption isn't always about radical reinvention—it can stem from reimagining the usage context of a staple product.

Other foods are beginning to emulate this strategy. Grapes, through trends like cotton candy varietals and candying techniques shared widely on social media, are moving beyond the snack category and into broader meal occasions. Cottage cheese, another long-standing item, is riding a social media revival as a base for dips, spreads, and savory snacks, contributing to its double-digit growth in March.

https://www.foodnavigator-usa.com/Article/2025/05/07/egg-innovation-spurs-demand/

Protein Demand And Flavoured Cheese Trends Create New Growth Avenues

The article examines how shifting consumer preferences in Asia—particularly rising interest in protein-rich foods and flavoured cheeses—are opening up new commercial opportunities across the dairy sector.

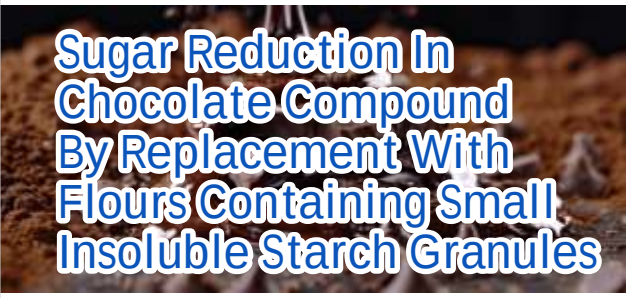
According to insights from the California Milk Advisory Board (CMAB), there's a growing appetite for high-protein dairy products, influenced by global food trends disseminated through travel and social media. This trend is no longer confined to Western markets; it's catching on across diverse Asian demographics.

Flavoured cheeses, especially those infused with herbs, wine, or truffle, have piqued consumer curiosity, with smoked cheeses finding favour for their versatility in local cuisines.

U.S. dairy producers, particularly those under the Real California Milk banner, are exploring ways to cater to these emerging preferences through innovations like extended shelf-life milk—which can last up to 180 days—and customized packaging formats. Smaller pack sizes (e.g., 150g cheese) suit Asian cooking and snacking habits, where dairy consumption tends to be lower than in the West.

The article doesn't paint these shifts as seamless. It highlights the need for consumer education, particularly around how dairy fits into local diets and meal preparation. Ultimately, the piece positions protein and flavour innovation as growth levers for international dairy brands seeking relevance—and resilience—in the evolving Asian market.

https://www.foodnavigator-asia.com/Article/2025/05/07/demand-for-protein-rich-products-and-flavoured-cheeses-are-trending-in-asia/



Sugar Reduction In Chocolate Compound By Replacement With Flours Containing Small Insoluble Starch Granules

This study, published in the Journal of Food Science (2024), explores an innovative strategy to reduce added sugars in chocolate compound by partially substituting sucrose with flours containing insoluble starch granules—specifically, oat and sweet rice flour.

The overarching goal was to maintain the physical texture and sensory appeal of chocolate while responding to consumer demands for lower sugar confections, a trend intensified by regulatory developments like the FDA's added sugar labelling mandate.

The researchers conducted two main studies. In the first, they produced six chocolate samples: a control with 54% sucrose; four sugar-reduced variants (with either 25% or 50% sucrose replaced by oat or rice flour); and one sample with unaltered sucrose content but reduced refining time. These were evaluated via a Difference from Control (DFC) sensory test—both with and without nasal occlusion—to differentiate taste from texture.

Results indicated that replacing 25% of sucrose with either flour did not yield perceptible differences compared to the control, regardless of nasal condition, suggesting minimal impact on mouthfeel or sweetness intensity. In contrast, 50% replacements were significantly differentiated, primarily due to texture deviations. Rice flour tended to produce chalkiness, while oat flour imparted a smoother, creamier texture—findings supported by open-ended consumer comments.

Study two assessed hedonic acceptance of the control and the two 25% sugar-reduced variants. While rice flour negatively affected consumer liking—especially on texture—chocolates with oat flour were rated comparable to the control across all attributes (overall liking, flavour, texture, sweetness). Notably, oat flour also retained sweetness perception despite reduced sucrose levels.

Instrumental analysis (rheology and particle size distribution) showed that oat flour's starch granules closely matched cocoa particle sizes, aiding texture mimicry. The oat flour chocolate maintained similar yield stress and viscosity, reinforcing its compatibility as a sugar-replacing bulking agent. Interestingly, the textural likeness correlated more strongly with yield stress than particle size alone.

Ultimately, the study concludes that 25% sucrose replacement using oat flour can deliver a chocolate product with preserved sensory quality and consumer acceptance—without compromising texture or sweetness. The authors note, however, that nutritional benefits such as glycemic impact remain speculative and warrant further investigation. https://doi.org/10.1111/1750-3841.16923

Nutresa In Colombia Launches Low-cost Chocolate To Recover Consumers Affected By Cocoa Price Hike

Faced with the impact of the global increase in cocoa prices, Grupo Nutresa, through its subsidiary Compañía Nacional de Chocolates, is launching a new, cheaper line of table chocolate in Colombia: La Especial Ahorramax.

Share This initiative seeks to win back consumers who have stopped acquiring this traditional product due to its high cost, especially in regions where the daily consumption of hot chocolate is an ingrained custom. Mauricio Madrid, head of Beverage Marketing in Colombia for the company, explains that the consumption of table chocolate has decreased significantly in the country due to the sustained rise in international cocoa prices.

Grupo Nutresa's latest move in Colombia underscores an adaptive strategy shaped by economic pressures and shifting consumer needs. In response to the global cocoa price surge, which has notably dampened consumption of traditional hot chocolate—a staple beverage in many Colombian households—the company's subsidiary, Compañía Nacional de Chocolates, has introduced *La Especial Ahorramax*. This is a low-cost table chocolate designed to restore affordability without compromising consumer expectations around flavour and texture.

