



PFNDAI

# FOOD, NUTRITION & SAFETY MAGAZINE

BULLETIN FEB 2023

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# EDITORIAL

There was a news item in national dailies about government planning a big boost to the health sector in the country. Already the Finance Minister announced over 13% increase in the budget for health sector and there are also indications that government wants huge push to research in the area.

As per the reports, the government has decided to allow public and private medical college faculty and private sector R&D teams to use facilities in select ICMR laboratories for research.

Except in private sector, most research has been done for improving publication list in various educational and research institutions. More publications mean better chances of promotion. This can sometimes lead to researchers planning research for number of publications rather than finding something new and sometimes very useful.

There is now an opportunity for scientists to plan something really big, at times work in teams with researchers from other institutions and try to compete with global researchers at cutting edge research.

ICMR has plenty of funds which have been used to procure excellent research facilities. Educational institutions are starved of funds and can barely take up research to compete with scientists globally.

This can change now and professors can not only teach the modern subjects from health and nutrition, but also do some really useful research which in turn helps better understand and teach those subjects.

There should be a lot of flexibility between educational and government research institutions. The professors should spend some time in government labs doing research and some of the researchers there should try to teach a few courses. This would help both areas, education and research.

Science always keeps developing more and more as our understanding of it improves. We still don't know many things which are only discovered through research. This understanding must be taught to students who are going to be tomorrow's professionals. Thus both areas can contribute for mutual betterment. Interactions between teachers and researchers would certainly be highly productive.

It is hoped that this feeling among government officials also spreads in other areas besides medical and health. There are excellent facilities which can be used by a large number of scientists from educational and private research institutions for the progress of science in this country.

Prof Jagadish Pai,  
Executive Director, PFNDIA

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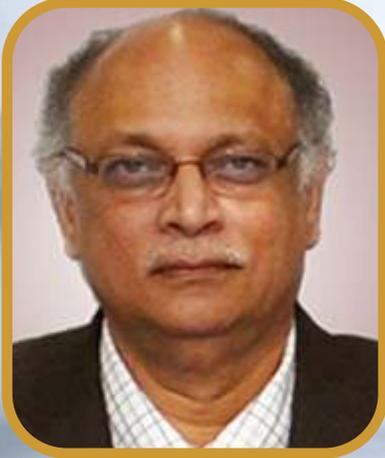
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# FOOD FOR THOUGHT OR THOUGHT FOR FOOD



AUTHOR

**Dr B Sesikeran,**

Former Director,  
National Institute of Nutrition (ICMR)  
Hon. Scientific Director, PFNDAI

Climate change is a reality now. Many countries are visibly being affected by the extremes of weather. The reason being, a progressive increase in the temperature on earth and this is directly related to amount of greenhouse gases that are generated not only by the use of fossil fuels but also by Agriculture activity.

Among the agricultural activities, livestock production is a major contributor but even rice cultivation can contribute to greenhouse gases to a smaller extent but by virtue of its large areas of cultivation it is also a significant contributor. Higher temperatures on earth will result in melting of glaciers, increase in ocean levels, higher ocean temperatures, soil erosion, soil salinity, severe droughts, unseasonal rains, higher precipitation with flooding and runoff of fertile soil, storage losses and so on and so forth, all ultimately challenging our food and nutrition security. It is projected that iron and zinc deficiency in food crops may go up about 20%. This would mean an additional 175 million zinc deficient, particularly children, about 122 million protein deficient as well. There would be about a 4% decrease in iron intake among the vulnerable population due to the deficient crops. It is well known that higher

temperatures not only reduce the productivity but also result in the reduction in nutrient composition.

Nature has provided us options probably in anticipation of such changes or due to evolutionary changes which have taken place millions of years ago when similar cycles of global warming took place. We have access to 2 kinds of crops a) C3 crops like rice wheat maize which require high amount of water and cannot withstand very high temperature nor can they survive in high levels of atmospheric carbon dioxide. b) C4 crops like Maize, Pearl millets, Sorghum etc, capable of efficient photosynthesis even under higher temperatures low water inputs as well as high atmospheric carbon dioxide levels. It is left to us now to shift towards higher millet cultivation and consumption. It is heartening to note that the United Nations has declared this year as the year of millets, responding to India's call and supported by 70 other nations. Even the union budget this year has given adequate resources to the institutions working in the area of Millet Research and also to promote the use and consumption of millets. The Harvest Plus program under the CGIAR has already developed several nutri-cereals, which are essentially millets with high nutrient content. This is through conventional breeding and development of hybrids between nutrient rich Millet varieties and Climate resilient varieties. They are iron rich, or high in zinc and some other nutrients like pro vitamin A as well. These need to be propagated on a large scale by enabling farmers to obtain good

incomes by shifting from rice and wheat to these millets. Millets are also being made available through the public distribution system. There have been concerns whether the high Phytate and high anti nutrient content in these millets are likely to inhibit micro nutrient absorption but studies done by NIN along with the Harvest Plus program have shown that the bioavailability of iron in these varieties of millets is comparable with the other food crops and is unlikely to compromise iron absorption. We also have modern technologies like genetic engineering, gene editing which could be used to fast track the production and cultivation of some of these high nutrient climate resilient crops. There is in addition a huge spin off benefit since millets are a good alternative to mitigate non-communicable diseases. They are beneficial to individuals who are obese to reduce their energy intakes and also for those with cardiovascular disease or type 2 diabetes mellitus to reduce their sugar and lipid absorption.

Let us hope that all these technologies together would increase the area under cultivation, also improve the quality of the Millet crops and industry would gear up to this situation in promoting the market for these crops. This year's budget also mentioned about providing resources to improve storage of food grains, which has been a problematic area all these years through conventional storage methods leading to food losses. Modern storage methods are required so that these Millet crops can be stored safely for a longer period of time. Food technology should gear up to improve the shelf life of Millet flour to minimize wastage due to shorter shelf life after milling. Collectively we can ensure food and nutrition security despite adverse environment.



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# REGULATORY VIEWPOINT

AUTHOR

**Dr Joseph I Lewis,**  
Chairman, Regulatory Affairs,  
PFNDIA



Food control systems are an encyclopedia of dedicated frameworks that set rules of how foods produced, processed, sold and consumed should comply. When a country adopts an internationally recognized framework, it signals the world that a compatible system is in place. It builds confidence in the independence of decision making and institutional capabilities. When government instructs institutions like FSSAI to work within recognized frameworks it endorses these frameworks and expects decision making to follow best practice knowingly and compliantly. Compliance is expected of both regulators and regulated.

The Codex Food Category System (FCS) is one such framework. It arranges foods according to a facet of things. A facet is a well-defined characteristic used to organize a complex subject into its sensible parts. Each category begins with the source (raw commodity), then moves up

the value chain from source-commodities (minimal processing), to composite foods. It follows not only a value addition facet but also a process logic, e.g., untreated, dried, frozen, canned, fermented or cooked. Everything is related by category descriptors. Because foods are so arranged - into categories - technological justification and condition of use are determinable while allocating food additives. Frameworks lock up structures for consumer safety and freedom to trade.

There is also recognition of the when, what and why we consume foods. How would otherwise stakeholders and regulators - involved in setting food standards - know, which is which and what is what? Most foods are eaten for enjoyment, many ordinarily eaten everyday as part of a meal. There are foods specially formulated, processed and prepared for a particular nutritional purpose that are part or total meal replacements; perhaps less enjoyed but necessary. Some foods - not represented as conventional foods - are taken in small unit doses (tablets, pills, capsules) to supplement the diet by increasing the total dietary intake. Mainly, three

consumption expressions are being used; foods ordinarily consumed by all, foods for a particular nutritional purpose and foods that supplement the diet. By categorizing all foods "as marketed", the FCS places them in a consumption context, even suggesting the occasion (breakfast cereals, ketchup, jam) or purpose of use (infant foods, complementary foods, sports nutrition, weight management). In a major contradiction with Codex methodology of allocating additives by category, supplements under proposed regulations are now being allocated by form.

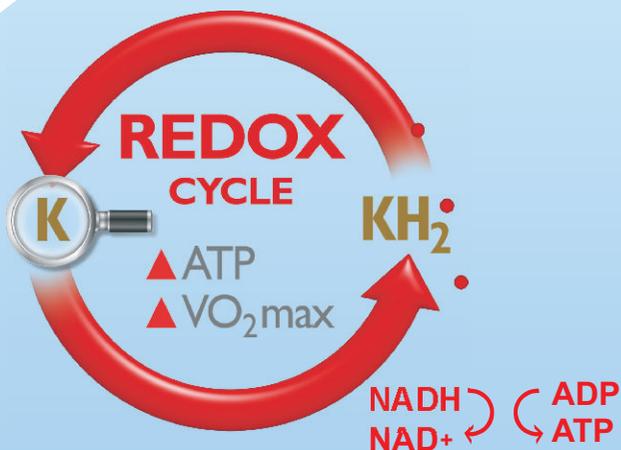
Regulatory drafting begins by adopting Codex. Its frameworks provide institutional design for governance and international legalization in trade. The FCS template for allocation of additives assists in estimating consumption-based exposures. It is scientific, open and transparent to business and regulators globally. When changes are made, inconsistent with context, the framework is dented. Constant tinkering finally dismantles the entire framework, until none exists. Understanding context, prevents unreasoned interference. For example, Codex places tomato puree, paste and ketchup in different categories for a reason. Beverage whiteners are placed in one sub category and excluded from others, yet India has them in two subcategories. The contextual facet is not clear. Frameworks provide safety, structure and equitable processes and should be preserved.

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# PERSPECTIVES ON PROTEIN QUALITY



**AUTHOR**

**Dr Shobha A. Udipi,**  
 Research Director and Head,  
 Hon. Director, Integrative  
 Nutrition and Ayurceuticals,  
 Kasturba Health Society-  
 Medical Research Centre,  
 Vile Parle (West), Mumbai -56

Proteins are essential for life as they are part of the numerous critical biological processes in the human body. Proteins are important for a variety of physiologic and metabolic responses including the accretion and maintenance of lean body mass/muscle tissue as well as bone.

Protein intake i.e. quantity and its quality can influence tissue turnover and tissue repair, the synthesis of numerous secretory proteins, hormones, peptides, immune factors and immune function, enzymes involved in metabolism of innumerable reactions including digestion, absorption, transport through carrier proteins, detoxification mechanisms and anti-oxidant defence systems. The amount of muscle and lean body mass

directly influence the physical work capacity and physical performance that includes sports and athletics.

In the long-term, protein quality influences several epochs during the life course comprising linear growth during infancy, childhood and puberty-menarche-adolescence, aging and age-related loss of muscle mass and bone, cognitive function and the prevention of several chronic degenerative diseases like cardiovascular disease, hypertension, cancer. Therefore, it is important to be able to accurately and objectively define protein quality as it not only has an important role in fulfilling

human nutrition requirements but for product development and at the national/global perspectives for formulation of nutrition policy, trade.

All dietary proteins are not similar. Their source/origin can be either of animal (non-vegetarian) or vegetable/plant origin. These proteins differ in their amino acid composition, particularly in the essential/indispensable amino acids and thus differ in their protein quality and ability to meet the requirements of the nine essential as well as the conditionally essential amino acids. Amino acid requirements depend upon age, stage of growth or physiological state as well as state of health/ disease condition. Also, proteins differ in their digestibility.





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Egg protein is generally regarded as the reference protein with which food proteins are compared. Egg protein has 100% digestibility. Several methods are used to measure protein digestibility as summarized in [Table 1](#).

The US FDA currently uses PDCAAS to measure the protein quality in most foods and the Canadian government uses the PER.



**Table 1: Measurement of Protein Digestibility and Protein Quality**

Measurement	Method
Protein Digestibility	
True Digestibility	<p>It is the proportion of the amount absorbed from the amount consumed and requires measurement of fecal protein.</p> <p>Determined by measuring the amount of N consumed and excreted. First, the obligatory losses of urinary and fecal N must be determined, after feeding nitrogen-free diets. This is followed by determination of the amounts of urinary and fecal N after consumption of the test protein.</p>
Biological value	Determined by calculating the nitrogen used for tissue formation divided by the nitrogen absorbed from food. The product is multiplied by 100 and expressed as a percentage of the nitrogen utilized.
Net protein utilization	Similar to biological value except that it involves a direct measure of retention of the absorbed nitrogen. Net protein utilization and biological value both measure the same parameter of nitrogen retention, however, the difference lies in that the biological value is calculated from nitrogen absorbed whereas net protein utilization is from nitrogen ingested.
Protein Quality	
Protein efficiency ratio (PER)	Measures weight gain of growing animals divided by the amount of protein consumed. This technique requires feeding rats a test protein and then measuring the weight gain in grams per gram of protein consumed. The computed value is then compared to a standard value of 2.7, which is the standard value for casein protein.
Net protein ratio (NPR)	<p>Calculated as the overall difference in gain (gain in weight of the test group plus loss in weight of the protein-free group) divided by the protein eaten.</p> <p>After four weeks of feeding the test protein, the ratio of weight gain to protein consumed is calculated as PER. The ratio of the weight gain in test animal plus the weight loss in control animal to the protein consumption by test animal gives the NPR.</p>
Protein digestibility corrected amino acid score (PDCAAS)	<p>Protein quality is determined by expressing the content of the first limiting essential amino acid of the test protein as a percentage of the content of the same amino acid content in a reference (scoring) pattern of essential amino acids</p> <p>Adopted by FAO/WHO as the preferred method</p> <p>This scoring pattern is derived from the essential amino acid requirements of the preschool-age child. The chemical score obtained in this way is corrected for true fecal digestibility of the test protein. PDCAAS values higher than 100% are not accepted as such, but are truncated to 100%.</p>
Digestible Indispensable Amino Acid score (DIAAS)	<p>Allows for calculation of the amino acid quality of food proteins that are based on ileal digestibility rather than total tract digestibility and values for each amino acid may be calculated.</p> <p>Recommended as the successor to their previous method: Protein Digestibility Corrected Amino Acid Score (PDCAAS).</p> <p>Determines the digestibility of each individual amino acid.</p>

A joint FAO/WHO Expert Consultation on protein quality has stated that there is a need to:

- ❖ Review the knowledge related to protein quality evaluation
- ❖ Discuss various techniques used for evaluation
- ❖ Specifically evaluate the method recommended by the Codex Committee on Vegetable Proteins (CCVP) including the amino acid score corrected for digestibility
- ❖ The amino acid score used—Some but not all proteins can be evaluated due to poor digestibility and/or availability.



The Expert Consultation also noted that methods currently used were established at a time when information on human amino acid requirements was much less compared to what is available presently. Also, most methods used rat assays. However, this may not be fully extrapolatable to humans as rats require more sulfur-containing amino acids, histidine and branched chain amino acids than humans. (Boutri, 2022).

Each method has its limitations: For example, if we look at PER, while growth is assessed, this method

does not take into account maintenance requirements. If a protein does not support growth, but is adequate for maintenance, we cannot conclude that its PER is 0. Also, a PER of 2 for one protein does not mean it is two times better than a protein with a PER of 1. DIAAS determines the digestibility of amino acids at the end of the small intestine. Thus, it reflects more accurately the amount of amino acids absorbed and the extent to which the test protein meets the requirements for nitrogen and amino acids.

Generally, when utilizable protein is calculated and different proteins are rated, animal sources are generally ranked higher than are plant protein sources. This is because the digestibility of animal proteins is better and the essential amino acid content is fairly close to human requirements. In contrast to animal proteins,



digestibility of plant protein is relatively poor. This is because of their food matrices. Also, these proteins tend to have low proportions of one or more essential amino acid. For example, in cereals the limiting amino acid is lysine and in legumes it is methionine. Information is available on the digestibility of some plant proteins, their PDCAAS. With the exception of soy protein isolate that has a true protein digestibility of 96%, other proteins tend to have lower digestibility. Some legumes like peas and lentil have approximately 85-90% digestibility whereas digestibility of wheat flour is 92.3% and rice flour is 92%. Table 2 compares the animal and plant proteins.

Animal Proteins	Plant proteins
Generally contain all the essential amino acids with some exceptions like gelatin. PDCAAS is 1.00 or very close to 1.00	Typically, PDCAAS values are below 1.00 Can have insufficient amounts of one or more essential amino acids, Various plant sources differ in the limiting amino acid For example the limiting amino acids in Quinoa are Isoleucine, Leucine, Lysine, Threonine, Valine, in red kidney beans are sulfur-containing amino acids, Thr, Trp, Val, in rice and oats the limiting amino acids are lysine and threonine
Absorption- about 90%	Absorption- approximately 60-70%
Digestibility - very high ~85% or more	Digestibility less than that of animal proteins However, purified plant proteins have good digestibility (80-90%)



structures in the body. Digestibility of plant proteins is less because they are less soluble, they are generally located within discrete protein bodies within the cells. Also, the protective seed coat can often make the

protein less accessible to proteolytic enzymes in the intestines. (Flores-Silva et al., 2022).

Also, proteins digestibility is influenced by the various constituents/components in food, such as water, salts, metal ions, carbohydrates, lipids, phenolic compounds, flavour, aroma compounds, and acidulants used if any. Other factors also influence digestibility like pH, temperature, conditions used during processing like pressure, heating, cooling, freezing, drying, concentration, or derivatization by use of chemicals or modification by use of enzymes. Digestibility requires denaturation of the protein and/or inactivation of protease inhibitors, breakdown of tannins, both of which favour digestibility.

On the other hand, there are processes that render the protein resistant to the action of proteolytic enzymes reduce protein digestibility e.g. irradiation, cross-linking, aggregation, Maillard reaction and formation of Maillard reaction products, oxidation which can make the protein more hydrophobic or presence of disulfide bonds that stabilize the protein structure. Besides these factors, the naturally occurring structures of some proteins are unusual and make them less digestible such as collagen, elastin, keratin that essentially constitute supporting



Many of the studies have used animals (rats) to determine digestibility values, however, it may be necessary to compare the digestibility values obtained from animals with those from humans for identical foods. If amino acid scores are used for true digestibility of protein, they need to be corrected. Also, if new processes and/or products are developed, digestibility values need to be determined. Digestibility and PDCAAS values need to be determined for a variety of protein foods that are regularly consumed and part of Indian diets and for which values are not available in published databases.

Previously egg or milk protein were used as the reference pattern. Until further research confirms or provides a revised reference, currently the reference amino acid patterns

to be used are: for infants under one year of age, it is recommended that the reference be human milk amino acid consumption, whereas for others, the amino acid pattern recommended for children of preschool age as per the FAO/WHO/UNU (1985). However, the Expert Consultation has recommended that a substitute for egg protein be considered that will give a provisional pattern of amino acid requirements. Also, it has been recommended that the accuracy of scoring methods particularly chemically determined ones could require corrections for digestibility or biological availability. Besides this, it would be worthwhile to assess quality of proteins in terms of the implications for other areas of health.