The cost reduction hinges on a reformulated recipe: by substituting cocoa liquor (the most expensive component in traditional table chocolate) with a blend of cocoa powder, sugar, and palm kernel oil, Nutresa achieves significant savings while preserving hallmark sensory traits like aroma, sweetness, and characteristic foam. The initiative is strategically branded under *La Especial*, a well-established name with high consumer trust in Colombia's central regions, which gives the launch immediate cultural and commercial credibility.

Nutresa currently commands 43.5% of the table chocolate market, and this budget-friendly variant is projected to increase *La Especial*'s share from 6% to 11%, reinforcing Nutresa's market leadership.

Beyond economic value, the group is also betting on health-focused innovation. Its Lyne brand (previously *Chocolyne*) caters to Colombia's growing segment of health-conscious consumers seeking low-sugar but indulgent chocolate options. With a 65% share in the diet table chocolate niche, Lyne is promoted through inclusive messaging that challenges traditional beauty norms and empowers buyers with accessible wellness choices.

In totality, Nutresa's dual strategy—economic relief through *Ahorramax* and health positioning via Lyne—reflects its nuanced understanding of Colombian market dynamics. It bridges affordability and aspiration, cushioning economic shocks while embracing progressive shifts in consumer behaviour.
https://www.foodnewslatam.com/paises/77-colombia/16350-nutresa-en-colombia%20lanza-chocolate-de-bajo-costo-para-recuperar-consumidores-afectados-por-alza-del-cacao.html

Dairy-derived Ingredients

The stars are aligned for dairy-derived ingredients like milk powders and whey protein to shine.

Fired up by greater awareness of dairy's nutritional advantages and consumer demand for protein and functional ingredients, the $63.5 billion global dairy ingredients market will see a compound annual growth rate (CAGR) topping 6.3% from 2025 to 2034, projects Global Market Insights.

This piece from Food Technology Magazine offers an expansive snapshot of how dairy-derived ingredients are evolving to meet both nutritional science and shifting consumer demands. The projected growth rate—6.3% CAGR for the global dairy ingredients market from 2025 to 2034—is underpinned by powerful drivers: protein demand, clean-label expectations, gut health science, and an aging population increasingly focused on functional foods.
Milk powders continue to dominate, particularly in confectionery, but their reach is expanding into sports nutrition and RTD formats. Notably, skim milk powder is finding new applications in hot drinks and spreads, indicating a trend toward indulgent yet fortified formulations.

The whey protein segment is even more dynamic, with a projected 10.5% CAGR to 2030. While whey protein concentrate (WPC) remains a workhorse, the modest decline in WPC-containing launches reflects competition from alternative proteins rather than diminished functional value. However, sub-fractions like whey protein phospholipid concentrate (WPPC), glycomacropeptide (GMP), and lactoferrin

represent the future of specialized nutrition—offering benefits tied to immunity, microbiome modulation, and lean mass preservation.

The glossary serves as a technical touchpoint for practitioners, covering everything from basic milk protein fractions to bioactive peptides formed through renneting or hydrolysis. These are no longer niche—they're increasingly being woven into mainstream formulations, especially as consumers adopt GLP-1 agonists, triggering a boom in protein fortification across demographics.

https://www.ift.org/news-and-publications/food-technology-magazine/issues/2025/may/columns/ingredients-illustrated-milking-it-dairy-derived-ingredients

MSG Is Back On The Table

Once demonized under the specter of "Chinese Restaurant Syndrome"—a label now broadly debunked—MSG is being reappraised by chefs, writers, and food scientists.

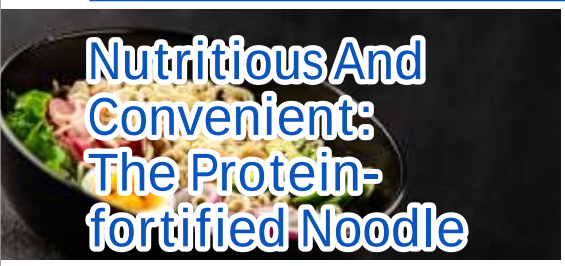
The author begins with a personal anecdote: his wife prepares Sohla El-Waylly's cucumber salad with chili crisp and MSG, and its remarkable savouriness prompts reflection on MSG's culinary power. This sets the stage for a deeper discussion on how MSG contributes umami, making dishes more palatable without overt saltiness.

The article highlights new cookbooks embracing MSG, like El-Waylly's Start Here, which advocate for its thoughtful use as a flavour enhancer. It also outlines the science: MSG is simply the sodium salt of glutamic acid—an amino acid found naturally in many foods. The fears around it, particularly in the U.S., stem from a 1969 letter to The New England Journal of Medicine and the resulting media panic. Subsequent double-blind studies have failed to confirm widespread adverse effects from MSG ingestion for the general population.

Yet, Ray acknowledges anecdotal reports from individuals who claim sensitivity, citing migraines, chest pressure, or indigestion. One reader shares a long history of symptoms tied to MSG consumption, while other commenters challenge this with psychosomatic explanations, referencing the prevalence of glutamates in everyday foods.

The piece touches on broader themes of culinary xenophobia, clean-label marketing, and scientific literacy. While some still view MSG with caution, its resurgence in kitchens and cookbooks suggests that attitudes are shifting—flavour first, stigma second.

https://www.wired.com/story/msg-is-back/



Nutritious And Convenient: The Protein-fortified Noodle

While college students in the past relied on instant noodles with little to no nutritional value, tech company-turned-food manufacturer Borealis Foods identified a white space for Gen Z consumers looking for affordable and nutritious foods on the go made with US ingredients.

Borealis Foods' instant ramen brand Chef Woo Ramen contains protein-enriched dough from legumes, such as yellow peas, and various grains, and is also vegan, shared the company's CEO and Founder Reza Soltanzadeh during Future Food Tech-San Francisco last month.

Borealis Foods' reimagining of instant ramen through its Chef Woo Ramen brand signals a new frontier in convenient nutrition, targeting Gen Z's appetite for clean-label, globally inspired, high-protein meals. As outlined in FoodNavigator-USA, the product leverages a protein-enriched, vegan dough derived from legumes (notably yellow peas) and grains—tapping into the functional food space while keeping preparation and affordability at its core.
The company's pivot from food science R&D to consumer-packaged goods in 2019 was enabled by existing infrastructure at Palmetto Gourmet Foods in South Carolina. This domestic, vertically integrated supply chain allows Borealis to maintain cost control and buffer against global disruptions and tariffs—a strategic edge amid rising protectionism and post-COVID supply fragility.

Flavour-wise, Chef Woo Ramen offers comfort and diversity—think Thai Lemongrass, Sweet Chili Togarashi, Braised Beef, Spicy Tequila Lime, and Roasted Chicken—aligned with younger consumers' growing preference for multicultural palettes. Price-wise, it retails for about $1.67 per cup (12-pack), undercutting comparable "better-for-you" ramen brands such as Huel ($4.95/cup) and Vite Ramen ($6.97/cup), while offering competitive protein and fibre profiles.

What's particularly compelling is the behavioural shift Soltanzadeh describes: teenagers now read Nutrition Facts panels closely, assessing protein quality, sugar levels, and net carbs—suggesting a more informed generation of snackers. In this context, fortified noodles represent both a practical meal and a pedagogical tool in nutritional literacy.

https://www.foodnavigator-usa.com/Article/2025/04/30/borealis-foods-fortified-ramen-taps-gen-z-consumers-with-a-us-supply-chain/

UPF and NOVA should be 'banned' from use in Food Science

The fightback against the misuse of ultra-processed food (UPF) and NOVA classification terminology to demonise food and drinks confused as 'unhealthy' by consumers has begun.

An open-letter penned and signed by leading academics and nutritionists, Professor Dr Daniel Hannelore and Professor Thomas Henle, calls out the problems caused by improper use of the terms and urges food and nutrition scientists to stop using UPF and NOVA in their work. "This view is primarily based on populist and sometimes sensationalised portrayals of findings from observational studies, which report presumed positive associations between UPF consumption and various diseases – or even a higher mortality risk – in large cohorts across different countries," the open letter reads.

As a result of the rhetoric, but not limited to, around two-thirds of European consumers now believe UPF consumption is bad for health and contributes to obesity, diabetes and other diseases. "We do not represent the side of industry, but that of science," said Henle. "Science must be objective, neutral and verifiable. The NOVA classification and the term 'ultra-processed food' do not meet these criteria."
The FoodNavigator-USA article captures a provocative moment in nutritional discourse: two prominent German scientists, Professor Daniel Hannelore and Professor Thomas Henle, have issued an open letter urging their peers to abandon the use of "ultra-processed food" (UPF) and the NOVA classification system in scientific research and policy debates.

Their core argument is that both the term UPF and the NOVA system lack scientific rigor and objectivity. According to the letter:
Observational studies linking UPF intake to health risks (e.g., diabetes, obesity, and mortality) are frequently over-interpreted and misrepresented in media, leading to widespread consumer alarm.

The NOVA classification, especially Group 4 (UPF), is said to be subjective, lacks reproducible criteria, and was conceived with a political agenda—specifically to critique large food corporations allegedly focused on profit. Foods as varied as wholegrain bread, baby foods, and plant-based beverages are lumped together with sodas and sausages, obscuring meaningful nutritional distinctions.
They caution that the oversimplified demonization of processed foods risks sidelining ingredient-level and nutrient-level analyses that are foundational to sound nutritional science.

The authors contend that this framework inhibits open scientific discussion, especially when critics are dismissed as industry-aligned. They call for a pivot toward evidence-based assessments, advocating nutritional recommendations grounded in composition and health impact rather than processing labels.

https://www.foodnavigator-usa.com/Article/2025/05/13/upf-and-nova-should-be-banned-from-use-by-food-scientists/

REGULATORY NEWS

Clean Label Trends: European Consumer Insights

Consumer demand for transparency, health, and naturality is driving the popularity of clean label products. With a growing emphasis on knowing what goes into their food, consumers are looking for items made from recognizable, simple, and minimally processed ingredients.

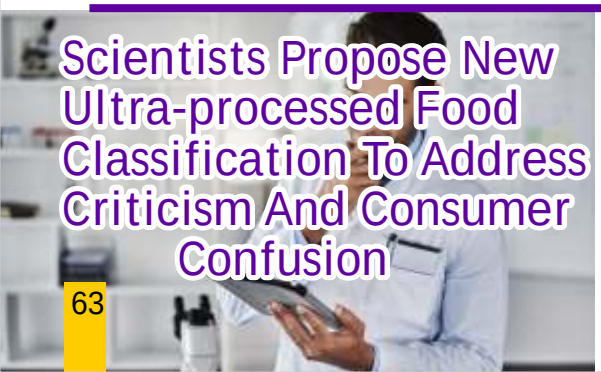
Innova Market Insights' Innova360 research highlights the demand for sustainability and authenticity, driving clean label trends and innovation across the food industry.