#### *Improving protein quality through complementation:*

Since plant proteins contain insufficient amounts of some amino acids vis-à-vis human requirements, mutual complementation with foods that in order to overcome this has evolved and is a part of the Indian dietary. One of the most common and familiar foods in the Indian dietary is khichdi, a combination of rice and dal. Similarly, rice-based dishes that are typically consumed are biryanis that contain meat/egg/paneer/fish or curd rice or kadhi rice.





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Eating bread and egg or bread pakodas in which bread is dipped in chana flour batter and fried or even the practice of eating rice with curds or dal/sambar or eating rotis/parathas/puris with pulse

preparations like chhole, or rajma or paneer curry are examples of complementation. Snacks like mung dal kachori, idli sambar,

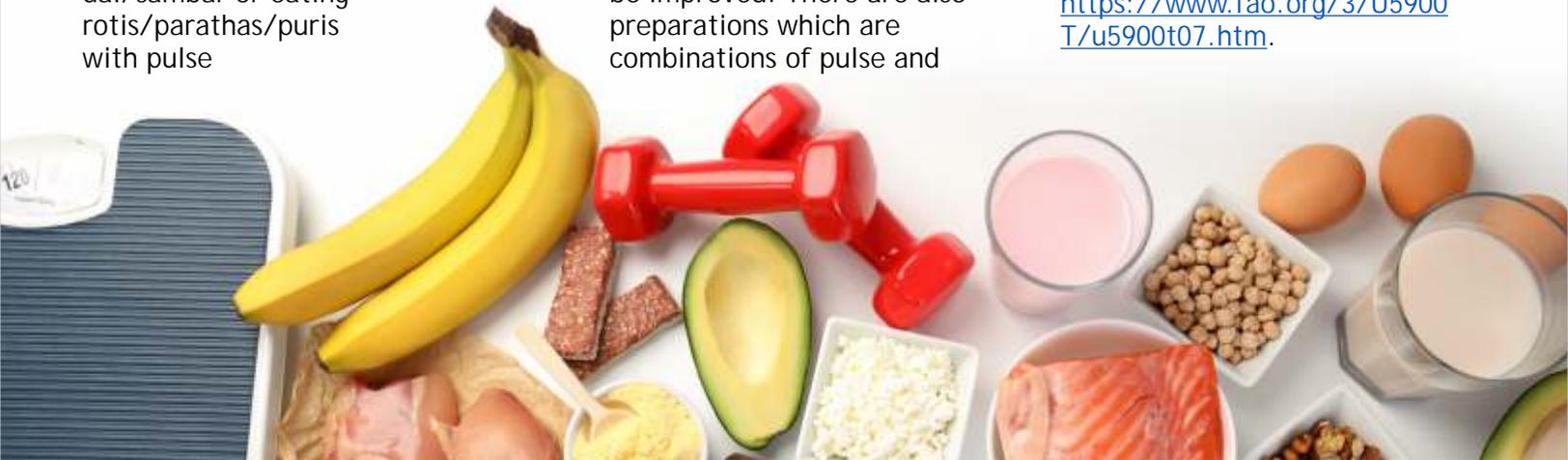
medu wada sambar, dahiwada, or sweets like besan rava laddoo, kheer made with rice and milk, puran poli are ways by which protein quality can be improved. There are also preparations which are combinations of pulse and

vegetable e.g. dal palak that can improve protein quality. Study of such combinations, their amino acid content and the extent to which the amino acid requirements are met is required.

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## COMING EVENTS

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## INTRODUCTION

Overcoming deficiencies in diet quantity and quality are major nutritional challenges globally particularly in developing countries. Comprehensive national nutrition survey 2016-18 in India, indicates that 24% to 28% children amongst the age group 5 to 19 years are stunted<sup>1</sup>. Low height for age (stunting) is a result of chronic undernutrition, poor maternal health, inappropriate feeding and care in the early life.

The long-term effects of stunting on individuals and societies are well known, which includes poor cognition and educational performance in children. It may be associated with a greater risk of weight gain and chronic diseases in later life.

High quality protein and micronutrient supplementation plays a very important role to avoid stunting<sup>2</sup>. While India has shown 20% decrease in child stunting from 2006 to 2018 however it still continues to be a health challenge. Stunting in India is not only associated with poverty, even the families who have access to nutritious food has shown stunting<sup>3</sup>.

Protein deficiency in adult may lead to weakness, anemia, poor muscle strength, and impaired immunity leading to infections. Though, World Resource Institute Survey

# PROTEIN QUALITY – AN ESSENTIAL ELEMENT OF PROTEIN NUTRITION



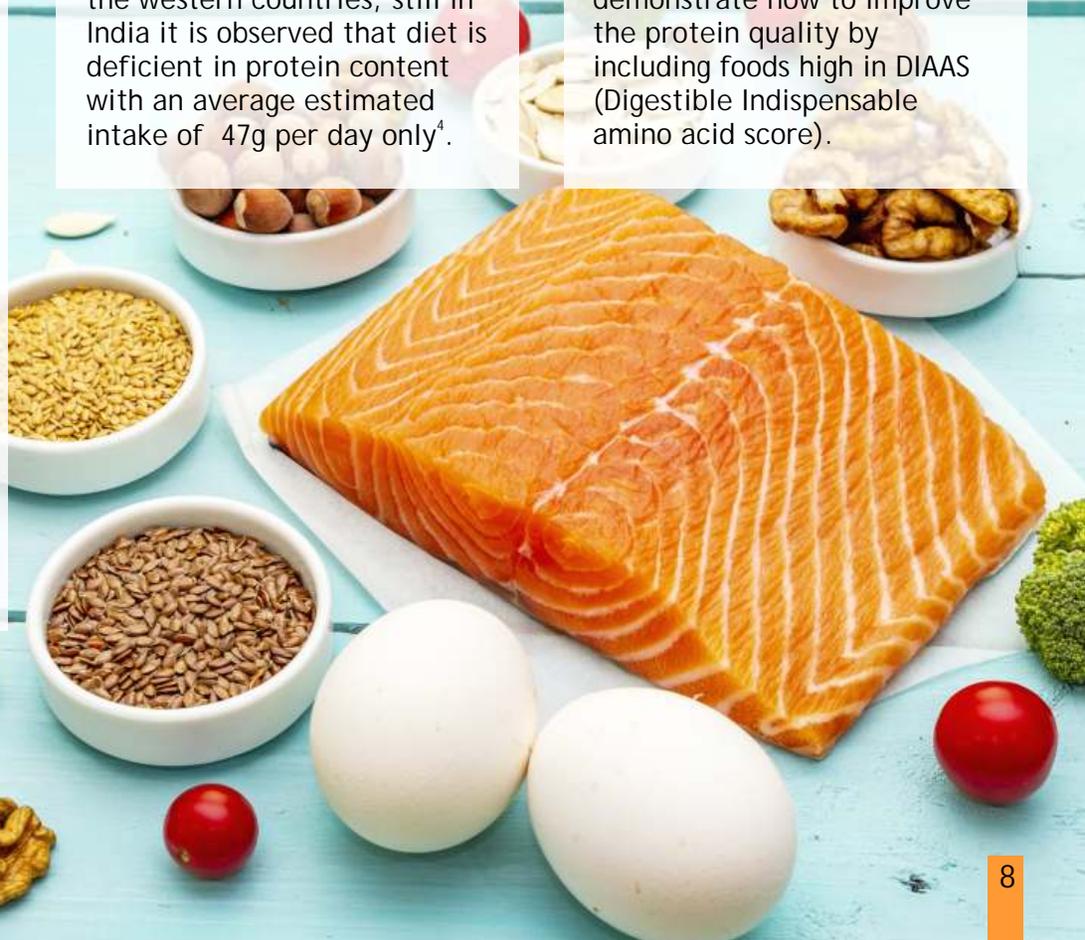
AUTHOR



Mr Makarand Parturkar  
General Manager, R & D,  
Zydus wellness

indicate that there is an excess consumption of protein across the world particularly in the western countries, still in India it is observed that diet is deficient in protein content with an average estimated intake of 47g per day only<sup>4</sup>.

In this review, we will evaluate common Indian meal for its protein adequacy. We will also demonstrate how to improve the protein quality by including foods high in DIAAS (Digestible Indispensable amino acid score).





requirement for Indians by establishing Recommended Dietary Allowances (RDA) and Estimated Average Requirements (EAR).

digestibility.

**ANIMAL SOURCE PROTEINS:**

Out of twenty amino acids, our body cannot synthesize nine amino acids (Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan, and Valine) so these amino acids are termed as essential / Indispensable amino acids. Proteins from animal sources (i.e. milk, eggs, meat & poultry and fish) provide the highest protein quality rating. This is primarily due to the

**DIETARY RECOMMENDATIONS**

World health organization (WHO) has suggested nutrient intake goals for establishing dietary recommendations to prevent diet-related chronic diseases in the population<sup>5</sup> (Table 1).

An adult men (65Kg), requires 2110 kcal, 130 g carbohydrates, 25 g visible fat and 54 g protein<sup>6</sup>. While growing children (16 -18 years Boys) require, 3320 kcal, 100 g Carbohydrates, 40g visible fat and 55g of protein.

'completeness' of proteins. Complete proteins contain both dispensable and indispensable amino acids.



Table 1. Ranges of population nutrient intake goals by WHO

Dietary factor	Goal (% of total energy)
Total fat	15 - 30%
Saturated fatty acids	<10%
Polyunsaturated fatty acids (PUFAs)	6 - 10%
n-6 Polyunsaturated fatty acids (PUFAs)	5 - 8%
n-3 Polyunsaturated fatty acids (PUFAs)	1 - 2%
Trans fatty acids	<1%
Monounsaturated fatty acids (MUFAs)	By difference
Total carbohydrate	55 - 75%
Free sugars	<10%
Protein	10 - 15%
Sodium chloride (Sodium)	<5g per day (<2g per day)
Fruits and vegetables	≥400g per day

<sup>a</sup> This is calculated as: total fat - (saturated fatty acids + polyunsaturated fatty acids + trans fatty acids).

Source: <https://www.fao.org/3/ac911e/ac911e07.htm>

Although protein from animal sources are also associated with high intakes of saturated fats and cholesterol, there have been a number of studies that have demonstrated positive benefits of animal proteins in various population groups<sup>7</sup>. High

These recommendations are in numerical terms as a percentage of energy supplied by the specific macronutrient in the diet. In a diet, one gram of Protein and Carbohydrate provides 4 kcal while 1g of fat provides 9 kcal. In 2020 ICMR-NIN expert group recommended the nutrient

**SOURCES OF PROTEIN IN THE DIET**

Protein is available in a variety of dietary sources. These include foods of animal and plant origins as well as in the form of Protein Supplements. Determining the effectiveness of a protein in the diet is a factor of protein quality and

animal protein diets also been shown to cause a significantly greater net protein synthesis than a high vegetable protein diet<sup>8</sup>.



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\*Refers to outcome of a clinical study published in Ind. J. Nutr. Dietet; (2008). Refer pack for more details. Growth and cognitive development are influenced by genetic, nutrition and environmental factors. Complan to be taken as a part of daily balanced diet.



Protein Quality - An Essential Element of Protein Nutrition

**VEGETABLE SOURCE PROTEINS**

Popular sources include legumes, nuts and soy. Apart from these products, vegetable based protein can also be found in a fibrous form called textured vegetable protein (TVP). It is also a low-calorie and low-fat source of vegetable protein. Vegetable sources of protein also provide phyto-nutrients and fiber.

Proteins from Cereals and Pulses should be combined to provide all of the essential amino acids. Together it can be a good source for protein and can likely help in reducing intake of saturated fat and cholesterol.

**ADEQUACY OF PROTEIN IN DIET**

Adequate energy from carbohydrates and fat is important in the diet to have efficient utilization of dietary amino acids to synthesize proteins. Similarly, 10 % to 15 % of total energy need (kcal) should be met from the proteins in the diet to avoid protein energy malnourishment (PEM)<sup>5</sup>. Indian Market Research Bureau (IMRB) found that 73% of urban rich Indians are protein deficient and 93% are unaware about their daily protein requirements<sup>4</sup>.

As per ICMR RDA an average Indian adult should consume 0.8g-1g per kg of body weight of protein while It is observed

that average dietary intake of protein amongst Indian is only close to 0.6 g per kg of body weight<sup>6</sup>. It is also observed that in Indian diet, Cereal grains are the predominant sources of protein and so deficient in essential amino acid particularly in Lysine.

**QUALITY OF PROTEIN**

Quality refers to the availability of amino acids that it supplies, and digestibility considers how the protein is the best utilized in the body. Typically, all dietary animal protein sources are 'complete proteins' i.e. a protein that contains all of the essential amino acids. Proteins from vegetable sources are considered 'incomplete' as they generally lack one or two of essential amino acids. Lysine, the essential amino acid is typically limiting in cereal grains while pulses are low in the sulfur-containing amino acids methionine and cysteine<sup>9</sup>.

Thus, someone who desires to get their protein from vegetarian sources will need to consume a variety of grains, and legumes to ensure consumption of all essential amino acids<sup>10</sup>.

Here is an example of a typical meal, and ways to increase the protein quality of the meal:

To evaluate adequacy and proportion of the protein in average Indian vegetarian meal we have considered a typical meal, which include 4 chapattis, one bowl of cooked polished rice, two bowls of dal and one bowl of vegetable. We have used Red gram dal (Arhar dal) for the calculations. Data from Indian Food Composition Tables 2017 published by NIN<sup>11</sup> used to calculate the total protein content of the meal (Table -2).

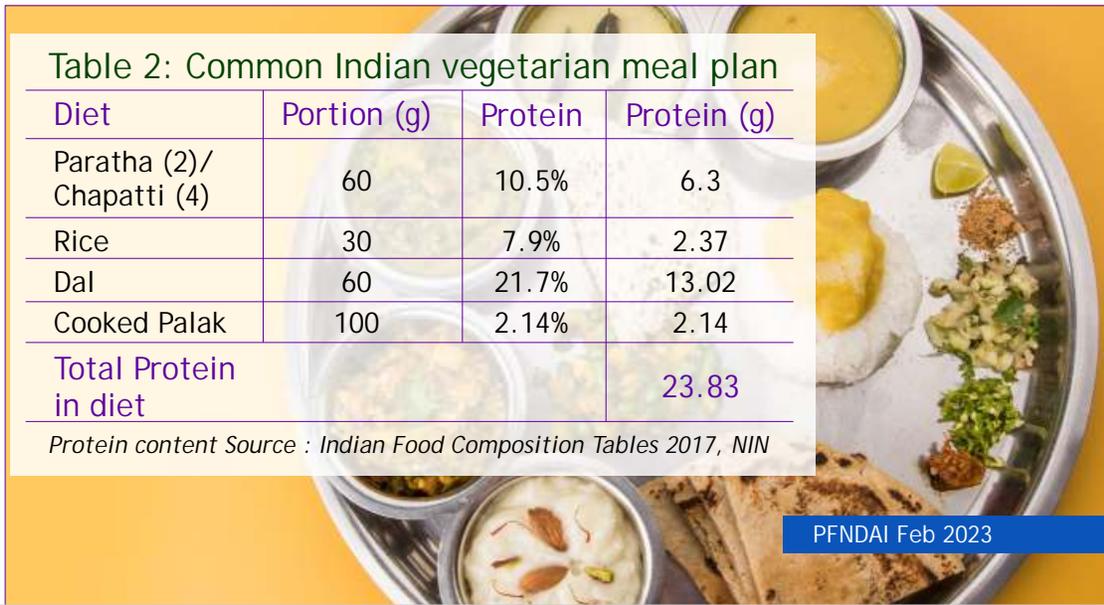
FAO recommended new scoring system termed the digestible IAA score (DIAAS) for assessing the protein quality. ICMR -NIN RDA 2020 also used these recommendations to estimate the quality of protein in diet. DIAAS of protein in diet is calculated basis the true ileal digestibility of the limiting amino acid<sup>6</sup>.

**DIAAS = True ileal digestibility of limiting amino acid X Limiting amino acid score**

**Table 2: Common Indian vegetarian meal plan**

Diet	Portion (g)	Protein	Protein (g)
Paratha (2)/ Chapatti (4)	60	10.5%	6.3
Rice	30	7.9%	2.37
Dal	60	21.7%	13.02
Cooked Palak	100	2.14%	2.14
<b>Total Protein in diet</b>			<b>23.83</b>

Protein content Source : Indian Food Composition Tables 2017, NIN



DIAAS value of meal  
We have used ileal digestibility score and method mentioned in ICMR -NIN RDA for Indians - 2020 to calculate the DIAAS value of meal plan mentioned in Table-2. Values for palak (spinach) were not available so not considered in the calculation. Further, one serving of dal replaced by 150g

portion of dairy product (milk / curd) in a meal and DIAAS is calculated.

DIAAS of a meal without dairy was only 73.2 (Table 3) while addition of dairy (milk /curd) 150 g in the diet significantly improves DIAAS to 98.7 for >18 year old population (Table 4).

Proteins with DIAAS of < 75 do not provide all essential amino acids (EAA). Good quality protein has DIAAS of 75 to 99 and mostly meets the requirement of all EAA. Excellent/high quality protein with DIAAS value > 100 where 100% or more of the amino acid requirement is complete.

**Table 3: DIAAS Calculation of an Indian meal in Table-2 (without dairy)<sup>5</sup>**

Foods	Weight g	Protein (g/100 g food)	Lys (mg /g protein)	True Ileal IAA digestibility Lys	Protein content in mixture g	True Ileal Digestibility IAA content in mixture mg
Wheat	60	10.5	33.1	0.84	6.3	175.2
Rice	30	7.9	37	0.94	2.37	82.4
Red Gram Dal (1st Serve)	30	21.7	61.6	0.57	6.51	228.6
Red gram Dal (2nd serve)	30 g	21.7	61.6	0.57	6.51	228.6
Spinach	100	NS				
Total					21.69	714.8
Amino Acids: mg/g (total for each amino acid / total protein content in the mixture)						32.95
Age Group	Reference pattern: mg/g protein				Digestible IAA reference ratio	DIAAS for Mixture %
3-10 years	48				0.69	68.7
11-14 years	48				0.69	68.7
15-18 years	47				0.70	70.1
>18 yrs	45				0.73	73.2

**Table 4: DIAAS Calculation of an Indian meal in Table-2 (with dairy)<sup>5</sup>**

Foods	Weight g	Protein (g/100 g food)	Lys (mg /g protein)	True Ileal IAA digestibility Lys	Protein content in mixture g	True Ileal Digestibility IAA content in mixture mg
Wheat	60	10.5	33.1	0.84	6.3	175.2
Rice	30	7.9	37	0.94	2.37	82.4
Red Gram dal	30	21.7	61.6	0.57	6.51	228.6
Spinach	100	NS				
Milk / Curd	150	3.3	85.9	0.96	4.95	408.2
Total					20.13	894.4
Amino Acids: mg/g (total for each amino acid / total protein content in the mixture)						44.43
Age Group	Reference pattern: mg/g protein				Digestible IAA reference ratio	DIAAS for Mixture %
3-10 years	48				0.93	92.6
11-14 years	48				0.93	92.6
15-18 years	47				0.95	94.5
>18 yrs	45				0.99	98.7



form of a micelle, which is a large colloidal particle. An attractive property of the casein micelle is its ability to form a gel or clot in the stomach. The ability to form this clot makes it very efficient in nutrient supply. The clot is able to provide a sustained slow release of amino acids into the blood stream, sometimes lasting for several hours<sup>13</sup>. This provides better

nitrogen retention and utilization by the body.

### IMPORTANCE OF MILK PROTEIN IN DIET

Milk proteins are of significant physiological importance to the body for functions relating to the uptake of nutrients and vitamins and they are source of biologically active peptides. Whole Cow milk contains 3.3 % protein while whole Buffalo milk contains 3.7% Protein<sup>11</sup>. Casein is the major component of protein found in bovine milk accounting for nearly 70-80% of its total protein.

Similar to whey, casein is a complete protein and contains the minerals calcium and phosphorous. Casein has a PDCAAS rating of 1.23 (generally reported as a truncated value of 1.0)<sup>12</sup>. Casein exists in milk in the



### ROLE OF HEALTH SUPPLEMENTS

Food habits and the inadequacy of protein in diet along with the deficiency of micronutrients like vitamins and minerals does not unleash the fullest potential of growth in children and also lead to poor performance in adult due to poor muscle strength.

Health food supplements support to mitigate the dietary deficiencies of proteins and micronutrients. Milk protein based health supplements provide High-quality protein having all essential amino acids. Milk protein supply adequate Lysine and thus support to utilize the other dietary proteins.

In vegan diet, Protein source is limited to plant base. Legumes and pulses have to be consumed in larger quantity to meet the daily protein needs.

Variety of proteins sources are also required to be mixed together to balance the daily requirement of all essential amino acids. Protein concentrate and isolates are the concentrated sources and thus help to meet the adequacy of protein with respect to quantity and quality.



### CONCLUSION

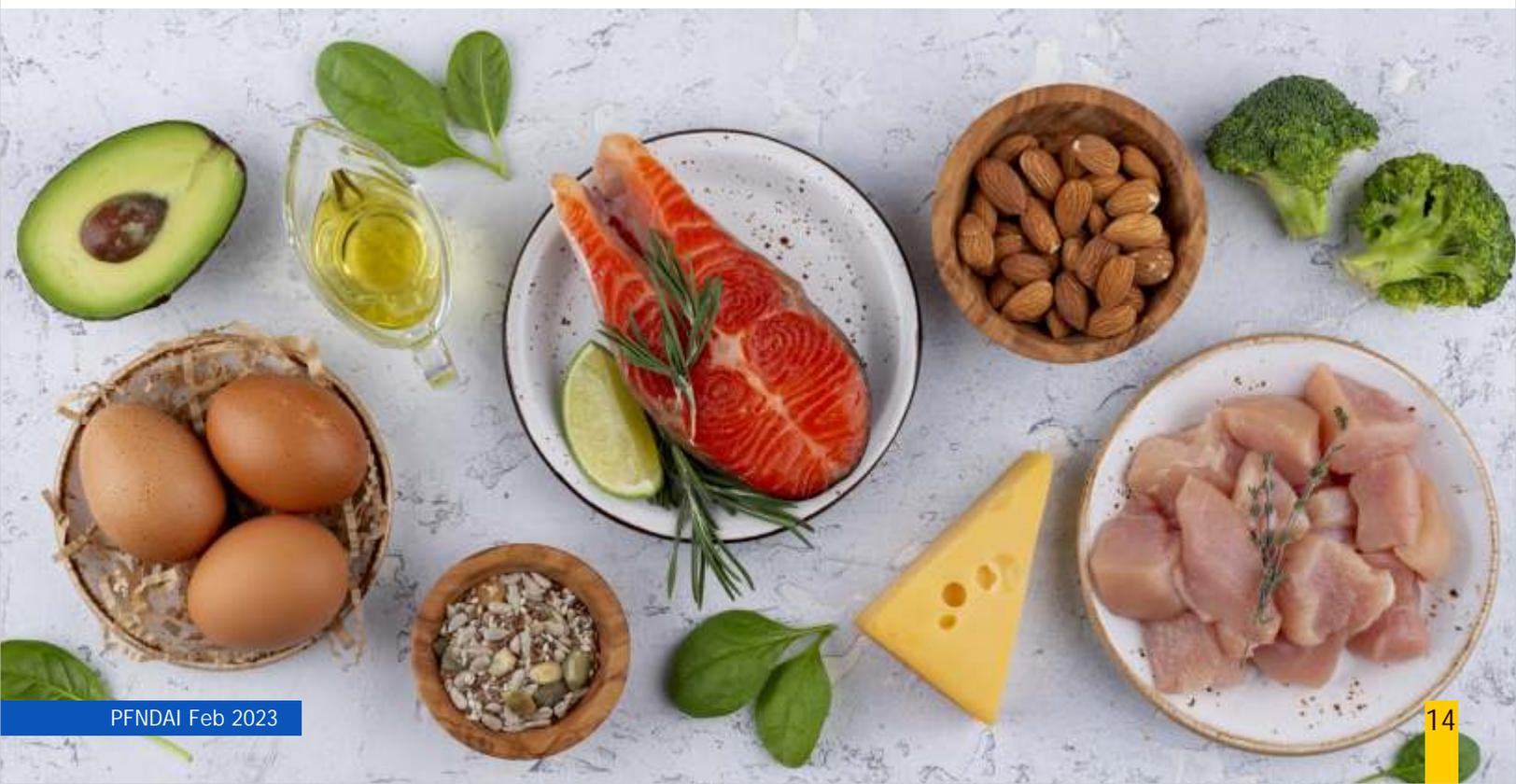
Adequate protein intake along with the micronutrients like vitamins and minerals is essentially required to avoid stunting and maintain the good health. Combination of High quality proteins of animal origin like milk, Egg etc having DIAAS score >100 is the best strategy to plan a diet for having the best utilization of the protein. Here we showed how a simple inclusion on 1 serve of dairy either in the form of milk/ curd can increase the DIAAS i.e. protein quality of the entire meal.

Use of health food supplement providing adequate supply of all essential amino acids and micronutrients as a part of daily diet can also be a good strategy to improve quality protein intake for good health.

**Disclaimer:** Please consult your healthcare professional for personalized dietary advice

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# PLANT PROTEINS IN FOOD: SELECTION & FUNCTIONALITY



AUTHOR

Dr. Vidya R. Sridhar  
Sr. Manager, Food Designer,  
Innovation & Science, Emerging Hub  
Amway Global Services India  
Private Limited

## Introduction

Protein is an essential nutrient for human body. They are the functional and structural units of cells, composed of long chains of amino acids and play vital role in the growth and maintenance of muscles, organs, and skin. While many people think that protein is primarily sourced from meat, it is also found in plenty in plants. Although animal proteins are typically

more complete, there is a growing trend towards plant-based proteins, due to their health benefits, the growing awareness of the impact of animal agriculture on the environment and its sustainability.

Understanding the different types of proteins available in the market along with their characteristics, quality and functionality will enable formulators to develop great tasting protein rich products.

This article will introduce readers to the types of plant proteins, their functionality and modification technologies that will enable successful application in food systems.

## Plant Proteins

Common plant proteins sources include soy, wheat, rice and pea. Some of the new sources of protein include those from legumes (lentils, fava, mung beans), grains (quinoa and amaranth), nuts and seeds (almond, cashew, chia and flax), oil-seeds (canola), potato, water lentil & algal (1, 2). Plant proteins are low in fat, rich in antioxidants with no cholesterol, making it a heart healthy option. Additionally, they contain good amount of fibre, and minerals such as iron and magnesium, and phytonutrients. The nutrient profile of proteins is illustrated in figure 1.



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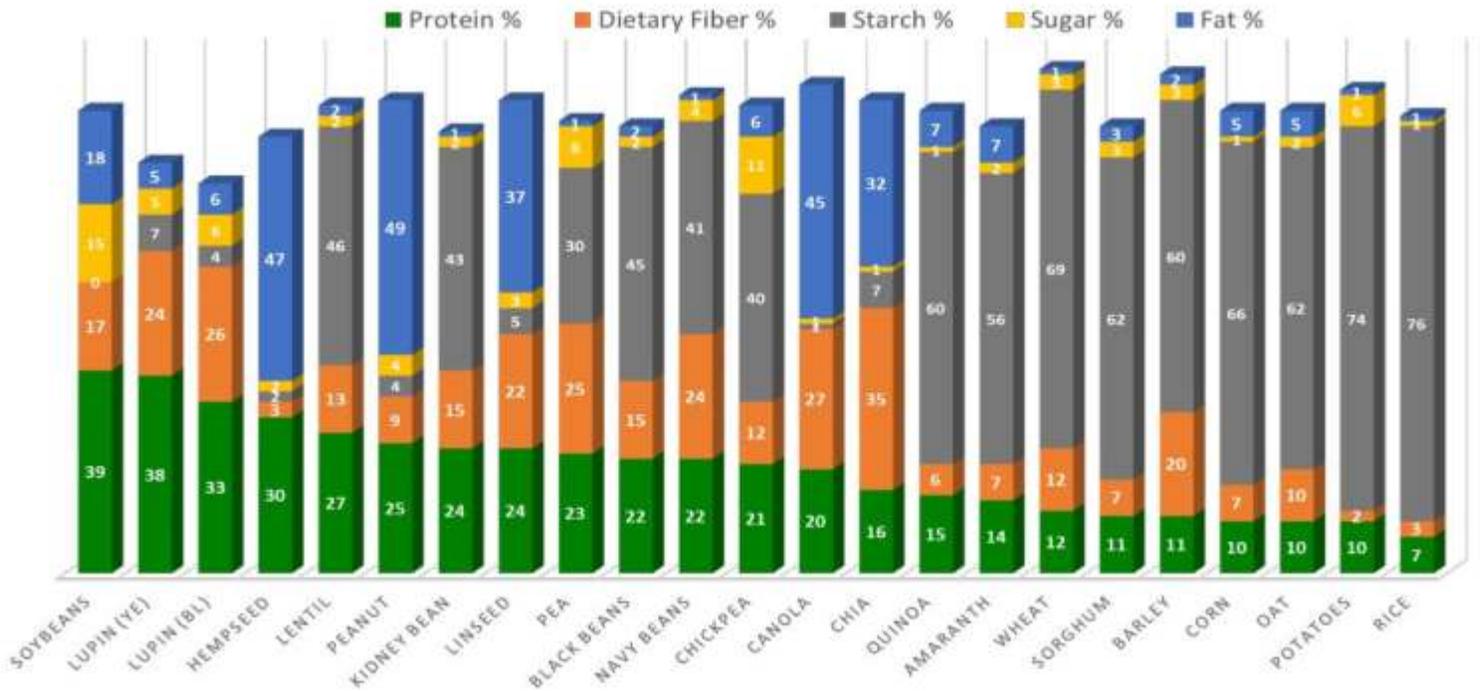


Figure 1. Nutrient distribution of Plant protein sources

Courtesy: ADM, Plant Proteins, Institute of Food Technologists (IFT) Short Course, June 1-2, 2019 References: 1 - USDA National Nutrient Database for Standard Reference; 2 - 2011 J. Appl. Poult. Res. 20 :95-101 & Czech J food Sci; 29, 2011 No 3: 203-211; 3 - FAO-INRA-Cirad. Feedipedia, & Nutiva

A protein that can deliver all nine essential amino acids is termed as a good quality protein and is commonly assessed using Protein Digestibility-Corrected Amino Acid Score (PDCAAS). Any protein that has a score of 1.0 or higher is defined as high quality protein.

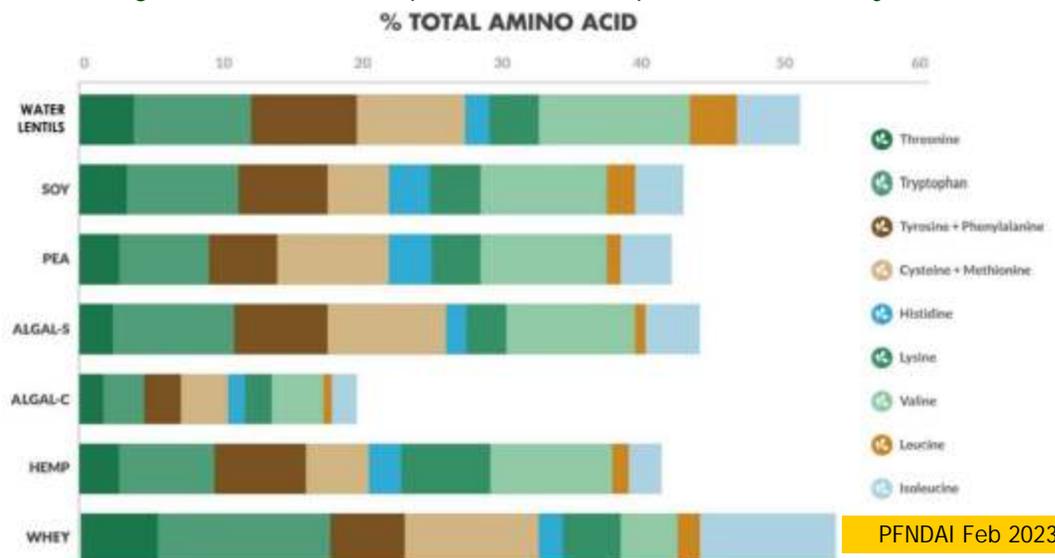
Plant proteins from legumes have higher quality of protein (PDCAAS score is >0.8) (3) and are often used in Asian cuisine. Some of the commonly found sources include soy, pea, chick-pea, mung bean, faba bean, and red-lentil proteins. Functionally, they are excellent choices for replacement of animal proteins due to their emulsification and water binding capacity (4). Soy protein is a versatile plant protein with high quality (PDCAAS >0.9) (3), functionality, availability, affordable with least beany taste. For

consumers who are sensitive to soy or wheat, pea, mung & fava bean or lentil proteins offer a hypoallergenic alternative. However, most often their beany off taste limits their usage. These off notes can be overcome by using masking flavours customized for specific proteins (4).

Amongst the cereal proteins, rice and wheat proteins are commonly used. Wheat protein

is commonly used in baked applications. However, for gluten sensitive population, rice protein could be used in combination with lentil or pea protein. Potato, water lentil (Duckweed) and algal proteins are upcoming high-quality proteins. These are equivalent to egg, wheat and whey in functional properties such as emulsification & gelation properties and in quality as demonstrated in amino acid profile in figure 2. (1, 2, 5).

Figure 2. Amino acid profile of Plant proteins vs. Whey Protein





Additionally, algal and water lentil are derived from aquatic organism, and plants through sustainable farming practices (aquaponics) with negligible or zero carbon footprint (1, 2, 5). However, cost, availability, regulatory approval and safety could limit their use.

Any product success is largely dependent on how it delivers to the customer on its product characteristics such as taste (beany off taste), texture (bite, sponginess, chewiness), juiciness (water holding capacity), or oiling off (oil holding capacity), all of which are driven by protein functionality.

**Protein Functionality**

Protein functionality is the physicochemical properties that enable proteins to contribute to desirable characteristics of food. Protein functionality is key driver for selection of protein, in addition to consumer need, protein quality, cost, regulatory approval, reliable source, sustainability, and safety.

For example, in processed meat such as sausage, the



Figure 3. Food applications as driven by Protein functionality

Courtesy: Ingredion, Plant Proteins, Institute of Food Technologists (IFT) Short Course, June 1-2, 2019

springiness, adhesion, chewiness and texture of the product is driven by gelation, and emulsification and juiciness is driven by water binding capacity property of meat protein. A meat analogue needs to mimic similar functionalities when using plant-based alternative.

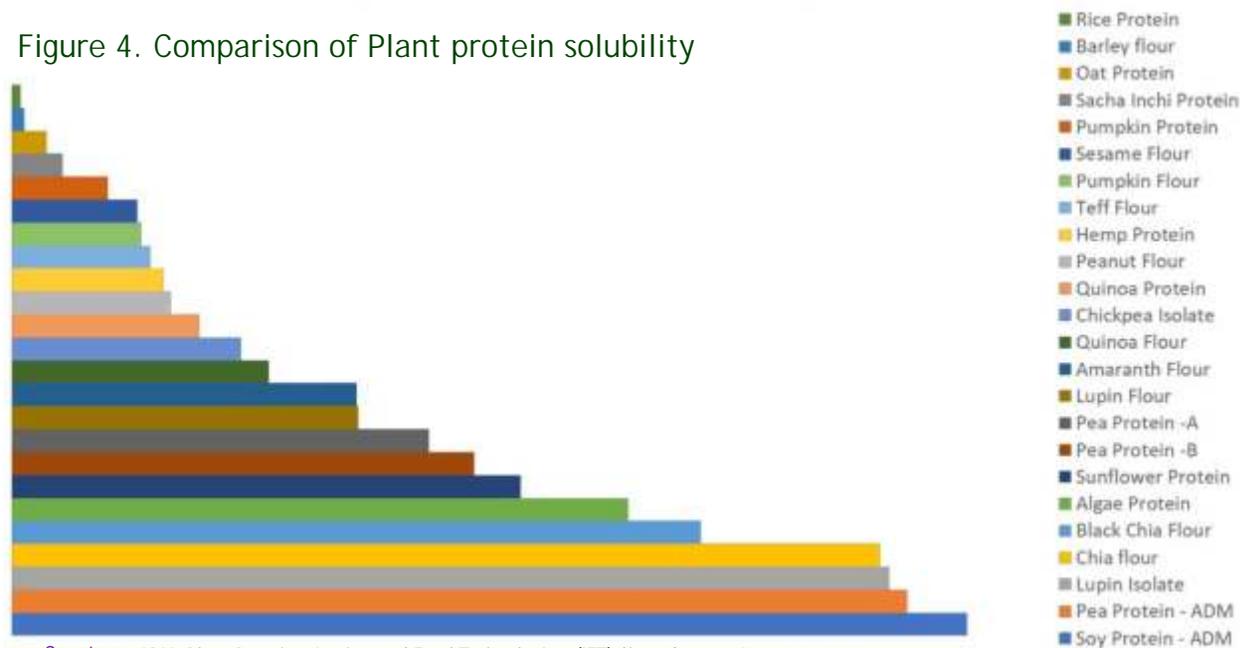
Similarly, to develop an egg free mayonnaise, cake, or muffin, one should be able to find an alternative that provides similar emulsification and foaming properties as egg protein. Food applications as driven by protein functionality is illustrated below in figure 3(1) for easier understanding of readers.