Consumers in Europe are increasingly focusing on clean label products, with a growing preference for natural and unprocessed F&B products with established health benefits. Over the past year, they have increasingly associated healthy food and beverages with being fresh and natural.
Moreover, 1 in 2 consumers reveal they purchased more fresh and unprocessed products during the same period, and 66% cite natural foods and ingredients as essential for a healthy, balanced diet. This shift toward natural foods reflects a growing awareness of healthier alternatives and a rising trend toward reducing the consumption of processed foods.

European consumers are driving a robust shift toward clean label products—those made with recognizable, natural, and minimally processed ingredients. This movement stems from growing concerns about transparency, health, and sustainability. Over the past year, more than half of consumers have increased their purchases of fresh, unprocessed items, with 66% prioritizing natural ingredients as key to a balanced diet. Alongside this, many actively limit sugar, salt, fat, and artificial additives, and choose snacks based on labels highlighting "natural," "nutrition-boosting," and "no preservatives."
Food manufacturers are responding, with 35% of recent product launches in Europe featuring clean label claims. Popular claims include ethical-environmental, organic, additive-free, and GMO-free attributes. Categories seeing rapid growth include meat substitutes, hot drinks, desserts, and confectionery—often in tandem with plant-based innovation and fiber-rich formulations.

Ingredient transparency and trust play a central role in purchasing decisions, with many consumers favoring products featuring raw, locally sourced, or artisanal components. They're also showing a willingness to try unfamiliar ingredients, provided they're natural and provide clear benefits. Sustainability adds another layer to clean label appeal; botanical flavors and eco-friendly sourcing practices are gaining attention, with some consumers even willing to pay a premium for such qualities.

The next generation of clean label innovation emphasizes shorter ingredient lists and clarity about product origins, supported by digital tools like scanning apps for provenance verification. These products increasingly address "free-from" needs while focusing on nutrient enrichment, high-protein content, and plant-derived options that match evolving expectations around health and environmental impact.
https://www.nutritioninsight.com/news/innova-market-insights-clean-label-trends-european-consumer-insights-innova360.html



Scientists Propose New Ultra-processed Food Classification To Address Criticism And Consumer Confusion

Researchers propose a new system to address criticism that the current widely adopted classification for foods' processing levels, Nova, is too broad or vague.

Through a more nuanced approach, the development team says the new system distinguishes ultra-processed foods that may contribute to a healthy diet, such as fortified foods.

The alternative was developed by US-based WiseCode, a company that has developed an app to provide consumers with information on ingredients found in packaged foods. The proposed scoring system considers an assessment of the associated health risks of ingredients based on scientific understanding, calorie share from added sugars, and ingredients with known health concerns.

The newly proposed food processing classification by WiseCode marks an attempt to inject nuance into a landscape long dominated by the Nova system, which critics argue casts too wide a net under the label of "ultra-processed." Nova's four-tier framework—ranging from minimally processed to ultra-processed—has been foundational in guiding policy and consumer awareness, yet its lack of differentiation among processed foods with varying nutritional profiles has led to frustration in both research and regulatory circles.

WiseCode's alternative system refines this approach by integrating the degree of processing, nutrient composition, and potential health risks of individual ingredients. Their model draws on data from over 100,000 commercial products and more than 5,000 ingredients, ultimately segmenting food into five categories: minimal, light, moderate, ultra, and super-ultra processed. Under Nova, over 95% of those products would land in the ultra-processed category. WiseCode, in contrast, achieves a more even distribution—allowing plant-based alternatives, fortified cereals, or high-fiber breads to be evaluated more contextually than candy bars or sugar-laden beverages.

Richard Black, WiseCode's chief scientific officer, explains that their method assesses not only processing techniques, but also added sugar levels, artificial ingredients, and known health concerns. Their mobile app allows consumers to scan packaged foods and receive feedback on where a product lands on this spectrum. While promising, experts like Amanda Avery from the University of Nottingham caution that the system still lacks robust validation. The app's efficacy in changing consumer behavior or influencing manufacturing remains to be demonstrated in peer-reviewed studies.

Still, the direction is clear: ultra-processing alone does not equal unhealthy, and nutrient profiling must be coupled with formulation complexity to guide health-promoting choices. WiseCode joins other tools like GroceryDB in offering accessible food transparency, and its evolving database hints at dynamic integration with emerging science—potentially including gut microbiome impacts, additive tolerances, or novel ingredient profiles.

https://www.nutritioninsight.com/news/ultra-processed-foods-new-classification-nova.html

FDA Greenlights Lutein Ingredient For Infant Nutrition

The US FDA has recognized OmniActive Health Technologies' Lutemax Free Lutein for its use in infant formula. This GRAS (generally recognized as safe) clearance allows the inclusion of the botanical ingredients specialist's flagship lutein ingredient in the highly regulated early-life nutrition category.

Lutemax Free Lutein is made from marigolds, an edible flower that has been long utilized for its high lutein content and is grown using sustainable practices from non-GMO seeds. The ingredient is produced through a fully vertically integrated supply chain for traceability and transparency.

The FDA's response positions it as a new option for infant formula manufacturers looking to address growing consumer and pediatric demand for ingredients that help support vision and brain health.

The FDA's recognition of Lutemax Free Lutein for use in infant formula represents a significant milestone in early-life nutrition—and quite a strategic advance for OmniActive Health Technologies. This lutein ingredient, derived from sustainably sourced marigolds, now meets GRAS safety standards for infants, allowing manufacturers to bring formulas closer to the nutritional profile of breast milk, where lutein is naturally abundant.

What's notable here is the combination of safety validation and functional relevance.

Lutein is a major carotenoid in both the retina and brain, accumulating during pregnancy and infancy when visual and neural development are most rapid. OmniActive's portfolio, including Lutemax 2020 and Lutemax Kids, already has clinical backing for benefits like blue light filtration, memory support, and visual acuity enhancement. This new GRAS clearance specifically bridges a nutritional gap for formula-fed infants who may lack adequate lutein due to limited maternal dietary intake.

From a regulatory standpoint, this approval reflects OmniActive's capacity to navigate the complexities of infant nutrition compliance—arguably one of the most tightly regulated domains in food science. It also showcases the power of ingredient vertical integration and traceability, both increasingly demanded by pediatric professionals and informed parents.This move may signal broader ingredient innovation in infant formulas targeting cognition, immune priming, and gut-brain axis support.

https://www.nutritioninsight.com/news/fda-omniactive-lutein-vision-eye-sight-supplements-infant-nutrition.html

Front-of-pack Warning Labels Don't Lower Obesity Rates

As the FDA mulls interpretive food warning labels, a Georgetown University study shows these schemes have been powerless to halt obesity trends.

In an attempt to tackle stubbornly high adult obesity rates over 40% in the US, the FDA is advancing a proposed front-of-pack (FOP) label that highlights whether a food or beverage contains low, medium or high levels of sugar, saturated fats and sodium.

But a new study from Georgetown University titled *Can Front-of-Pack Product Labeling Fix the Obesity Crisis* says that the FDA has not learned the lessons from other countries using such interpretive food warning labels: there is no hard evidence that they have been effective in improving consumer diets or in arresting rising obesity rates.

Despite widespread implementation in countries like Chile, the UK, and France, the evidence suggests these labels don't alter overall dietary habits, especially among those most affected.

Part of the issue is behavioural. The consumers most at risk—those with overweight or obesity—tend not to engage with nutritional information at all. So even if labels are present and clear, they're not reaching the intended audience. And because the labels only address packaged foods, they neglect a significant source of caloric intake: away-from-home meals, which are notoriously hard to track and regulate.

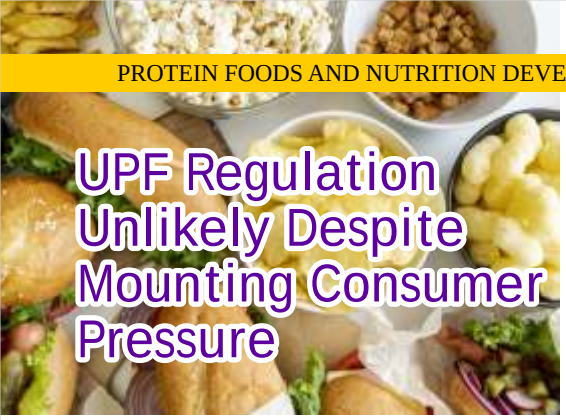
Chile's experience is telling. Despite introducing sugar taxes, warning labels, and advertising restrictions in stages since 2014, obesity rates have climbed steadily year after year. The Pan American Health Organization now projects the country's overweight and obesity rates could approach 87% by 2030. It's not that people are unaware—it's that awareness alone is insufficient to drive sustainable change.

So where does that leave policymakers? This study argues that a far more effective approach might be portion control. Offering indulgent products in smaller, single-serve formats allows consumers to enjoy the foods they love, but in moderation.

And because it doesn't require sweeping behavioural changes—just a nudge toward better habits—it may hold more promise as a scalable intervention. Interestingly, nearly half of consumers are already gravitating toward smaller portions to curb hunger and eat more healthfully.

https://www.forbes.com/sites/hankcardello/2025/04/30/new-study-front-of-pack-warning-labels-dont-lower-obesity-rates/

Fig: Chile black stop sign food labels depict high levels of calories, sugars, sodium and saturated fats



UPF Regulation Unlikely Despite Mounting Consumer Pressure

Think-tank says growing calls for stricter regulations on ultra processed foods won't succeed Consumers across Europe are increasingly concerned about the impact of ultra-processed foods (UPF), believing them to be damaging to health and the environment, and leading to growing calls for tighter regulation.

A recent study covering 14 European countries found just 35% of consumers trust that UPFs are safe under current regulations. 65% meanwhile feel that further regulations were required. Despite this, analysts at think-tank Nesta, believe arguments for stricter regulations on UPFs are "weak" and unlikely to bring about enforcement.

The article argues that while public concern over ultra-processed foods (UPFs) is rising across Europe—driven by health and environmental anxieties—the case for dedicated regulatory action remains weak according to Nesta, a UK-based think tank.

Despite 65% of surveyed consumers calling for greater regulation, Nesta suggests that existing frameworks targeting high-fat, salt, and sugar (HFSS) products already cover the majority of UPFs. Their UK supermarket data analysis revealed that 64% of UPF calories were linked to HFSS items, rising to 78% when staples like bread and yoghurt (often nutritionally neutral) were excluded.

Central to the regulatory debate is the NOVA classification system, which has come under scrutiny for its broad and often ambiguous categorization. Critics argue it fails to account for the nutritional value of certain products—yoghurt being a prime example—and lacks scientific precision necessary for policy enforcement.

In response, some players like Zoe have proposed alternative scoring systems, such as the Food Risk Scale, to differentiate health impacts within UPF categories.