Every protein is characterized or assessed for its functional properties by conducting various tests (solubility and emulsification index, water

binding capacity, oil binding capacity, gel strength) that is developed into a ingredient specification of protein. For example, if one must develop a protein supplement that is to be taken as instant drink, solubility will be the key functionality to look for. Solubility of plant proteins is typically low, however, there are proteins that are more soluble than others, as illustrated below in figure 4(1).



Figure 4. Comparison of Plant protein solubility



Courtesy: ADM, Plant Proteins, Institute of Food Technologists (IFT) Short Course, June 1-2, 2019

A formulator would then choose proteins not only based on its solubility index but also other factors such as consumer need, cost, availability, taste, regulatory approval, safety, and other such factors to deliver a successful product in market.

Apart from specific functionalities of proteins, the knowledge on the mechanism of action of the protein for each of the functional

attribute (table 1, (1)), enables troubleshooting and finding solutions in case the selected protein in formula does not perform well.

For example, during the development of gluten-free bread, one could select various substitutes of wheat protein and flour to form formulations. These could be screened for desired product characteristics that are either quantitative using texture analyzer

(adhesiveness, cohesiveness, chewiness, hardness and length), qualitative through sensory analysis or both. If formulations are not delivering the desired product characteristics, such as softness or length (rise), it could probably be due to poor water entrapment (mechanism of action) driven by poor gelation (function) properties. Thus, we could target improving gelation of the protein substitutes.

Table 1: Functionality and Mechanism of action for Proteins in various food systems

Function	Mechanism	Food Systems
Solubility	Hydrophilic interactions	Beverages, soups
Gelation	Water entrapment & immobilization, network formation	Processed meats, gelled products, cakes, cheeses, baked goods
Water binding	Hydrogen bonding, ion hydration	Processed meats, breads, cakes
Emulsification	Adsorption at interfaces	Emulsified meats, cream soups, cakes, dressings
Viscosity	Water binding, hydrodynamic size & shape	Beverages, soups, sauces, salad dressings
Texture (cohesion, elasticity, adhesion)	Hydrophobic, ionic & hydrogen bonding, disulfide cross-links	Processed meats, baked goods, pasta
Foaming	Interfacial adsorption, film formation	Whipped toppings, ice creams, cakes, meringues

Courtesy: ADM, Plant Proteins, IFT Short Course, June 1-2, 2019



If further work with formulations does not help, improvements in protein functionality could be possible by protein modification technologies.



### Protein Modification & Functional Colloids

Proteins modification could be done at the level of amino acids (building blocks of protein), the side chains of amino acids or the protein structure by various physical (high pressure, radiation, ultrasound, lyophilization), chemical (acylation, glycosylation, deamidation, cross-linking), and enzymatic methods (oxidases, transglutaminase, endopeptidase) to enhance functionality, alter allergenic potential and quality of protein (1, 6). Additionally, hydrolyzing protein or reducing its size or modifying its surface hydrophobicity can increase protein solubility and nutrition (quick absorption) (1).



Food proteins can also be used to design functional colloids to deliver bioactive compounds, improve bioavailability of nutrient, digestion. Functional parameters such as gelation and aggregation of proteins are used to entrap and protect bioactive compounds from unfavorable conditions of food processing to produce a delivery system at macro, micro and nanoscale (6, 7). The biopolymers (protein, polysaccharides and lipids) are explored in development of novel food structures like nano/microparticles, nanogels, films, hydrogels, oleogels with modified nutritional (fat reduction, high protein,



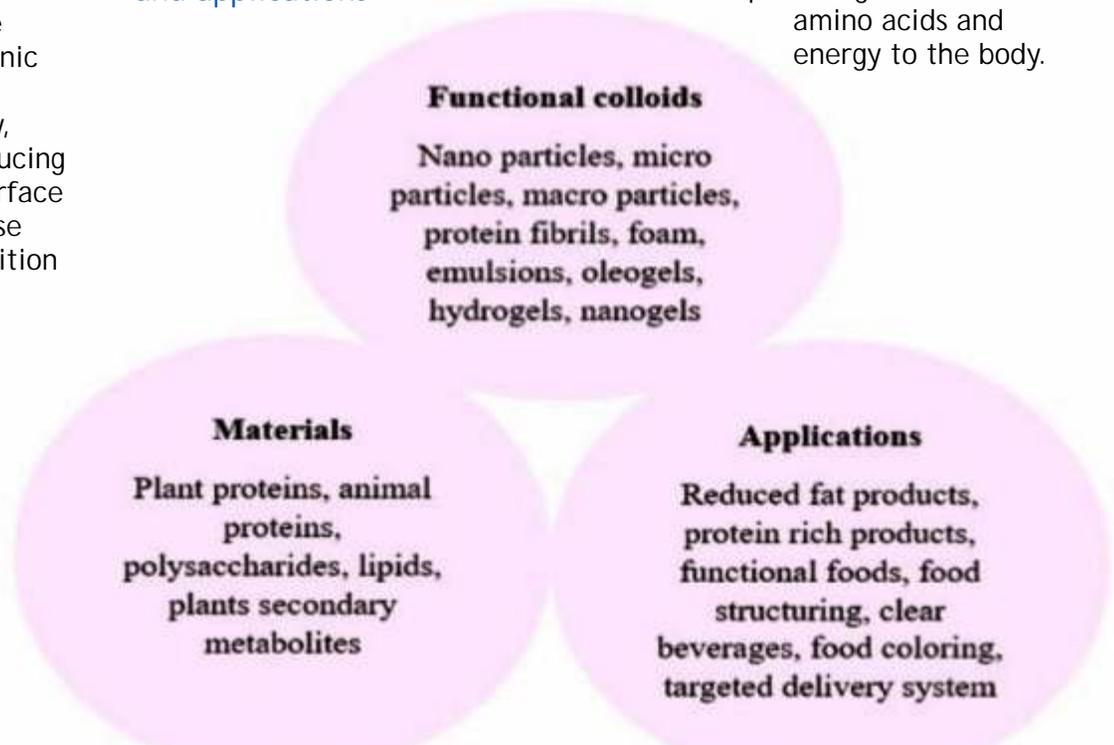
satiety) and physicochemical properties (6, 7; figure 5).

### Summary

In summary, proteins are an essential macronutrient for growth, maintenance, and repair of cells and tissues. They are also important for metabolic processes such as digestion, respiration, and reproduction. Primarily, proteins are either derived from animal or plant sources with differences in quality, functionality, and availability.

Overall, proteins are an essential part of the diet and play a vital role in providing essential amino acids and energy to the body.

Figure 5. Schematic representation of functional colloids, ingredients, and applications



Reference: Alweera et al., LWT - Food Science and Technology 154 (2022) 112667



In food applications, proteins are primarily used as nutrition supplements and also as functional ingredient to form emulsions and foams, to create textures and flavours, and for a variety of culinary applications.

Although proteins are sourced from animal and plants, there is a rise in consumer need for high quality, sustainable, environment friendly, healthier, clean label plant proteins as alternatives to animal proteins.

Protein quality, functionality, cost, availability, regulatory approval, and safety influence the choice or selection of protein for its application in food, other than consumer

need.

In particular, understanding protein functionality and its mechanism of action will enable designing successful food formulations. Protein modification and

functional colloids are upcoming technologies that utilize plant proteins in creating novel food structures with enhanced functional properties.

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# NUTRITIONAL AND ANTI-NUTRITIONAL CONSTITUENTS IN MILLETS- THE TWO SIDES OF THE SAME COIN

Milletts are small cereals with an excellent ability to grow in less fertile and dry land, more resistant to pests and could be cultivated throughout the year. Hence, these are called sustainable crops suitable to address global hunger. Though India is the largest producer of millets in the world, its consumption is not uniform across the states. Millet consumption is higher in Gujarat (Pearl Millet and Maize), Karnataka (Finger millet) and Maharashtra (Sorghum) than the other states.

Milletts are gluten free, highly nutritious yet cheaper healthy food option. Nutritional composition of millets is comparable to that of cereals for energy, carbohydrate, protein, fat and B vitamin content. But the dietary fibre and mineral content is higher in millets (Table-1). Due to the nutrients, dietary

AUTHOR  
**Prof. Subhadra Mandalika (Rtd).**,  
 College of Home Science, Nirmala Niketan,  
 Nutrition Consultant, Senior Vice President,  
 Association of Sports, Nutrition & Fitness  
 Sciences (ASNFS),  
 Former Convener, Nutrition Society  
 of India, Mumbai Chapter  
 email: [drmsubhadra@gmail.com](mailto:drmsubhadra@gmail.com)

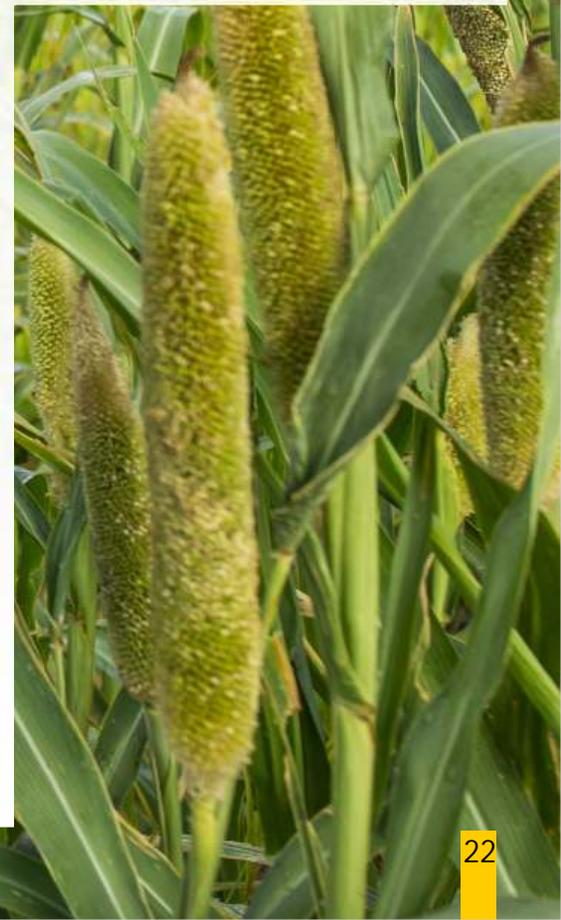


fibre and phytochemicals millets offer multiple health benefits. However, millets also contain certain anti-nutritional factors that would interfere with mineral absorption, protein metabolism etc., if not removed/inactivated. This article emphasises both sides of millets i.e. their health benefits and anti-nutritional factors.

### Nutritional benefits

Milletts could be the best solution for global burden of micronutrient malnutrition especially for iron, zinc and calcium deficiencies. Barnyard millet, being rich in iron and protein is ideal for preventing and/or managing nutritional anaemia whereas finger millet (ragi/nachni) is an excellent source of calcium and hence contribute to bone health. The higher niacin content in Proso millet and barnyard millet prevents/cures pellagra. Being

rich sources of B vitamins, regular consumption of the same would help in overall metabolism and health.



Nutritional and anti-nutritional constituents in Millets- The two sides of the coin



The antioxidants such as polyphenols and phenolic acids in millets are protective against cancer.

Magnesium) cannot be separated for absorption. The major phenolic acids in millets are ferulic, p-coumaric, and cinnamic acids. Poly phenols are heat stable, acid resistant but alkali sensitive.

It is interesting to note that some of the



**Clinical benefits**

Millets are a healthy choice for gluten intolerant people. The high dietary fibre content in millets helps in weight loss, improves insulin sensitivity and maintains gut health. Semi or unpolished millets are low in glycemic index and hence suitable for diabetics in maintaining glycemic control.

anti-nutritional factors in millets are also considered nutraceuticals as most of them offer antioxidant benefits and prevent several diseases such as cataract, Alzheimer’s disease, cancer, liver diseases, heart diseases etc.

In addition, several millets are potential hypolipidaemic agents due to the high dietary fibre content, antioxidants and bioactive compounds, thereby make an ideal option for heart patients. Calcium rich finger millet is highly beneficial in hypertension and diabetes.

**Anti-nutritional factors in millets**

Millets also contain certain anti-nutritional factors such as tannins, phytates, trypsin and enzyme inhibitors (Table-2) which need to be inactivated before consumption. Phytic acid cannot be digested by human gut hence, hence the minerals chelated by phytic acid (Zinc, Iron, Calcium and

**Reduction of anti-nutritional factors in millets:**

Anti-nutrients in millets can be inactivated/reduced through various methods such as dehusking, milling, soaking, germination/sprouting, cooking, malting, and fermentation. However, the duration of some of these treatments decides the extent of effect.

Table-1: Percent Nutrient composition of selected millets

Millets	Energy Cal	Carbohydrate Grams	Protein Grams	Fat Grams	Total Dietary fiber Grams	Calcium mg	Iron mg	Zinc mg
Pearl millet #	347	61.78±0.85	10.96±0.26	5.43±0.64	11.49±0.62	27.35±2.16	6.42±1.04	2.76±0.36
Finger millet#	320	66.82±0.73	7.16±0.63	1.92±0.14	11.18±1.14	364±58.0	4.62±0.36	2.53±0.51
Foxtail millet*	331	60.9-75.2	11.50-12.3	2.38-4.3	-	31	2.8	2.4
Little millet#	346	65.55±1.29	10.13±0.4	3.89±0.35	7.72±0.92	16.06±1.54	1.26±0.44	1.82±0.14
Barnyard millet*	307-398	50.0-68.8	6.2-10.5	2.2 -3.6	12.6	20-22	5.0-18.6	3.0
Kodo millet#	331	66.19±1.19	8.92±1.09	2.55±0.13	6.39±0.60	15.27±1.28	2.34±0.46	1.65±0.18

#IFCT, 2017

\*<https://doi.org/10.1590/fst.25017>

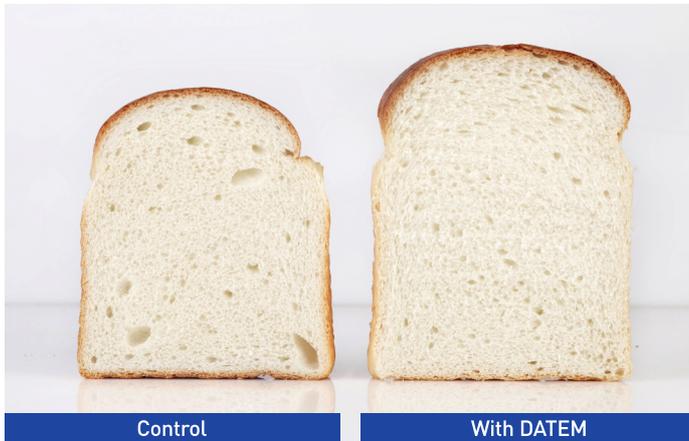
# DATEM Powder (E 472e): For Bakery Applications



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**Decortication/Dehulling/Removal of husk**

Phytic acid, tannins and polyphenols are concentrated in the husk of millets. Hence, removal of husk by decortication can considerably reduce the concentration of these anti-nutritional factors. In the pearl millet, decortication was found to reduce phytates and polyphenols by 53% and 9%. However, bran also contains several minerals along with dietary fibre both of which get removed during the milling and polishing process. Hence, partial refining or polishing would cause less harm and hence could be considered. In addition, baking or heating of milled/semi refined millets has

been proved to further reduce the anti-nutrient factors.

**Soaking and germination:**

Soaking reduces cooking time of grains, causes release of vitamins and minerals from the millets thus increases their bioavailability. Soaking increases the permeability of cell wall of millets resulting in release of tannins into the soaking solution. The enzymes-phytase and polyphenol hydrolase present in millets are activated during Soaking and germination.



These reduce the content of phytic acid and polyphenols. Soaking and/or germination for longer duration could be more beneficial.

Table-2: Antinutritional factors in millets and their effects

	Phytic acid	Tannins & Phenolic compounds	Saponins	Lectins & haemagglutinins	Enzyme inhibitors
Chemical Nature	myo-inositol-1,2,3,4,5,6-hexakis dihydrogen phosphate	Anti-oxidant polyphenols (Tannins), phenolicacids and their derivatives, flavonols, flavones, and flavanonols	Steroids or triterpenes and contain a sugar moiety in their structure	A form of sugar-binding proteins	<ul style="list-style-type: none"> <li>• protease inhibitors,</li> <li>• α-amylase inhibitors</li> </ul>
Sources	Maize, Kodo Millet	Pearl millet, finger millet, Little Millet (Samai)	Quinoa,	Finger millet, Maize	Ragi/ finger millet, sorghum, pearl millet, Italian millet, and barnyard millet
Effects	<ul style="list-style-type: none"> <li>• Forms complexes with minerals and Inhibit their absorption and bioavailability</li> <li>• Impairs protein digestion</li> </ul>	<ul style="list-style-type: none"> <li>• Decrease bioavailability of amino acids</li> <li>• Cause cardiac and respiratory problems,</li> <li>• Affect appetite</li> </ul>	<ul style="list-style-type: none"> <li>• Affects integrity of intestinal mucosal membrane</li> <li>• Affects absorption of vitamin A &amp; E</li> <li>• Inhibit digestive enzymes</li> </ul>	<ul style="list-style-type: none"> <li>• Affects pancreas</li> <li>• Affects growth</li> <li>• Reduces nutrient absorption</li> </ul>	<ul style="list-style-type: none"> <li>• Affects protein digestibility</li> <li>• Causes growth retardation</li> </ul>

### Fermentation

Fermentation reduces anti-nutrients and improves the digestibility of various nutrients in millets. In addition, during fermentation the probiotic lactic acid bacteria produce several bioactive compounds from millets, which make the product therapeutically beneficial.

### Heating and/or Cooking

Heating/cooking involves boiling, roasting, microwaving and autoclaving. Each of these methods have been proved to be effective in reducing various anti-nutritional factors millets.

**Extrusion cooking** which involves a combination of thermal and mechanical processes has been found to reduce phytates by hydrolysing it to inositol penta, tetra and triphosphates.

**Steam precooking** reduces the heat sensitive phytates by hydrolysis, and tannins by damaging the cell wall.

### Conclusion:

Millets are nutritious food grains and highly suitable for addressing the issue of global micronutrient malnutrition. However, these small cereals contain certain anti-nutritional factors such as phytates, tannins polyphenols etc., all of which could be inactivated by various methods.

Hence, including a variety of millets in the daily diet is highly recommended to prevent malnutrition in apparently healthy persons as well as in persons experiencing clinical conditions.

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# SPRAY DRYING AND FOOD PROCESSING

AUTHOR

Ms Nithyakalyani V.,

Food Technologist,  
PFNDI



Convenience foods are a blessing for students residing in hostels, for working men/women who live independently as these can be quickly prepared into a wholesome and tasty meal. Most instant foods available in the market will fall under this category of convenience foods, be it instant coffee, instant tea, milk powder, instant soup mixes. Many of these items are prepared by some form of drying methods.

## What is Drying of Foods?

It is one of the oldest and important methods of food preservation.

Preservation involves extending the shelf life of the food product by preventing its spoilage. Certain microorganisms grow; some chemical and enzymatic reactions take place in foods, which can lead to the spoilage of the food. These activities need moisture. Drying or dehydration of the food reduces the water content and helps the food stay fresh for an extended period. Commonly but not always, when one says dehydration, a dryer is used while drying is mostly done naturally.

The other advantages of drying foods can be listed as follows:

- o Drying reduces size, volume and weight thereby packaging becomes easier and cheap. This also leads to reduced bulk transportation costs.
- o Drying facilitates further processing for e.g. drying of grains/ cereals for producing flour.

The objective is to dry the food product quickly, at low cost and with minimum changes in the quality of the product.

Different types of dryers are employed in food industries namely tray dryers, cabinet dryers, drum dryers, fluidised bed dryers, spray dryers, freeze dryers and many more. One of the most versatile drying method used for making powders is spray drying.

Spray drying is effective for highly heat sensitive materials. Instant coffee and tea, milk powders, soymilk powder, enzymes, cocoa, potato, ice cream mix, butter, cream, yoghurt, cheese, fruit juices, meat and yeast extracts, encapsulated flavours,

wheat and corn starch products, egg powders, etc. are some products which can be prepared by spray drying.

Spray Drying is a process where a food in its liquid or slurry form is converted into a dry powder by using a hot air to dry the food material rapidly.



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direction as the feed (co-current), opposite to direction of feed (counter current) or mixed flow. Co-current flow of air is the most preferred as the air at the higher temperature touches the wet particles first. As the particles dry the air cools as it gives its heat to food drops to vaporise moisture from food. Thus, cooler air meets dried particles preventing them from overheating.

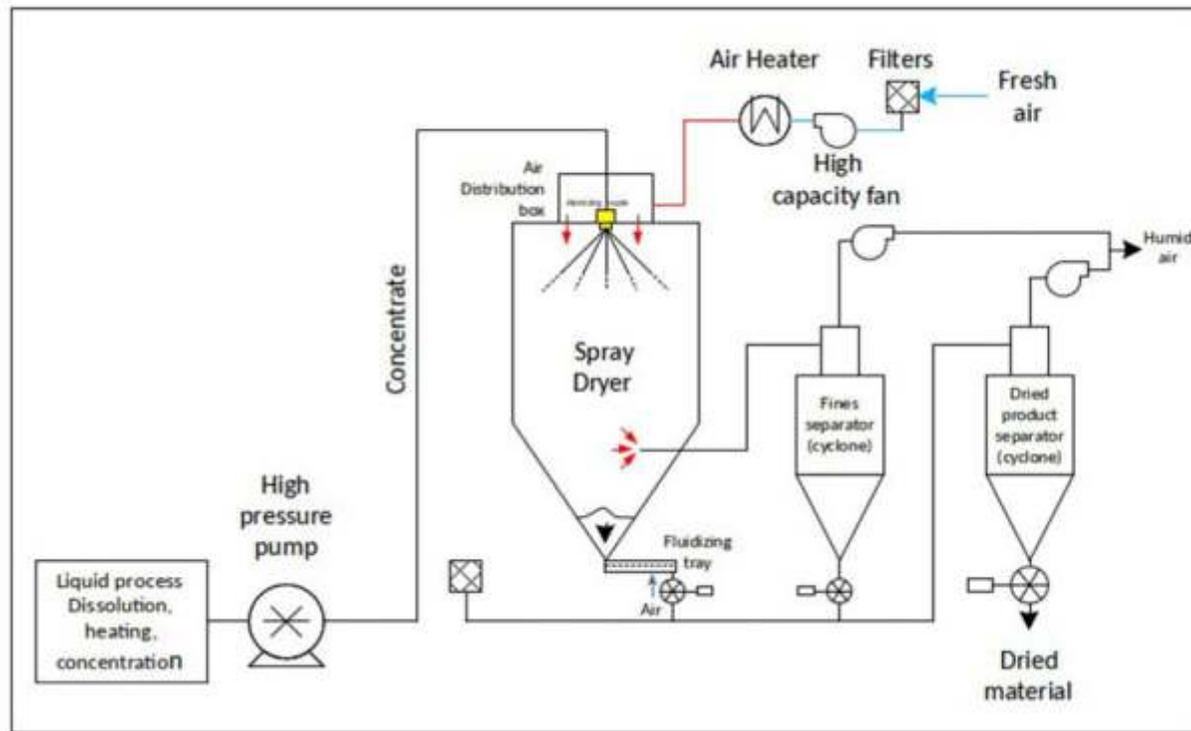
Removal of moisture occurs along the length of the chamber. The dried product is collected at the bottom of the chamber. The particle size of the final product ranges from [25 to 150 micron](#). This powder is pneumatically conveyed to a cyclone, where it is separated from the air. The air from the drying chamber is also passed through another cyclone to separate any fines that it may be carrying and returns it to the product stream.

In this context it will be interesting to look at two popular spray dried products milk powder and instant coffee powder.

**Principle of a Spray Dryer-** Food material (in a fluid form) to be dried is atomized i.e. converted to fine spray of droplets and is exposed to a moving stream of hot gas, the temperature of the droplets increases resulting in dried form of spherical particles.

A spray disk atomizer is also provided at the roof of the chamber and is capable of rotating between 3000 to 50000 rpm. As the atomizer rotates, the centrifugal force drives the droplets into a helical path. Different types of atomizers are available. It is vital to minimize the size of the droplets so that it dries faster.

**Working of a Spray dryer-** It consists of a large cylindrical stainless steel drying chamber with a short conical bottom. Hot air is introduced from the roof of this chamber near the spray of liquid food and the temperature of the inlet air is adjusted in such a way that the droplet dries before reaching the walls. Flow of air can be in the same





final product may have around 3% water.

Powder obtained here may have poor reconstitution property i.e. it

may not mix well with water. To overcome this issue agglomeration was developed. In this process the fine dried powder is rewetted to about 8-15% moisture and then dried again. The powder is now granular and dissolves easily. This can now be packaged and stored appropriately.

The production of milk powder set a precedence for other instant powders to be manufactured. One such popular beverage item is instant coffee. Initially there were obstacles such as clumping of coffee powder due to its low water solubility and loss of flavour while instant coffee powder was manufactured but persistent efforts gave way to instant coffee powders that smell and taste exactly like freshly brewed coffee.

**INSTANT COFFEE-**

Coffee robusta beans are widely used for this process as it more attractively priced and easier to grow than Coffee arabica. The beans are roasted, ground and brewed before drying to obtain instant coffee powder. The drying process is completed using either a spray dryer or freeze dryer.

Here's a look at the spray drying process

for instant coffee powder: The cooled clarified liquid concentrate is passed in the form of droplets from a nozzle (atomizer) at the top of a drying tower. Hot air at around 250° C is passed through the tower to dry up the moisture. The dry coffee powder collects at the bottom and appears as free flowing, non-dusty particles containing 2-4% moisture. This can be followed by agglomeration process to produce coarser particles that will dissolve completely when rehydrated. In this process, the dry powder is slightly wetted by exposing it to steam so the particles adhere to one another and form larger, granular particles.

Aromatic volatiles that have been extracted earlier could be added at this stage to make up for the loss of flavour compounds due to high temperature being used.

The instant coffee powder is packaged under low humidity, low oxygen environment in a moisture proof container to keep away moisture and retain the flavour in the final product.

As it can be seen in both these products, spray drying is one of the important steps in the manufacturing process to obtain a high quality end product.



**MILK POWDER -**

Milk contains around 87% water. It is used for making chocolate, cheese and baby formula along with a host of other items. Powder may be obtained by removing the water present in the milk.

First step in the manufacture of milk powder would be to conduct a quality check on the milk being used for safety reasons followed by standardization and homogenization to achieve the right fat content and even fat distribution.

This is followed by removal of water that takes place in three phases:

**Ultrafiltration-** Here 60% of water is removed by passing the milk through a number of membrane filters.

**Evaporation:** Steam is passed under pressure to evaporate another 25% of water. This process is done quickly to ensure that most nutrients in the milk are retained.

**Spray Drying-** Around 30 meter high drying chamber is used for this process. The concentrated milk is fed under high pressure from the top of the chamber and sprayed down as fine droplets (atomization). Hot air is blown down along with the milk, which removes the remaining water, so the



### Advantages of Spray Drying:

- It is a quick drying and a single step process. The process is continuous, automatic and is also cost effective and simple.
- It is a gentle process suitable for both heat sensitive and heat resistant materials. So, even enzymes and proteins can be processed without much loss of activity.
- The raw material can be solution, slurry, emulsion, paste, melt or cake, all of it can be processed.
- The final quality of the product can be controlled, spherical and relatively uniform particles can be produced.
- When compared to other drying process like freeze drying it is cheaper and involves a shorter process thereby consuming lesser energy.

### Disadvantages of Spray Drying

- Capital investment costs are high.
- Spray dryer is a convection dryer so the thermal efficiency is low around 30-40%

Though there are certain hitches in using a spray dryer it can be used to produce a lot many dry powders that just need hot water to be added to it to prepare a reconstituted product that is as close to fresh product. Therefore, spray dryers are here to stay and help in manufacturing convenience products for the benefit of the consumers.

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# WEBINAR REPORT ON FUTURE OUTLOOK ON HEALTHY INGREDIENTS WITH SPECIAL EMPHASIS ON PROTEINS "FOOD & NUTRITION EXPO 2022"



Protein Foods & Nutrition Development Association of India conducted the first ever Virtual Exhibition & Webinar on Future Outlook on Healthy Ingredients with Special Emphasis on Proteins under the "Food & Nutri Expo 2022" on 14th Dec 2022.

The sponsor for the event was Hindustan Unilever, Marico, Nestle India Ltd & Fine Organics Industries.

There were 7 Exhibitors for the Virtual Exhibition - Vista Processed Foods, Hexagon Nutrition Ltd, Roquette India Pvt Ltd, SA Pharmachem Pvt Ltd, Prolicious, Sensient India Pvt Ltd & PFNDAI.

The delegates were able to access the whole virtual event consisting of a webinar & virtual exhibition, participant was allowed to visit all the stall, explore the various products of the exhibitors & get the E-Brochure' & exchange business cards. The participant was having access to the Networking lounge to



**Ms Anuja Padte,**  
Food Scientist,  
PFNDAI



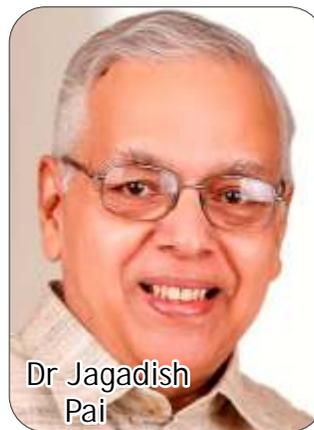
**Dr Shashank Bhalkar,**  
Assistant Director,  
PFNDAI

AUTHORS

have one on one conversations with exhibitors, speakers, and experts.

There were 3 Informative sessions which were held under the Webinar & the sessions were sponsored by Amway, Marico & Zydus Wellness. The sessions were as follow

1. Current Developments in Proteins
2. The emergence of Health Foods, Supplements & Claims
3. Dialogue Among Leaders on Nutri cereals & Proteins



**Dr Jagadish Pai**

## Session I

The webinar started with a warm welcome to all the Delegates, Speakers, Sponsors & Exhibitors for the event by **Dr Jagadish Pai**, Executive Director PFNDAI. **Ms Dolly Soni**, Manager Marketing and Projects, PFNDAI gave brief information of the first-ever

**FOOD and NUTRITION EXPO 2022** & also introduced all the speakers.



**Ms Dolly Soni**

**Dr Shatadru Sengupta**, Vice President - Legal, Hardcastle Restaurants Pvt Ltd; Chairman, PFNDAI, gave a welcome address where he mentioned the changes raised after the



pandemic and people certainly became aware of Nutrition, Health & Safety. He gave some highlights on the webinar topics which were to be discussed by the expert. He gave his best wishes to all the speakers, panellists & sponsors for the event.

The first session of the webinar was Current Developments in Proteins. The first speaker for the session was **Dr Sesikeran B**, Former Director, NIN (ICMR), Hyderabad & Hon. Scientific Director, PFNDAI.

Dr Sesikeran gave a presentation on the topic Importance of Proteins with the Health Benefits of Plant Proteins. He mentioned that Protein



is required right from conception until death at every stage they are needed for the growth of the body for the maintenance of the various system & basic metabolism. Our country has overcome protein deficiency to some extent but at the same time, there is a common opinion that

animal proteins are superior to plant proteins. He highlighted audience about different protein sources such as animal, plant & others. He further mentioned that According to ICMR - NIN RDA published in 2020, PE (protein efficiency) ratio

requirement ranges between 5-15 across all age groups. PE ratio is based on the weight gain of a test subject (normally rats) divided by its intake of a particular food protein during the test period. In humans, it depends on the age and physiological condition of the individual. He also explained to the audience on allergenicity of proteins.

The second presentation was by **Dr Shobha Udipi**, Hon Director, Integrative Nutrition and Ayurceuticals, Medical Research Centre-Kasturba Health Society.

Dr Udipi presented on Recent Perspectives on Quality of Proteins, where she mentioned that protein in our diets accurately & objectively defines protein quality -an important role in addressing human nutrition requirements, nutrition policy, trade, and product development. Further, she also mentioned that US FDA currently uses the Protein Digestibility-Corrected Amino Acid Score (PDCAAS) to



measure protein quality in most foods, Canadian government utilizes the PER. She also briefed on the Issues/Challenges in Quality Evaluation. At the end of her talk, she explained structural changes modify protein digestibility.

The third presentation was by **Dr Govindarajan Raghavan**, Head R&D, Zydus Wellness presented on Developing Innovative High Protein Products where he spoke on Diet Diversity, which is crucial to meet the nutritional needs, and gave a brief on the



consumption of the right quantity & quality of protein & the daily requirements needed. Further, he spoke on the Role & Types of Protein i.e. Structural, Biochemical & Kinetic & the types of amino acids. Dr Govindarajan briefed on the various sources of proteins, which are Plant Protein, Animal Protein, Dairy Protein (Milk & Milk Products), Insect Protein & Algal Protein.

He explained in briefly the DIASS score & also highlighted the Scientific Literature on Protein Blends. Further, he spoke on the survey conducted on the Taste & Protein Quality while the formulation of high Protein Products was done.

# 8 IMMUNITY NUTRIENTS BANAYE RAKHE IMMUNITY HAR DIN



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In the end, he mentioned that the future will be the application of advancing omics tools, databases & networks to the breeding of new varieties in record time for emerging plant-based protein food systems.



Mr Pranay Jain



Mr Vinay Hastak



Dr Bhavna Sharma



Dr Jagadish Pai

There was a Q & A round taken for all the speakers after the respective presentations. Also after the Presentation, there was a Panel Discussion which was moderated by **Dr J S Pai**, Exe. Director PFNDAI & the panellist were **Mr Vinay Hastak**, -Vista Processed Food, **Dr Bhavna Sharma**, Head, Nutrition Science Division, ITC Foods, **Mr Pranay Jain**, Founder Body First.

Dr Pai welcomed all the panel members and the interaction started with the Q&A round where the panel interacted on the various subject matters. Many of the high protein food products are either high-sugar beverage mixes or bars etc. or meat analogs. Why industry does not think of some new products? & Plant proteins

especially from legumes are mostly globular which are difficult to imitate the fibrous structures of animal proteins. So, there is a need for adding many additives, which may not be welcome to consumers, & whether there are any solutions for it.

### Session II

The second session of the webinar was Emergence of Health Foods, Supplements & Claims. The first speaker for the session was **Dr Vidya Sridhar**, Senior Manager, Food Designer, Amway India Enterprises Dr Sridhar presented on the topic Application of Proteins to Make Healthier Food Products.

She highlighted the audience in brief on protein quality, protein functionality & applications. She explained in detail about protein & protein nutrition & also covered in detail the roles of protein & protein quality: Animal vs Plant scores as there are very essential while developing any new products. She further spoke on the emergence of plant protein & the sources of plant proteins, which are pulse protein, cereal protein, potato protein, water lentil protein, nuts protein & oilseed protein. She also briefed the audience on the protein Functionality & applications & of the food format of protein.

She concluded her talk by interpreting the application vs functionality for different food

categories & also the challenges overcome while applications. She summarised her talk by mentioning that the Consumer needs increasing for high-quality clean-labelled protein-rich products. New-age proteins are on the rise with excellent functionality to meet consumer needs.

Understanding the functionality of protein is key to choosing the right protein for successful application in food.

The Second talk for the session was by **Dr Sudershan Rao**, Dy Director (retd) National Institute of Nutrition, Hyderabad. Dr

Sudershan presented on the topic of Validation of the Health Benefits of Functional Foods before Making Health Claims. He mentioned that "Health Claim" means any representation that states, suggests, or implies that a relationship exists between a food or a constituent of that food and health & also mentioned the essential components that are Nutraceutical Ingredients & health-related benefits.

Further, he spoke on the requirements of under regulations for health claims & the process for the substantiation of health claims (Codex).



Dr Vidya Sridhar



Dr Sudershan Rao

Dr Rao further explained to the audience the essential components of systemic review i.e., the search strategy used to capture the scientific evidence, food or property of food, the health effect-proposed relationship & a final list of studies based on the inclusion and exclusion criteria. He also briefed on how the decision tree needs to be approached for establishing food health relationships and the criteria that should be considered. He concluded his talk by mentioning that Substantiation is a basic requirement of making a health claim & observational studies or studies in animal models or in vivo and in vitro studies are not sufficient for substantiation of a health claim.