While Nesta advises against new UPF-specific regulation, it encourages governments to apply pressure on retailers to improve the overall healthfulness of shopping baskets, rather than expanding ambiguous regulatory categories.

https://www.foodnavigator.com/Article/2025/04/25/case-for-ultra-processed-foods-regulation-is-weak/

Brazzein Sweetener Gets Fda Green Light As Sugar-reduction Momentum Grows In Confectionery

Bestzyme's next-gen sweet protein secures GRAS status, unlocking new potential for sugar-reduced chocolate and confectionery innovation as brands meet demand for healthier indulgence Functional protein specialist Bestzyme has received GRAS (Generally Recognised as Safe) approval from the US Food and Drug Administration (FDA) for its flagship sweetener, MelliaBrazzein – a milestone that opens up fresh opportunities for reduced-sugar formulations in confectionery.

The FDA's "No Questions" letter, issued on April 26, 2025, confirms the agency has no safety concerns about Brazzein for its intended use as a general-purpose sweetener. Produced using precision fermentation, MelliaBrazzein is derived from a naturally occurring sweet protein found in the fruit of the West African oubli plant. It has been developed for industrial-scale application across categories including chocolate, where reducing sugar without compromising taste and texture remains a key challenge.

Brazzein's FDA GRAS approval marks a significant inflection point for sugar reduction in confectionery, not simply because it offers sweetness without calories—but because it embodies three converging innovation vectors: metabolic health, clean-label formulation, and precision fermentation.

Mellia Brazzein's appeal lies in its ability to replicate sweetness intensity and mouthfeel while being gut-friendly and metabolically inert. Its digestibility and non-glycemic profile directly address consumer concerns around glucose spikes and microbiome disruption—concerns that are increasingly shaping health-forward indulgence decisions.

What's especially relevant is how Brazzein modulates flavour, enhancing or smoothing taste profiles rather than merely sweetening—a departure from the bluntness of many synthetic alternatives.

The industrial scalability via precision fermentation is equally pivotal. By using genetically modified microbial systems, producers can sidestep agricultural limitations, enhance sustainability, and gain tighter control over consistency and purity. This supports both regulatory expectations and formulation performance, especially in applications like chocolate where rheology and crystallization play critical roles.

From a regulatory lens, GRAS approval underscores FDA's openness to next-gen ingredients as long as safety and substantiation align. Yet uptake elsewhere—like under EFSA or FSSAI—will hinge on local frameworks around novel proteins, biotech-derived ingredients, and allergenicity assessments. If Indian and EU regulators harmonize around such proteins, Brazzein may well catalyse a wave of precision-fermented sweetener submissions and fortify regulatory precedents.

As for consumer resonance, Brazzein straddles indulgence and functionality—an increasingly lucrative duality in product positioning. Whether it's paired with fibre (as Nestlé is doing) or used in hybrid sweetener matrices to achieve progressive sugar reduction, it offers both an R&D platform and a marketing story.
https://www.foodnavigator-usa.com/Article/2025/05/02/brazzein-sweetener-receives-fda-approval-as-sugar-reduction-demand-rises-in-confectionery/

Traceability and Food Safety, the Strategic Role of Agtech in Ensuring Safe And Sustainable Food

The global demand for safe, sustainable food with verifiable information on its origin has put agri-food traceability at the centre of the production agenda.

Beyond a simple commercial requirement, it has become a key pillar to guarantee food safety, transparency of agricultural practices and compliance with international standards. Share In this context, AgTech technologies emerge as essential allies to build more reliable food systems, both for consumers and markets. During the panel "Food value chain, traceability and market access", organized by the European Union in Argentina, specialists from the public and private sectors and the entrepreneurial ecosystem analysed how digitalization can boost safety and open up new opportunities for producers.

Traceability as a guarantee of safety and reliability
Traceability allows us to follow the journey of a food from its primary production to the final consumer. Not only does it respond to the need to know its origin, but it also requires details on agricultural practices, inputs applied, post-harvest handling, transport and storage conditions. This information is vital to ensure safety: quickly identify potential contaminations, make efficient recalls and prevent health risks.

The article highlights how Argentina is embracing AgTech to reimagine traceability and food safety as essential pillars of its agri-food ecosystem. With rising global demands for transparency, digital solutions are no longer optional but foundational to market access, consumer trust, and sustainable production.

At its core, traceability is being elevated from a compliance function to a strategic differentiator—tracking food from farm to fork, with granular details on production, inputs, and transport. According to Gabriela Tallarico of INTA, digitalization is now "the language of global trade," underscoring its role in sustainability and competitiveness.

AgTech innovations—ranging from smart sensors and blockchain platforms to AI-enhanced data systems—are revolutionizing how safety data is captured and authenticated. Yet, a major challenge persists: uneven adoption. Large producers are reactive; SMEs face barriers in resources, digital literacy, and scalability. Experts warn that effective traceability isn't about buying machines—it's about integrating technologies with strategic intent and trained personnel.

Scalability is a key concern, especially for bulk commodities like soy and corn. Gustavo Idígoras of VISEC stresses the need for uniform traceability frameworks backed by credible certification and state support. Failure to comply risks exclusion from critical global markets.

What stands out is a shift toward holistic traceability—tracking not just origin, but the ethics and environmental impact of production. Animal welfare, water and carbon footprints, and regenerative agriculture metrics are emerging as the next frontier. AgTech must become the interpreter of nature's signals, as Tallarico puts it, helping stakeholders anticipate and validate complex sustainability indicators.

https://www.foodnewslatam.com/paises/73-argentina/16339-trazabilidad-e-inocuidad-alimentaria,-el-papel-estrat%C3%A9gico-de-las-agtech-para-garantizar-alimentos-seguros-y-sostenibles.html

FSSAI Proposes Stricter Rules For Dairy Analogues

The article outlines proposed regulatory changes from the Food Safety and Standards Authority of India (FSSAI) aimed at curbing consumer confusion and potential misuse of dairy analogue products—namely plant-based or synthetic alternatives that mimic traditional dairy foods.