The last talk for the session was by **Dr A Sivakumar**, Head Regulatory, HUL.



**Dr A Sivakumar**

Dr Sivakumar presented on the topic of Newer Systems of Healthy Rating of Food Products. In his talk he briefed the audience about Front of Pack Labelling (FOPL) & the objectives of front of pack labelling i.e. to educate the consumer on the nutritional quality of F&B products, enable consumers to make healthier choices quickly & intuitively & driver reformulation by F&B industry.

He also briefed on types of

FOP labelling systems used globally under nutrient specific systems i.e. numeric only (GDA Labelling), colour coded labels (multiple traffic Lights), warning labels (black octagon labels of Chile) & summary indicator system i.e. scale base graded labels (Health Star Rating, Nutriscore). He further spoke on the FOPNL journey in India, which started in the year 2013, & the FOPL model for India was announced in 2021-2022. Further, he spoke on Food Safety & Standards (Labelling & Display) Amendment Regulations, 2022 & the INR product categories, which included Category 1: Solids (including dairy products & beverages) Category 2: Liquids (excluding dairy products) Category 3: exempted from FOPNL.

He also explained why we need product group-specific categories in INR. He concluded his presentation by summarising on per serving/portion-based algorithm and not 100g/100ml, Inclusion of category-specific product groups, broaden the "positives" definition: vitamins, minerals, essential fats, reconstitution principle to be applied (beverages-HFD, squash, and soups), exclude HFSS definition as it creates ambiguity.

There was a Q&A round taken for all the speakers after the respective presentations. Also after the Presentation, there was a panel discussion which was moderated by **Dr Shashank Bhalkar** Ass. Director, PFNDAI & the panellist for the session were



**Mr Arjun Dasoondi**



**Ms Shilpa Wadhwa**



**Dr Shashank Bhalkar**

**Mr. Arjun Dasoondi**  
Associate Vice President, Process & Packaging Engineering, I&S- Amway,

**Ms Shilpa Wadhwa** Head - Nutrition, Health & Wellness, Nestlé India.

There were few questions discussed on the health foods, supplements & claims like are Indian consumers even aware of how to read the existing food labels and the importance of each parameter on the label? Any survey has been done to understand this. & health rating of food products is nice. However, how far are they practicable? Can you have each and every piece of food going into mouth be highly nutritious?

Does the authority want people to have a better overall diet or remove all sweets, savouries and fried foods removed from the market?



### Session III

The third session was "Dialogue on Nutri Cereals and Proteins" which was the cherry on the cake of the whole program. We were fortunate to have towering personalities from Industry and research on this very current and important topic of "Nutri Cereals". The time of this dialogue was very apt, as FAO has declared 2023 as Millet year.

#### Initial thoughts of speakers on Millets

**Dr Sesikeran B**, Former Director, NIN (ICMR), Hyderabad & Hon Scientific Director, PFNDAI was the moderator of the discussion.



**Dr Sesikeran B**

In his opening remarks briefly talked about Millets in India. It has 5000 years of existence in India with its ups and downs. This crop requires little water, and can grow in hotter temperatures. Initially, it was consumed by a large population. Then people switched over wheat and rice thinking that this is food for poor.

Now in the era of climate change and also when NCDs are on rise, Nutri Cereals are gaining importance because of their ability to grow in harsh climate having lesser greenhouse effects and also their composition of relatively higher protein and fibre helpful in controlling lifestyle ailments. Dr. Sesikeran then asked speakers to share their initial thoughts.

**Dr. Dayakar Rao** (Principal Scientist IIMR) who has about three decades of research work experience on Millets, described the development of these Nutri-Cereals post-independence. Initially, they were grown for self-consumption by farmers. After green revolution, rice and wheat became staple diet.



**Dr Dayakar Rao**

Now with emergence of NCDs and typical Nutritional profile of Millets, which are helpful as diet for these conditions, they are gaining importance and have transformed from crop for self-consumption to commercial crop. IIMR has been responsible to build this value chain from scratch.

Government programs like Nutri Hub are also helping to build the value chain. Like other cereals, their proteins also lack in Lysine and they can be complemented with legumes.

**Dr. Nikhil Kelkar** (Joint managing Director, Hexagon Nutrition) briefly gave his opening remarks. He talked about how high protein and



**Dr Nikhil Kelkar**

fibre make them healthy cereals. There is need to develop a range of products to popularize them. Also, the usage by urban population should increase.

**Dr. Prabodh Halde** (Head Research and Regulatory Affairs, Marico) mentioned that 2023 will be International Millet Year as declared by FAO.

In addition to Protein and



**Dr Prabodh Halde**

Fibre, we should not forget Vitamins and Minerals from these wonderful cereals.

Another point he mentioned that there is lot of

awareness created about these is creating pressure from Consumers to have products based on Millets. He is hopeful that even 10% of our population changes to Millets will be good.





Ministry of Food Processing is encouraging millet based start-ups by giving PLI scheme. The products are distributed in ICDS schemes. APEDA is doing export promotions of these products. Presently twenty Government departments are working on value chain of Millets. Next question was for Dr. Nikhil. Daily fibre needs are quite high. How to meet by consuming Millet based products? In his reply, Dr. Nikhil said the daily requirement is 25 to 30 g which is difficult to meet. It can be met by addition of other fibres like Isapgol. These kinds of fibres are difficult to swallow. However new ingredients like resistant maltodextrins which are also with low glycemic index may be used. When asked about presently only products like multigrain atta are mainly available with is insignificant, Dr. Prabodh mentioned mainly two issues. Product taste, which very critical for consumers and secondly, maintaining quality of grains at farm level.

**Second round:**

In the next round of questions, Dr. Dayakar Rao was asked about issue of Antinutritional factors in Millets. He responded this is known fact



since seventies, but with advancement in processing technology like Extrusion, Germination or Fermentation, it is not of great concern. Dr. Nikhil was asked about role of proteins in age related issues like Sarcopenia. He said the issue is real as even in case of urban population, the daily requirements are not met for proteins. By using clinical nutrition supplements the issue can be tackled to some extent. D. Sesikeran added that not only meeting daily requirements is important but also the physical activity is equally important. When asked about Fortification of Millets based products, Dr. Prabodh responded that the Millets are rich in Micronutrients. Instead of fortifying externally, this can be achieved by use of two different Millets to get the desired result. Millets can be presented in the form of tasty products like Ice Cream etc. Dr. Dayakar opined that although many Millets are rich in micronutrients giving as much as one third of RDAs, the bioavailability is a question. He also mentioned the efforts of IIMR with other ICAR institutes to create composite products like Millets plus Mushrooms to get sufficient Micronutrients.

**Third round:**

Question to Dr. Dayakar was on storage of Millets and flour. He gave very exhaustive reply. Grains can be stored for about twelve months, which is reasonably good storage period. In case of flours, because of lipase getting activated during milling, the rancidity developed shortening the shelf stability. Vacuum

packing will help but will be good only for export as the cost is involved. Dual technology where first the germ is removed prior to milling might help. Converting flour in value added products by extrusion will also help extending shelf life. Dr. Nikhil was asked on his views on whey proteins quality aspects. He said that we are importing lot of whey proteins. When used in clinical nutrition products, instantised whey is required because of good dispersibility. Whey proteins have PDCAAS of 1, BV of 104 and NPU of 92. They are rich in BCAA, therefore can be used in sports nutrition products. The next question to Dr. Prabodh was lot of new sources of proteins like chia seeds, quinoa etc. are being imported. and marketed. We want to promote millets. How do we tackle the issue? Dr. Prabodh said that they can be consumed as in India as we have protein deficiency. The cheaper sources like millets can be used by the people in the bottom of the pyramid. Dr. Dayakar Rao added that he sees this will not be that difficult to handle as the Prime minister himself is talking of using the millets in all the forums. There are twenty outreach programs developed for millets. Lot of big industries want to work on millet products with IIMR and that shows good future for millets.





**Protein Foods & Nutrition Development Association of India organized**

# Food & Nutrition Expo 2022

(Webinar & Virtual Exhibition)



**Held on 14th December 2022**

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Thus, this interesting session covered all the aspects of these wonder cereals. This includes history, present status, work by research institutes and industry, raw material and product problems, government support and future.

The webinar ended with a vote of thanks to all the sponsors, exhibitors, speakers, panellist, audience & organizing team by Ms Dolly Soni, Manager Marketing and Projects.

Please click the attached link to view the live-recorded Webinar <https://fb.watch/ipJhAeAqN/>

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# REGULATORY ROUND UP



AUTHORS

**Dr. N. Ramasubramanian,** Director, VR FoodTech,  
[n.ram@vrfoodtech.com](mailto:n.ram@vrfoodtech.com)

**Dr. Shashank Bhalkar,** Asst Director,  
 PFNDAI

Dear Readers

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

[Latest list of FSSAI approved food testing laboratories.](#)

[FSSAI in its order dated 10 February 2023 has enhanced the ease of doing business in the licensing process.](#) In the past, the entire licensing fees had to be paid at the time of application. In case of rejection, there was a delay in refund. This has been corrected vide this order. As per the order, the FBO need to pay only Rs 1000 at the application stage and the rest after the license is granted. The license shall be issued only after paying the difference amount.

[FSSAI has published list of](#)

[products approved and rejected under FSS \(Non Specified Food\) Regulation, 2017](#)

[Final notification setting standards for Basmati rice, Fowl eggs, lowering the fat requirement in double toned milk, limits for naturally occurring formaldehyde in fresh water and marine fish.](#)

The salient aspects of the regulation are

- A new standard for Basmati, a premium variety of rice, has been introduced. The standard also describes Basmati varieties like Brown, Parboiled Brown, Milled and Parboiled Milled, etc. Quality parameters for different varieties have been established. We are sure that this introduction will be helpful to the trade.

- Blended Rice: This notification allows blending of Basmati rice with any Basmati resembling rice. Such a blended rice product will have to carry a mandatory declaration indicating the percentage of different rice in the blend.



- Supplement for Children as described in 2.4.11 of FSS (Food Products Standards and Food Additives) Regulation, 2011 has been amended. In the original regulation, Vitamin E was erroneously expressed as "L Tocopherols" which is now corrected as "Alpha Tocopherols". New requirements for Energy - Protein ratio, protein quality in terms of PDCAAS have been specified.

- Extender and Binders, used in the meat and meat products have been defined.
- Limits for naturally occurring formaldehyde in various species of Fishes (Marine and Freshwater Fin fishes, Marine Lizard Fishes, Frozen Stored marine Fish products) have been stipulated.
- In case of Chocolate standards, declaration with regard to addition of vegetable oils and fats is amended.



- Under Appendix A of FSS (Food Products Standards and Food Additives) Regulation, 2011, the limit of Tocopherols in vegetable oil is reduced from from GMP to 300 mg/ Kg maximum.
- Many additional processing aids are permitted in many categories under Appendix C of FSS (Food Products Standards and Food Additives) Regulation, 2011

[The Food Authority vide its letter dated 12.01.23 has directed the regional directors and central licensing officers to ensure that the Food](#)

[Business Operators manufacturing “ Non Carbonated water based \(Non Alcoholic\) beverages” are complying with the prescribed standards under 2.10.6 \(3\) of FSS \( Food Products Standards and Food Additives\) Regulation, 2011.](#) Apparently this is to counter the move by a few manufacturers of packaged drinking water using this category to circumvent the BIS certification requirement.

[FSSAI is cracking down on manufacturers of dairy analogues describing the products like “Vegan Ghee” , “ Plant based Ghee/Butter”.](#) The descriptions like ghee, butter are strict dairy terms and cannot be used in dairy analogue products.

As per conditions of the licensing, manufactures, relabellers and repackers are directed to get their products analysed for contaminants once in six months from a NABL certified FSSAI approved laboratory. [Now, FSSAI through its order dated 13 January 2023 has directed the food business operators to upload the laboratory reports directly on the portal on or before 31 March 2023 for the year 2022-23.](#) It is expected that this would be linked to the online submission of Form D returns.



[Ports have been earmarked for the import of high risk foods milk and milk products, meat, fish and their products, egg powder, infant foods and health supplements.](#)

[List of registered foreign manufactures, exporting high risk foods like milk and milk products, Nutraceuticals, Infant Foods to India, is put on the FSSAI website under the heading “REFOM”.](#)

[Health certificate requirement in case of imported consignments of high risk foods like milk, fish and pork and their products has been postponed to 01 March 2023.](#)

[Here is a great news for license holders. Licenses would be instantaneously renewed on application provided no changes or amendments are sought. However, the license would be issued only for a year.](#)

[Compliance date of declaration of unit sale price has been pushed to 01 April 2023.](#)



# RESEARCH IN HEALTH & NUTRITION

## Study Finds Dieters May Overestimate the Healthiness of Their Eating Habits

Science Daily November 1, 2022

In a small study, most adults seeking to lose weight overestimated the healthiness of their diet, according to preliminary research to be presented at the American Heart Association's Scientific Sessions 2022.

Nearly half of adults in the U.S. try to lose weight each year, according to the Centers for Disease Control and Prevention, with a majority attempting to eat more fruits, vegetables and salads. Healthy eating is essential for heart and general health, and longevity. Dietary guidance from the American Heart Association issued in 2021 advises adults to eat a variety of fruits and vegetables; opt for whole grains rather than refined grains; choose healthy protein sources; substitute nonfat and low-fat dairy products for full-fat versions; choose lean cuts of meat (for those who eat meat); use liquid plant oils instead of tropical oils and animal fats; choose minimally processed over ultra-processed foods; minimize foods and beverages

with added sugar; choose foods with little or no added salt; and limit or avoid alcohol.

Researchers evaluated the diets of 116 adults aged 35-58 years old in the greater Pittsburgh, PA, area who were trying to lose weight. Study participants met one-on-one with a dietitian to discuss their nutrition and then tracked everything they ate and drank every day for one year on the Fitbit app. They also weighed themselves daily and wore a Fitbit device to track their physical activity.



Researchers calculated a Healthy Eating Index (HEI) score at the beginning and end of the study based on the types of foods that participants reported eating. Participants were asked to complete a 24-hour food recall for two days at each time point. The HEI is a measure for assessing how closely a dietary pattern aligns with the U.S. government's Dietary Guidelines for Americans. A score of 0 to 100 is possible,

with a higher score indicating a healthier diet. The score is based on the frequency of eating various dietary components such as fruits, vegetables, whole and refined grains, meat and seafood, sodium, fats and sugars.

Participants self-scored their beginning and ending diet quality to determine their perceived scores. Their scores were also on a 0-100 scale based on the components of the HEI. The self-assessment of their beginning diet was a "look back" as they scored both their starting and ending diets at the end of the study. The difference in their starting and ending score was their perceived diet change. A difference of 6 points or less between the researchers' HEI score and the participant's perceived score was considered "good agreement."

At the end of the study, about 1 in 4 participants' scores had good agreement between their perceived diet score and the researcher-assessed score. The remaining 3 out of 4 participants' scores had poor agreement, and most reported a perceived score that was higher than the HEI score assigned by researchers. The average perceived score was 67.6, and the average HEI score was 56.4.



In judging the change in diet score over 12 months, only 1 in 10 participants had good agreement between their self-assessed change compared to the change in the researchers' HEI score. At the end of the study, participants improved their diet quality by about one point based on the researcher-assessed score. However, participants' self-estimate was a perceived 18-point improvement.

"People attempting to lose weight or health professionals who are helping people with weight loss or nutrition-related goals should be aware that there is likely more room for improvement in the diet than may be expected," said Cheng. She suggests providing concrete information on what areas of their diet can be improved and how to go about making healthy, sustainable nutrition changes.

"Future studies should examine the effects of helping people close the gap between their perceptions and objective diet quality measurements," she said.

"Overestimating the perceived healthiness of food intake could lead to weight gain, frustrations over not meeting personal weight loss goals or lower likelihood of adopting healthier eating habits," said Deepika Laddu, Ph.D., an assistant professor in the College of Applied Health Sciences at the University of Illinois, Chicago, and chair of

the American Heart Association's Council on Lifestyle Behavioral Change for Improving Health Factors.

"While misperception of diet intake is common among dieters, these findings provide additional support for behavioural counselling interventions that include more frequent contacts with health care professionals, such as dieticians or health coaches, to address the gaps in perception and support long-lasting, realistic healthy eating behaviours."

### Tracing Tomatoes' Health Benefits to Gut Microbes

Science Daily November 8, 2022

Two weeks of eating a diet heavy in tomatoes increased the diversity of gut microbes and altered gut bacteria toward a more favourable profile in young pigs, researchers found. The research is published in the journal *Microbiology Spectrum*.

Ten recently weaned control pigs were fed a standard diet and 10 pigs were fed the standard diet fine-tuned so that 10% of the food consisted of a freeze-dried powder made from the tomatoes.

Fibre, sugar, protein, fat and calories were identical for both diets. The control and study pig populations lived separately, and researchers running the study minimized their time spent with the pigs -- a series of precautions designed to ensure that any

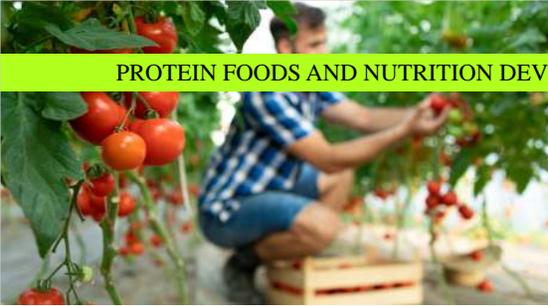


microbiome changes seen with the study diet could be attributed to chemical compounds in the tomatoes. Microbial communities in the pigs' guts were detected in fecal samples taken before the study began and then seven and 14 days after the diet was introduced.

The team used a technique called shotgun metagenomics to sequence all microbial DNA present in the samples. Results showed two main changes in the microbiomes of pigs fed the tomato-heavy diet -- the diversity of microbe species in their guts increased, and the concentrations of two types of bacteria common in the mammal microbiome shifted to a more favourable profile.

This higher ratio of the phyla Bacteroidota (formerly known as Bacteroidetes) compared to Bacillota (formerly known as Firmicutes) present in the microbiome has been found to be linked with positive health outcomes, while other studies have linked this ratio in reverse, of higher Bacillota compared to Bacteroidota, to obesity.





Tomatoes account for about 22% of vegetable intake in Western diets, and previous research has associated consumption of tomatoes with reduced risk for the development of various conditions that include cardiovascular disease and some cancers.

But tomatoes' impact on the gut microbiome is still a mystery, and Cooperstone said these findings in pigs -- whose gastrointestinal tract is more similar than rodents' to the human GI system -- suggest it's an avenue worth exploring.

### 'Healthy Plant-Based Diets Better For the Environment than Less Healthy Plant-Based Diets

Science Daily November 10, 2022

Healthier plant-based dietary patterns were associated with better environmental health, while less healthy plant-based dietary patterns, which are higher in foods like refined grains and sugar-sweetened beverages, required more cropland and fertilizer, according to a new study led by researchers at Harvard T.H. Chan School of Health and Brigham and Women's Hospital.

The study, which is one of the first to look simultaneously at the health and environmental impacts of various plant-based diets, was published in the

November 2022 edition of The Lancet Planetary Health.

Previous research has documented that different types of plant-based diets have various health effects. For example, plant-based diets higher in whole grains, fruits, vegetables, nuts, legumes, vegetable oils, and tea/coffee are associated with reduced chronic disease risk, while plant-based diets high in fruit juices, sugar-sweetened beverages, refined grains, potatoes, and sweets/desserts are associated with an increased risk of chronic disease. Yet little research has been conducted to determine the environmental impacts, such as greenhouse gas emissions, use of high-quality cropland, nitrogen from fertilizer, and irrigation water, of these dietary approaches.

Using data from the Nurses' Health Study II, the researchers analyzed the food intakes of more than 65,000 qualifying participants, and examined their diets' associations with health outcomes, including relative risks of cardiovascular disease, and with environmental impacts. To differentiate plant-based dietary patterns, the researchers characterized participants' diets using various dietary indices, including the Healthy and Unhealthy Plant-based Diet Indices. Higher scores on the unhealthy plant-based diet index indicated



higher consumption of refined grains, sugary drinks, fruit juice, potatoes, and sweets/desserts; while higher scores on the healthy plant-based diet index indicated higher consumption of vegetables, fruits, whole grains, nuts, legumes, vegetable oils, and tea/coffee.

Participants who consumed healthy plant-based diets had lower cardiovascular disease risk, and those diets had lower greenhouse gas emissions and use of cropland, irrigation water, and nitrogenous fertilizer than diets that were higher in unhealthy plant-based and animal-based foods. Participants who ate unhealthy plant-based diets experienced a higher risk of cardiovascular disease, and their diets required more cropland and fertilizer than diets that were higher in healthy plant-based and animal foods.

### Carnitine Intake is Associated with Better Postnatal Growth and Larger Brain Size in Very Preterm Infants

Science Daily November 14, 2022



A recent study by the University of Eastern Finland and Kuopio University Hospital shows that carnitine intake in the first postnatal weeks promotes better growth and larger brain size at term equivalent age in very preterm infants.



Carnitine intake from breast milk in particular seems to be associated with better growth. The findings were published in *Nutrients*.

Carnitine is a compound similar to amino acids, and its primary function in the body is to transport long-chain fatty acids to the cell powerhouse mitochondria for energy production. In addition, earlier studies have suggested that carnitine may also be involved in nervous system development. Carnitine is both obtained from nutrition and produced by the body. In preterm infants, the main sources of carnitine are breast milk and infant formulae containing carnitine.

### Very preterm infants have an increased risk for developing carnitine deficiency

"Very preterm infants born before 32 weeks of gestation are at risk of developing carnitine deficiency due to limited tissue stores, immature endogenous synthesis, and insufficient intake from nutrition. Due to rapid growth, they also have an increased need for carnitine," says Postdoctoral Researcher Suvi Manninen of the University of Eastern Finland.

The associations of carnitine intake and serum carnitine levels with the growth and brain size of preterm infants have not been studied in a

longitudinal setting before. In this new study, the researchers measured the carnitine levels of preterm infants at three time points and calculated the intake of nutrients, including carnitine, over the first five postnatal weeks. The researchers examined the associations of serum carnitine levels and nutrition with the growth of weight, length and head circumference, as well as brain diameters determined by magnetic resonance imaging.

The intake of carnitine, and free carnitine and short-chain acylcarnitine concentrations in serum, were associated with the growth of preterm infants and with cerebellar size in particular. In addition to these associations, dietary carnitine was found to correlate with free carnitine and short-chain acylcarnitine concentrations in serum, suggesting that these carnitine levels can be considered markers of carnitine intake.

Further research is still needed on whether carnitine supplementation is necessary during prolonged parenteral nutrition and, on the other hand, whether breast milk should be enriched with carnitine in some situations in the dietary treatment of preterm infants.

### Honey Reduces Cardio-metabolic Risks

Science Daily November 16, 2022

Researchers at the University of Toronto have



found that honey improves key measures of cardio-metabolic health, including blood sugar and cholesterol levels -- especially if the honey is raw and from a single floral source.

The researchers conducted a systematic review and meta-analysis of clinical trials on honey, and found that it lowered fasting blood glucose, total and LDL or 'bad' cholesterol, triglycerides, and a marker of fatty liver disease; it also increased HDL or 'good' cholesterol, and some markers of inflammation.

"These results are surprising, because honey is about 80 per cent sugar," said Tauseef Khan, a senior researcher on the study and a research associate in nutritional sciences at U of T's Temerty Faculty of Medicine. "But honey is also a complex composition of common and rare sugars, proteins, organic acids and other bioactive compounds that very likely have health benefits." Previous research has shown that honey can improve cardio-metabolic health, especially in in vitro and animal studies.





The current study is the most comprehensive review to date of clinical trials, and it includes the most detailed data on processing and floral source. The journal *Nutrition Reviews* published the findings this week.

The researchers included 18 controlled trials and over 1,100 participants in their analysis. They assessed the quality of those trials using the GRADE system and found there was a low certainty of evidence for most of the studies, but that honey consistently produced either neutral or beneficial effects, depending on processing, floral source and quantity.

The median daily dose of honey in the trials was 40 grams, or about two tablespoons. The median length of trial was eight weeks. Raw honey drove many of the beneficial effects in the studies, as did honey from monofloral sources such as Robinia (also marketed as acacia honey) -- a honey from False Acacia or Black Locust Trees -- and clover, which is common in North America.

Khan said that while processed honey clearly loses many of its health effects after pasteurization -- typically 65 degrees Celsius for at least 10 minutes -- the effect of a hot drink on raw honey depends on several factors, and likely would not destroy all its beneficial properties. He also noted other ways to consume

unheated honey, such as with yogurt, as a spread and in salad dressings.

## Antioxidant Flavonols Linked to Slower Memory Decline

Science Daily  
November 22, 2022

People who eat or drink more foods with antioxidant flavonols, which are found in several fruits and vegetables as well as tea and wine, may have a slower rate of memory decline, according to a study published in the November 22, 2022, online issue of *Neurology*<sup>®</sup>, the medical journal of the American Academy of Neurology.

"It's exciting that our study shows making specific diet choices may lead to a slower rate of cognitive decline," said study author Thomas M. Holland, MD, MS of Rush University Medical Center in Chicago. "Something as simple as eating more fruits and vegetables and drinking more tea is an easy way for people to take an active role in maintaining their brain health." Flavonols are a type of flavonoid, a group of phytochemicals found in plant pigments known for its beneficial effects on health.

The study involved 961 people with an average age of 81 without dementia. They filled out a questionnaire each year on how often they ate certain foods. They also completed annual cognitive and memory

tests including recalling lists of words, remembering numbers and putting them in the correct order. They were also asked about other factors,



such as their level of education, how much time they spent doing physical activities and how much time they spent doing mentally engaging activities such as reading and playing games. They were followed for an average of seven years.

The people were divided into five equal groups based on the amount of flavonols they had in their diet. While the average amount of flavonol intake in US adults is about 16 to 20 milligrams (mg) per day, the study population had an average dietary intake of total flavonols of approximately 10 mg per day. The lowest group had an intake of about 5 mg per day and the highest group consumed an average of 15 mg per day; which is equivalent to about one cup of dark leafy greens.

To determine rates of cognitive decline, researchers used an overall global cognition score summarizing 19 cognitive tests.



The average score ranged from 0.5 for people with no thinking problems to 0.2 for people with mild cognitive impairment to -0.5 for people with Alzheimer's disease.

After adjusting for other factors that could affect the rate of memory decline, such as age, sex and smoking, researchers found that the cognitive score of people who had the highest intake of flavonols declined at a rate of 0.4 units per decade more slowly than people whose had the lowest intake. Holland noted this is probably due to the inherent antioxidant and anti-inflammatory properties of flavonols.

The study also broke the flavonol class down into the four constituents: kaempferol, quercetin, myricetin and isorhamnetin. The top food contributors for each category were: kale, beans, tea, spinach and broccoli for kaempferol; tomatoes, kale, apples and tea for quercetin; tea, wine, kale, oranges and tomatoes for myricetin; and pears, olive oil, wine and tomato sauce for isorhamnetin.

People who had the highest intake of kaempferol had a 0.4 units per decade slower rate of cognitive decline compared to those in the lowest group. Those with the highest intake of quercetin had a 0.2 units per decade slower rate of cognitive decline compared to those in the lowest group. And

people with the highest intake of myricetin had a 0.3 units per decade slower rate of cognitive decline compared to those in the lowest group. Dietary isorhamnetin was not tied to global cognition.

Holland noted that the study shows an association between higher amounts of dietary flavonols and slower cognitive decline but does not prove that flavonols directly cause a slower rate of cognitive decline.

### Higher Vitamin K Intake Linked to Lower Bone Fracture Risk Late in Life

Science Daily November 28, 2022

Breaking bones can be life-changing events -- especially as we age, when hip fractures can become particularly damaging and result in disability, compromised independence and a higher mortality risk. But research from Edith Cowan University's Nutrition and Health Innovation Research Institute has revealed there may be something you can do to help reduce your risk of fractures later in life.

In collaboration with the University of Western Australia, the study looked at the relationship between fracture-related hospitalisations and vitamin K1 intake in almost 1400 older Australian women over a 14.5-year period from the Perth Longitudinal Study of Aging Women.

It found women who ate more



than 100 micrograms of vitamin K1 consumption -- equivalent to about 125g of dark leafy vegetables, or one-to-two serves of vegetables -- were 31 per cent less likely to have any fracture compared to participants who consumed less than 60 micrograms per day, which is the current vitamin K adequate intake guideline in Australia for women.

There were even more positive results regarding hip fractures, with those who ate the most vitamin K1 cutting their risk of hospitalisation almost in half (49 per cent).

Study lead Dr Marc Sim said the results were further evidence of the benefits of vitamin K1, which has also been shown to enhance cardiovascular health. "Our results are independent of many established factors for fracture rates, including body mass index, calcium intake, Vitamin D status and prevalent disease," he said.

"Basic studies of vitamin K1 have identified a critical role in the carboxylation of the vitamin K1-dependant bone proteins such as osteocalcin, which is believed to improve bone toughness. A previous



ECU trial indicates dietary vitamin K1 intakes of less than 100 micrograms per day may be too low for this carboxylation. Vitamin K1 may also promote bone health by inhibiting various bone resorbing agents."

Dr Sim said eating more than 100 micrograms of vitamin K1 daily was ideal -- and, happily, it isn't too difficult to do. "Consuming this much daily vitamin K1 can easily be achieved by consuming between 75-150g, equivalent to one to two serves, of vegetables such as spinach, kale, broccoli and cabbage," he said.



## Fries Back on the Menu? Parallel Studies Tout Benefits of Potatoes on Weight and Insulin Response

21 Nov 2022 Nutrition Insight

Rich in fibre and nutrients, potatoes are often singled out as a food to limit. However, experts in two separate studies are revealing that the oft-fried food can not only be a part of a healthy diet, but also help decrease body mass index (BMI) - a major factor in the development of Type 2 diabetes - and may improve

### insulin sensitivity.

Researchers looked at the effects of higher intakes of potatoes on blood pressure, lipids, and glucose, and found that after accounting for other dietary and lifestyle factors, there was no increased risk of cardio-metabolic disorders associated with potato consumption. Additionally, the effects of "feeling full" may be one of the key factors in how potatoes affect BMI.

### Effortless weight loss

The study included 36 participants between the ages of 18 to 60 that were either obese, overweight, had insulin resistance or some mixture of the three. They were given controlled diets for eight weeks that substituted about 40% of the typical meat consumption with either beans or potatoes. The meals were also high in fruits and vegetables.

The results showed that, even though blood glucose levels were only nominally affected, insulin resistance was significantly decreased. Moreover, BMI decreased almost 6% from baseline with potatoes compared to less than 4% with beans.

Beans are often considered preferable to potatoes, but the study shows people may achieve better outcomes with potatoes.

Contrary to common belief, potatoes did not negatively



impact blood glucose levels.

The individuals who participated in our study lost weight. Each participant's meal was tailored to their personalized caloric needs, yet by replacing some meat content with potato, participants found themselves fuller quicker, and often did not even finish their meal.

Furthermore, study shows that a diet high in potato content has no negative effects on the cardio-metabolic system either, even if the potatoes were fried.

The researchers found no association between eating four or more cup equivalent portions of potatoes with Type 2 diabetes or hypertension after evaluating case studies from the Framingham Offspring cohort - a second-generation study that monitored and recorded the health of the children of 5,209 participants.

By William Bradford Nichols





## Krill Oil Supplementation Found Effective against Age-Related Brain Degeneration

25 Nov 2022 Nutrition Insight

A new research paper is suggesting that krill oil supplementation might serve as a possible approach for healthy brain aging interventions. Lipid extracts from Antarctic krill are rich in long-chain omega 3 fatty acids, choline, and astaxanthin.

In the study, researchers from the University of Oslo, Oslo University Hospital and Akershus University Hospital used *C. elegans* and human cells to investigate whether



krill oil promotes healthy aging. The paper entitled "Krill oil protects dopaminergic neurons from age-related degeneration through temporal transcriptome rewiring and suppression of several hallmarks of aging" was published in the journal *Aging*.

### Understanding molecular mechanisms

The researchers highlight there is accumulating evidence that interfering with the basic aging mechanisms can enhance healthy longevity and that interventional or therapeutic strategies targeting multiple aging hallmarks could

be more effective than targeting one hallmark. However, while health-promoting qualities of marine oils have been extensively studied, the underlying molecular mechanisms are not fully understood.

Krill oil rewires distinct gene expression programs that contribute to attenuating several aging hallmarks, including oxidative stress, proteotoxic stress, senescence, genomic instability and mitochondrial dysfunction.

Mechanistically, krill oil increases neuronal resilience through temporal transcriptome rewiring to promote anti-oxidative stress and anti-inflammation via health span regulating transcription factors such as SNK-1.

Moreover, krill oil promotes dopaminergic neuron survival through the regulation of synaptic transmission and neuronal functions via PBO-2 and RIM-1.

"Collectively, krill oil rewires global gene expression programs and promotes healthy aging via abrogating multiple aging hallmarks, suggesting directions for further pre-clinical and clinical explorations," the researchers note.

Edited by Joshua Poole



# FOOD SCIENCE & INDUSTRY NEWS

## Microalgae-Based Ice Cream: Vegan Alternative with “Higher Nutrition”

10 Nov 2022 Nutrition Insight

Danish Technological Institute (DTI) and Sophie’s BioNutrients are unveiling the “world’s first” chlorella-based ice cream to boost the availability of environmentally friendly food sources. The vegan, dairy-free ice cream was created using dairy-free Chlorella Protein Concentrate.

“Microalgae, in general, have a good nutritional profile, meaning that they contain both healthy oils or fatty acids and have a good protein quality and amino acid composition. In the case of ice cream, using microalgae as a base will mean a good nutritional profile of the final ice cream as well,” Anne Louise Dannesboe Nielsen, director of AgroTech at DTI, tells NutritionInsight.

“Microalgae is one of the planet’s most nutrient-rich and versatile resources. We have shown another facet of this superfood’s unlimited possibilities - a dairy and lactose-free alternative to ice cream that, due to microalgae, offers a higher



Image Source: Sophie’s BioNutrients/Danish Technological Institute

nutrition content than most available dairy-free alternatives,” says Eugene Wang, co-founder and CEO at Sophie’s BioNutrients.

Wang explains that the use of microalgae aids in the advancement of allergen-free cuisine and the possibility of

more inclusive eating.

“Microalgae is a good way of securing high quantities of healthy proteins in a very environmentally sustainable way,” says Nielsen. “Ticking the boxes for both nutrition and sustainability means that microalgae are receiving a lot of attention now and I guess they will become part of our future diet.”

Neutral-coloured, unadulterated microalgae flour was produced from *Chlorella Vulgaris* and harvested in three days in a protected environment. The *Chlorella Vulgaris* microalgae strains utilized are GRAS in the

US and approved by the European Food Safety Authority for use as food ingredients or supplements. *Chlorella* ice cream can deliver double the recommended amount of vitamin B12 in a single serving. Additionally, *chlorella* is a strong source of iron.



This ice cream innovation, unlike traditional plant-based ice cream, has a complete nutritional profile, replicates the texture of natural ice cream when combined with other functional ingredients and is simple to make into several popular ice cream flavours with additional toppings. The main challenge with working with a lot of new ingredients, including microalgae, is obtaining the right taste and texture.

Furthermore, masking of the taste is often required when working with new ingredients, which was also the case for these microalgae.

By Nicole Kerr

## Salted Egg Chips Gains Steam in US: 'Asian Snack-Aisles Are One of the Highest-Growing Segments'

By Mary Ellen Shoup  
11-Oct-2022 - Food Navigator USA

Singaporean snack brand IRVINS is broadening its reach into the US snacking category with its salted egg chips and salted egg salmon skins, which have become some of the most popular snacks

across Southeast Asia. The process involves taking the yolk from duck eggs that have been sitting in a salty clay brine for 30 days.

The yolk is then cooked over a flaming hot wok until it bubbles and is combined with a blend of chillies and other spices before being gently mixed with the chips (potato or crispy salmon skins) forming the salted egg chips.

"Really when you talk about the boom that led to how I expanded my company globally was when I transformed the food from the restaurant to become packaged snacks," CEO Gunawan told FoodNavigator-USA. The products quickly took off among Singaporean consumers as well as in the Philippines and other Asian markets.

Gunawan acknowledges that crispy salmon skins may be a hard sell for less adventurous consumers, which is why the

brand also offers more universal products such as its salted egg potato chips and is expanding flavours with new launches including sour cream & onion and truffle potato chips.

It is also working on some more 'clean label' versions of its products that omit certain ingredients such as MSG to gain distribution into popular natural retailers. "We want to work with American companies to make some localized products," said Gunawan.