Triggered by media reports indicating that such analogues are being misrepresented and sold as genuine dairy products, FSSAI is seeking to enforce clearer labelling, naming conventions, and licensing rules. One key proposal is to require pre-packaged labels to explicitly identify the type of analogue used (e.g., "analogue of cheese") followed by its component ingredients in descending proportion. For the food service industry—including restaurants and caterers—menus would need to clearly indicate when a dairy analogue is used, such as "analogue of paneer," to ensure informed consumer choices.

To tighten control, loose sales of dairy analogues would be prohibited, and only larger-scale businesses (not petty food enterprises) would be permitted to manufacture them.

This would increase accountability and reduce risks associated with unregulated production. Overall, these measures reflect India's broader push to harmonize standards for plant-based and synthetic food products, while safeguarding consumer rights and market integrity.

https://www.foodnavigator-asia.com/Article/2025/05/07/fssai-proposes-tighter-controls-on-dairy-analogues/

FDA approves 3 natural food dyes amid reformulation push

The palette of approved natural food colours expands, as major food and beverage companies reformulate ahead of a 2026 deadline The FDA approved three natural food dyes, following petitions from Sensient, Innophos and Fermentalg, as the agency works to remove all petroleum-based food dyes from the food system by the end of 2026 in collaboration with food and beverage companies.

This article from FoodNavigator-USA outlines a significant development in FDA's strategy to phase out synthetic, petroleum-based food dyes in favour of natural alternatives—a move with profound implications for product reformulation, consumer perception, and regulatory alignment.

Three newly approved natural dyes are highlighted:
Butterfly Pea Flower Extract – Long used in beverages, it's now allowed in savoury snacks like chips and crackers. Its vibrant blue and purple hues are likely to gain traction in clean-label reformulations.

Calcium Phosphate – Approved for use as a white pigment in confectionery and some ready-to-eat meat products. Its inorganic nature may raise discussions on the definition of "natural," given consumer sensitivities.

Galdieria Extract Blue – Sourced from unicellular red algae, this biologically derived pigment bridges biotechnology with natural coloration and will be used in breakfast cereals, frostings, and frozen treats.

These approvals come amid broader FDA efforts to accelerate colour additive evaluations under Section 721 of the Federal Food, Drug, and Cosmetic Act, including exposure assessments and toxicological reviews.

The agency's actions are framed within a wellness-oriented narrative, as echoed by HHS Secretary Robert F. Kennedy's remarks about removing dyes with no nutritional value.

Critically, the FDA's regulatory momentum appears partly shaped by state-level initiatives, especially California's ban on Red Dye No. 3 and other additives, with nearly 30 states proposing similar laws. This evolving dynamic—where states catalyse national reform—may redefine federal oversight strategies, particularly as resources remain limited. As noted by FDA officials, the agency might increasingly "follow rather than lead" in chemical safety review priorities.

https://www.foodnavigator-usa.com/Article/2025/05/12/fda-adds-3-natural-food-dyes/

Danish Decision Presents Fresh Opportunities For MFGM

Milk fat globule membrane (MFGM) can be used beyond the infant formula category across the EU after Danish authorities confirmed it is not a novel food.

Dairy manufacturers have welcomed the decision, saying it opens up opportunities not just in Europe but potentially in other markets too.The decision from the Danish Veterinary and Food Administration (DVFA) allows for MFGM to be declared clearly on products for both infants and adults.

The Danish Veterinary and Food Administration's (DVFA) recent decision clarifying that bovine whey protein concentrate containing milk fat globule membrane (WPC MFGM) is not a novel food under EU regulations could reshape the strategic landscape for functional nutrition developers.

This ruling affirms that WPC MFGM—obtained via membrane filtration and widely used pre-1997—is eligible for inclusion in food formulations for infants and adults without undergoing the costly and time-consuming novel food approval. That opens doors not only in Europe but potentially in regulatory frameworks that take cues from the EU, such as parts of the GCC or ASEAN regions. It's especially notable for manufacturers aiming to formulate clean-label cognitive and gut-health-enhancing products using dairy-derived bioactives.

From a compositional standpoint, this version of WPC has 2–4 times the fat content of standard WPC and contains higher concentrations of key bioactive lipids like phospholipids and sphingomyelin—both integral to neural and cellular health. Its low lactose content (10–12x lower than regular WPC) and rich lipid profile make it a more compatible matrix for elderly nutrition or gut-sensitive populations.

Arla Foods Ingredients' commentary underscores growing interest in the cognitive potential of MFGM, not just in infants but in aging populations—a translational opportunity from perinatal to geriatric care. With emerging research showing improvement in both short- and long-term memory, and campaigns like Whey360 underway, the functional dairy space could see a new wave of product innovation centred around this bioactive.

https://www.vitafoods.com/childrens-health/danish-decision-presents-fresh-opportunities-for-mfgm

Ashwagandha: Europe's Botanical Benchmark For Safety And Efficacy

This feature reads like a masterclass in how traditional botanical ingredients can be anchored within modern scientific and regulatory frameworks.

KSM-66's positioning as a gold standard in ashwagandha extracts isn't merely branding—it's built on a remarkable matrix of Ayurvedic fidelity, clinical validation, and sophisticated quality assurance.

The distinction between root-only and leaf-containing extracts is particularly consequential. Many manufacturers shortcut this with aerial parts that elevate withanolide levels but introduce cytotoxic compounds like withaferin A and withanone.

KSM-66's decision to adhere strictly to root-derived material aligns with both Ayurvedic tradition and safety expectations under EFSA and global regulators. Their use of DNA verification and HPTLC fingerprinting to authenticate purity strikes at the heart of widespread adulteration.

Equally notable is the extract's safety profile across multiple endpoints—hepatic, thyroidal, hormonal—validated via OECD and GLP protocols and supported by longitudinal human trials. Its non-disruptive endocrine action, particularly the normalization of TSH in subclinical hypothyroidism without overstimulation, suggests homeostatic support rather than pharmacological dominance—a desirable trait for adaptogenic agents. That it demonstrated safety at doses up to 4500 mg/kg bodyweight per day is a strong claim, likely to resonate well with regulators across Codex and FSSAI as botanical risk assessment frameworks mature.

There's also strategic brilliance in KSM-66's integration into thousands of SKUs globally. Its footprint across demographic cohorts—from children to athletes—strengthens its case not only as a therapeutic agent but as a versatile nutraceutical cornerstone.

https://www.vitafoodsinsights.com/botanicals-herbs/ksm-66-ashwagandha-europe-s-botanical-benchmark-for-safety-and-efficacy

South Korea to Implement Food Safety Self-inspection for Firms Using 'Simple Processing'

South Korea is implementing a self-inspection project for local food manufacturing companies that utilise 'simple processing' (Getty Images) Self inspections will now be allowed among South Korean food firms which utilise 'simple processing', in a bid to improve food safety.

The local Ministry of Food and Drug Safety (MFDS) announced the beginning of this initiative in May 2025, to first be piloted with food firms making pickled cabbage (a common precursor for kimchi-making) and dried kelp.

"This pilot project aims to strengthen the capabilities of local food firms that use simple processing methods to produce agricultural and marine products to perform self-inspections that will help them to meet national food safety standards and requirements," MFDS Minister Oh Yoo-Kyung said via a formal statement. "Simple processing refers to methods such as cutting, peeling, drying and washing, but where the original food ingredients can still be recognised for what they are.

South Korea's move to implement self-inspection for firms engaged in "simple processing" seems like a pragmatic shift toward risk-based, decentralized food safety governance—particularly in sectors dealing with low-risk products like pickled cabbage and dried kelp. What makes this noteworthy isn't just the pivot to self-regulation, but the deliberate framing of "simple processing" as a distinct category—one where the food retains recognizability and doesn't involve additive intervention, thus skirting the conventional boundaries of processed food classification.

From a regulatory architecture perspective, this echoes broader global trends toward tiered safety protocols where lower-risk food operations are managed with proportionate oversight. For MFDS, the challenge clearly involves scaling surveillance across over 3,000 enterprises with limited public health personnel—a familiar constraint in many jurisdictions post-pandemic.

The incorporation of multilingual self-inspection guidelines is also a culturally responsive step, given that foreign nationals comprise more than 70% of the workforce in these facilities. By leveraging self-monitoring tied to national standards and local authority audits, MFDS is essentially deputizing firms to be the first line of defence—an approach that could serve as a template for similar low-intervention segments in countries like India or Thailand.

This raises interesting questions for cross-border harmonization: Could Codex develop guidelines around "recognizably unprocessed" foods that account for ethnobotanical traditions and culinary preservation methods? And how might national regulators balance food integrity with public health safeguards when labour shortages and seasonal risks (like heat-related hygiene breaches) compound the challenge?
https://www.foodnavigator-asia.com/Article/2025/05/27/south-korea-to-implement-food-safety-self-inspection-for-local-firms-using-simple-processing/

Fssai Boosts Street Food Safety

The Food Safety and Standards Authority of India (FSSAI), under the Ministry of Health and Family Welfare, has intensified its nationwide efforts to ensure that every citizen has access to food that is safe, hygienic, and of good quality.

Through stricter enforcement, vendor training, certification programmes, and mobile testing units, the government aims to strengthen public trust in the food ecosystem. More than 3 lakh street food vendors and petty operators have been trained across India.

Training modules cover personal hygiene, safe cooking methods, prevention of contamination, waste disposal, and customer service standards. This initiative helps informal street food sellers improve both their hygiene practices and earning potential.

Vendor training and street hub certifications have improved hygiene and quality in public eating spaces. Mobile testing has made food safety enforcement more transparent and accessible.

FSSAI plans to expand certification to more hubs and introduce advanced digital tracking tools for real-time monitoring of food businesses.

This initiative by FSSAI reflects a significant evolution in India's public health and food safety landscape—especially in the informal sector, which has long been underserved yet deeply embedded in cultural and economic life.

The multi-pronged strategy outlined here—licensing, training, certification, and mobile testing—signals a shift from reactive enforcement to proactive capacity building.

The FoSTaC programme, for instance, is not just a compliance tool but a social upliftment mechanism. By training over 300,000 street vendors, FSSAI is helping transform hygiene practices while also enhancing livelihoods.

The certification of 405 Street Food Hubs under Eat Right India is particularly noteworthy. It introduces a tiered quality assurance model that could serve as a blueprint for harmonizing informal food sectors across jurisdictions.

These hubs, once certified, become visible symbols of trust—an important behavioural nudge for consumers and a reputational incentive for vendors.

Mobile Food Testing Labs (MFTLs) are another innovation worth highlighting. Their deployment in remote and rural areas democratizes access to food safety infrastructure, which has historically been urban-centric. These labs not only test food quality but also serve as educational platforms, reinforcing safe practices at the grassroots level.

From a regulatory standpoint, this initiative reflects a convergence of public health, consumer protection, and economic inclusion. It also opens up interesting questions around digital traceability, real-time monitoring, and how India might integrate these efforts with global standards like Codex or EFSA's hygiene directives.

https://www.msn.com/en-in/foodanddrink/other/fssai-boosts-street-food-safety-here-s-what-you-need-to-know/