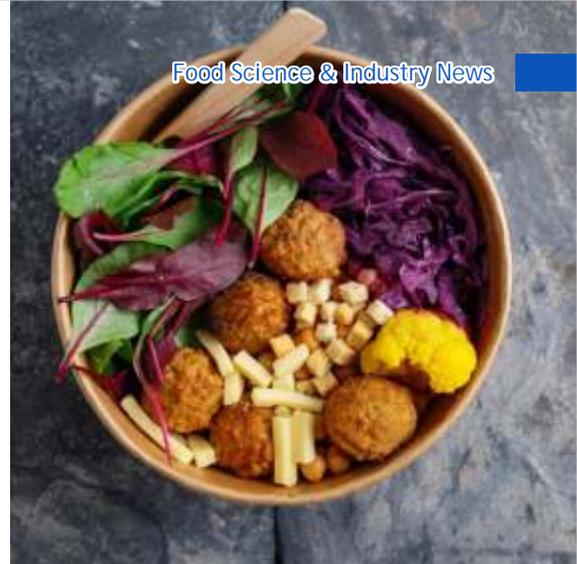
## 2023 Healthy Food Trends: Clean Label and Positive Nutrition Claims Crucial For Consumers

By Pearly Neo 11-Oct-2022 - Food Navigator Asia

Consumers in the Asia Pacific region will continue to be strongly driven by products with clean label and positive nutrition claims moving into the new year, with food and beverage brands also set to boost innovation to meet these demands. The health and wellness trend has been constantly on the rise in the food and beverage sector over the past few years, accelerated even more since the COVID-19 pandemic hit in 2020.



Image Source: <https://eatirvins.sg/>



Moving into 2023, industry experts are confident that this trend will continue to guide consumer purchasing decisions, with particular emphasis on the clean label and positive nutrition claims that are drawing great interest especially in larger markets.

"A recent survey has shown that almost 60% of consumers in Asia put great import on clean label products, saying that this has a fair to great deal of influence on their buying decisions," Innova Markets Team Manager Insights and Innovation Nicole Jansen said at the recent Fi Asia-Vitafoods event in Bangkok, Thailand.

"Within this, the fastest growing clean label claims in the region are claims that the product is natural (11%), that there are no added additives or preservatives (9%) and that it is GMO-free (5%). This is particularly important in large markets in Asia as we also found that consumers in these markets are the most likely to check product labels, i.e. India (77%), Indonesia (69%) and China (69%) all showed scores above the global average of 58%.

"The clean label trend has evolved a fair bit over the past few years, going from the initial natural and additive free requirements to also

being minimally processed, having a short ingredients list, providing transparency in the supply chain and also being ethical in its production - and this is likely to continue in the near future."

In addition to clean label, Jansen added that positive nutrition claims, or what is dubbed 'reductionism' i.e. the reduction of 'bad stuff' such as sugar, fat and salt, will also be very important when it comes to driving consumer purchasing decisions.

"Consumers want products that are low in ingredients they consider unhealthy, and these can range from sugar to salt to fat to gluten - 20% of consumers in Asia listed this as a top priority in healthy food and beverage selection," she said.

"We also found that sugar reduction is top of mind for most consumers at -41%, followed by fat reduction at -39% and salt reduction at -31%, and overall about 30% of all consumers in the region have been reducing their consumption of these ingredients. Food firms in the region have already started taking notice, and this can be seen via the new product launches of late - overall nearly 20% of all new F&B product launches in APAC focus on reduction claims, e.g. there have been an extra 17% of products with sugar reduction claims, 12% of products with low/no/reduced sodium claims, and 16% of products with fat reduction claims launched."

## Plant-Based Alternatives Won't Cut It, Argue Cell Ag Innovators: 'Consumers Are Unwilling To Compromise on Sensory Experience'

By Flora Southey 18-Oct-2022 - Food Navigator Asia

Meat and dairy alternatives made from 100% plants don't hit the mark on taste, texture, and nutrition, suggest cellular agriculture pioneers: "If you don't deliver on that, go home."

Between now and 2050, global populations are expected to rise to close to 9bn. With that, comes an increase demand for protein - animal-derived protein alone is expected to double compared to 2017 levels.

Increased awareness around the environmental impact of animal agriculture - livestock production is estimated to contribute to 14.5% of human-induced global greenhouse gas emissions - has helped to propel the global market for plant-based alternatives.





great number of players in food tech are working to bring novel ingredients to the market. In Europe, where Novel Foods regulation is more stringent than in other geographies,



It's estimated the global plant-based meat market is worth \$7.9bn, according to Markets and Markets, with projections it will reach \$15.7bn by 2027.

The global dairy market, recently valued at \$22bn, is forecast by Fortune Business Insights to grow to \$61.4bn by 2029. Yet whether plant-based meat and dairy alternatives are completely winning over consumers of their conventional counterparts is contested.

"We have a problem," according to Nadav Berger, founder and managing director of food tech investor PeakBridge VC. "Meat consumption is growing, and their replacements are not growing at the pace [required to] make a difference," he told delegates at the Future Food-Tech event in London. "We believe, at PeakBridge, that those alternatives are not good enough." It comes down to their taste, texture, and nutritional profiles, he suggested: "Nobody wants to kneel...The general audience will move to [meat] alternatives only if they're going to be tasty, clean, and healthy."

How can meat and dairy alternatives be developed to hit the mark on taste and nutrition? Some argue cellular agriculture is the only way. A

cellular agriculture-derived meat and dairy products have yet to be commercialised. Over in the US, however, precision fermentation-derived dairy player Perfect Day has been selling its animal-free whey since 2019. The company recently launched into Asia, and according to Alex Brittain, who heads up Perfect Day's international strategy, development and operations, the business 'has plans to come to Europe in the near future' as well.

Regulation is undoubtedly a concern for cellular agriculture pioneers, but according to Brittain, of all the barriers facing adoption of new food ingredients, he perceives consumer acceptance and trust to be the 'big challenge'. Changing consumer purchasing and consumption behaviour is near impossible, suggested the Perfect Day SVP. In 2018, recipe box company HelloFresh commissioned a survey on scratch cooking in the UK. Findings revealed a quarter of Brits are able to cook just three tried and tested recipes. "This goes to show how deeply entrenched and engrained shopping behaviours are, and how they link to food habits," he told delegates at the Future Food-Tech event.

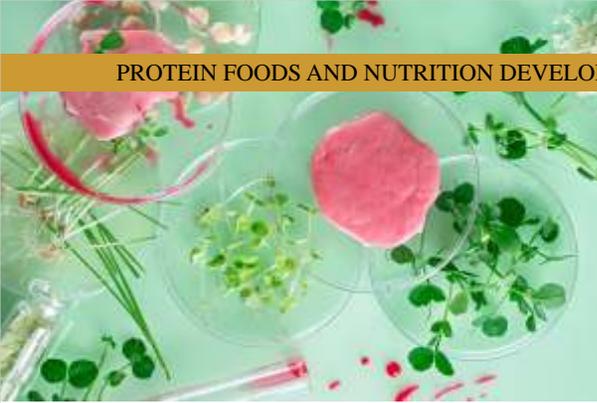
'We can't ask consumers to shop their way out of the climate catastrophe'

Of course, there is a 'small proportion' of people who are willing to compromise, suggested Perfect Day's Brittain, describing consumers who make decisions based on 'logic' and by 'thinking through sustainability'. "But I think that those people are, realistically, few and far between."

Whether the responsibility to reduce consumption - and accordingly, production - of animal agriculture-derived products lies with consumers or the food industry is another hotly contested topic. Israeli cultivated meat start-up Future Meat Technologies doesn't believe placing the responsibility on consumers is getting us anywhere, fast. "For the past 10-15 years, we've been saying to consumers that they should shop their way out of our climate catastrophe," said CEO Nicole Johnson-Hoffman.

"That is not a sensible approach to this problem. We have to deliver supply-side solutions. We have to supply consumers with foods that they need, that we know they will like, and that have already solved these problems for them."





Future Meat's solution is cultivated meat grown from animal cells in bioreactors. Its first products to market will likely be cultivated chicken and cultivated lamb products, with cultivated beef in the pipeline. Like Brittain, Johnson-Hoffman acknowledges that without meeting consumer expectation on sensory attributes, market disruption is far from a sure-thing.

### Plant-Based Products Are Globally Growing! But Do They Cater To All?

03-Oct-2022  
Food Navigator  
Asia

Plant-based foods such as meat and dairy alternatives have been around for many years, but they're becoming more popular and of higher quality than ever. Supermarkets and restaurants are increasing their stocks of plant-based products, driven by the growing number of vegans, vegetarians, and flexitarians in Europe, North America, and now even in Asia, where plant-based foods are traditionally common.



Smaller companies and brands started the plant-based revolution with meat alternatives for vegans and vegetarians. However, globally active major food companies are now investing heavily in this market. Due to these investments, they see significant potential in targeting not solely vegans and vegetarians but the rising number of flexitarians who have now become the major group consuming plant-based meat alternatives.

Along with the plant-based meat trends, plant-based dairy alternatives made from bases beyond soy - such as oat, almond, and potato - are making their way into the spotlight. After their success in EU and US markets, the

demand in Asia has also continued to grow in recent years. (TAKASAGO Global Trend Book 2022). Market research firm Euromonitor International expects sales

of dairy alternatives in Asia to grow 8% through 2022, compared with just 4% for traditional dairy. The company attributes this increase to growing consumer awareness around health benefits and environmental concerns surrounding conventional dairy products.

Indications suggest that plant-based alternatives will

continue to be a global megatrend and that innovative product development is vital for future success. However, in order to guarantee success, identifying what consumers expect and want when purchasing plant-based alternatives is critical.

Traditionally in the west, when consumers considered plant-based alternatives, they thought about soy milk and 'veggie' burgers. Often consumers felt these products were only for vegan/vegetarians or those on diets and wanted to eat more healthily. A study by Takasago confirmed there are 'multiple reasons consumers choose plant-based products', such as feeling better about eating more plant-based foods and health concerns. This consumer belief reinforced to manufacturers that 'plant-based meat' could be a consumer success.

Today, the plant-based meat market is larger than ever. According to Euromonitor, in 2021, global consumers purchased a record \$5.6 billion in retail sales, with a 16.5% one-year growth from 2020 to 2021 and a 75.9% three-year growth from 2018.





Furthermore, specific products, such as alternative milks and creamers, have become growth drivers for their overall categories. During 2020, PBMA saw a dramatic increase in sales from \$962 million to \$1.4 billion in retail sales, according to IRI Infoscan. While people were stuck at home during lockdown, they were looking to try new things and searching for new experiences. Despite the phenomenal growth over that initial period of 2019 to 2020, the PBMA (Plant-Based Meat Alternatives) market growth has stalled since 2021.

### Potato Protein Market Is Expected To Generate a Revenue Of USD 100.2 Billion By 2026

Oct. 3, 2022 /PRNewswire

Consumer worries about food allergies in products are a critical part of the expansion in Potato Protein market revenue, and an increase in the vegan population will promote market growth. Potato protein is a dry by-product derived from the production and separation of potato starch. It is a plant-based protein that combines excellent protein content with

effective fortification to fit into a healthy lifestyle. As a result, potato protein has a wide range of applications in the food and beverage industry, including baked goods, confectionery, soups and sauces, and snacks.

Potato protein is a dry by-product derived from the production and separation of potato starch. It is a plant-based protein that combines excellent protein content with effective fortification to fit into a healthy lifestyle. As a result, potato protein has a wide range of applications in the food and beverage industry, including baked goods, confectionery, soups and sauces, and snacks.



Potato is plant-based protein source that can aid with muscle maintenance. According to the most recent studies, protein derived from potatoes can be of excellent quality and help a person build and maintain muscular growth. For tissue growth and workout preparation, potato protein concentrate is beneficial. Weanling animals' performance



was sustained by using meals rich in potato protein.

In recent years, consumer interest in protein consumption has significantly increased. The need for plant-based protein sources has increased along with the demand for clean-label, allergen-free products. Additionally, the ease of digestion and compatibility with a vegan diet are two advantages that contribute to potato protein's widespread use. This has increased demand for goods that are protein-rich and protein-enriched and increased interest in plant protein components among food makers and foodservice operators.

This factor influenced the growth of the global potato protein market favourably. In addition, soy proteins have historically dominated the market for plant-based protein additives. However, potato protein is becoming more popular because it is acceptable for all types of livestock and may be use in place of soy proteins in some protein-rich diets.



## Cultivated Meat Revolution Changes Gear as FDA Gives “Historic” Nod to Cell-Based Chicken in US

17 Nov 2022

Upside Foods has become the first company in the world to receive a “No Questions” letter from the US Food and Drug Administration (FDA) for cultivated meat, poultry or seafood, which means the government food agency accepts Upside’s conclusion that its cultivated chicken is safe to eat. This is a truly groundbreaking moment for food and is seen as a step closer to commercialization.

“After a rigorous evaluation, FDA accepts our safety conclusion. Upside Foods is ushering in a new era in meat production with this “No Questions” letter, and this historic step paves the way for our path to market in the US. Cultivated meat has never been closer to the US market than it is today,” an Upside spokesperson tells FoodIngredientsFirst.

“It’s a hugely legitimizing moment for the cultivated meat industry, and will set the stage for the industry in the US and around the world. Our technology platform is capable of producing full cuts of meat, not just a ground or minced product. This enables our products to have amazing texture, and allows for greater versatility of culinary

# REGULATORY NEWS

applications. Our first product to market will be our delicious cultivated chicken filet,” they explain further.

Although much R&D continues to gather pace in the burgeoning cultivated meat industry, Singapore has been the only country to allow the commercialization of products, proving to be a hub for the cell-based movement. Approval in a major market has been absent, including the EU, where it is expected in 2025/2026. Meanwhile, South Korea is set to globally dominate cultivated meat patent filings, according to an analysis of the developing market of future protein sources.

### Cultivated chicken on US horizon

To have an official “greenlight” in the US regulatory process is a huge step forward for this major market. The evaluation by the FDA as part of a pre-market consultation, which concludes the agency, has “no further questions at this time” about UPSIDE Foods’ conclusion that its cell-based chicken is safe to eat. “This is a watershed moment in the history of food,” says Dr. Uma Valeti, CEO and Upside Foods founder.

“We started Upside amid a world full of sceptics, and we’ve made history again as the first company to receive a ‘No Questions’ letter from the FDA for cultivated meat. This milestone marks a major step toward a new era in meat production, and I’m thrilled that US consumers will soon have the chance to eat delicious meat that’s grown directly from animal cells.”

### Regulatory process

In the US, cultivated meat is regulated by the FDA and the USDA. Having received the FDA letter, Upside Foods will now work with the USDA’s Food Safety and Inspection Service (FSIS) to secure the remaining approvals so the cultivated chicken can go on sale.

“We’ve found that the more people learn about cultivated meat and the potential benefits it can provide to the world, the more excited they become about it. Those who have tasted our products have been blown away by how good and familiar they taste, so ultimately it will come down to consumer education and having people taste cultivated meat for themselves,” the spokesperson continues.

### What does the FDA say?

Before this food can enter the market, the next evaluation stage includes examining the company's facility to ensure it meets USDA and FDA requirements. In addition to the FDA's requirements, including facility registration for the cell culture portion, the manufacturing establishment needs a grant of inspection from the USDA-Food Safety and Inspection Service (FSIS) for the harvest and post-harvest portions and the product itself requires a USDA mark of inspection.

"The FDA's approach to regulating products derived from cultured animal cells involves a thorough pre-market consultation process. While this is not considered an approval process, it concludes when all questions relevant to the consultation are resolved. A transition from the FDA to USDA-FSIS oversight will take place during the cell harvest stage," explains the FDA.

### Slaughter-free, leveraging cells

Upside Foods grows meat, poultry and seafood directly from animal cells. These products are not considered vegan or vegetarian but meat, made without the need to raise and slaughter animals. Cultivated meat has been gathering pace for several years, with many developments globally. Seen as the solution to the world's ballooning population, alternative proteins without the need for animals and as a way to mitigate increasing climate pressures, companies are attracting billions in

investments and the R&D race is well and truly on.

Cell-based meat is made in a controlled environment subject to high testing standards for safety and quality control. It has the potential to help reduce the risk of harmful bacterial contamination.

By Gaynor Selby



### India Amends Food Safety and Standards (Foods for Infant Nutrition) Regulations 2022

Sep 1, 2022 Selerant Food News: Ashwanandhini Govindarajan

On August 31st, 2022, the Food Safety and Standards Authority of India published an article on the "[Gazette notification of Food Safety and Standards \(Foods for Infant Nutrition\) First Amendment Regulations, 2022](#)" in accordance with the Food Safety Standards act of 2006.

The document includes the following changes:  
In Regulation 4 of Food Safety and Standards (Foods for Infant Nutrition) Regulations, 2020, the "Food Safety and Standards (Packaging and Labelling) Regulations, 2011" is substituted with "Food Safety and Standards

(Labelling and Display) Regulations, 2020;

- In sub-regulation 2 of regulation 7, infant formula in powder format manufactured without the use of any vegetable oil, linoleate, vitamin E, etc., the product may be named "Infant Milk Food";
  - In regulation 10, the words "pH adjusting agents" is proposed to be replaced with "Acidity regulators".
- The regulation is effective October 01st, 2022.

### India Issues Food Safety and Standards (Labelling and Display) Amendment Regulations

Oct 17, 2022 Selerant Food Regulatory News: Ashwanandhini Govindarajan

On October 14th, 2022, the Food Safety and Standards Authority of India published the article on the "[Food Safety and Standards \(Labelling and Display\) Second Amendment Regulations, 2022](#)" as required by section 92 Food Safety Standards act of 2006.

The notification proposes the following changes for consideration:

- Section 2.6 Labelling of various types of bread shall comply with requirements as indicated under Specialty Ingredient and Minimum amount of Specialty Ingredient as % of Flour;



- Specialty Ingredients for Multigrain Bread shall be a minimum of 10% in the 1st year of enforcement, and thereafter it shall be 20%;
- Protein-enriched bread shall contain a minimum of 15% edible protein content;
- Labelling of Pan Masala with the health warning statement must cover 50% of the front-of-pack of the label.

The regulation is effective from May 01st, 2023.



## FSSAI proposes regulations for genetically modified food:

Press Trust of India November 21, 2022

FSSAI has come out with draft regulations for genetically modified food, proposing mandatory prior approval from the regulator to manufacture, sell and import food or ingredients produced from genetically modified organisms.

The proposed Food Safety and Standards (Genetically Modified Foods) Regulations, 2022 will apply to Genetically Modified Organisms (GMOs) intended for food use, as per

the Food Safety and Standards Authority of India (FSSAI).

The regulations, once implemented, will also be applicable to food ingredients produced from GMOs that contain modified DNA as well as for food ingredients produced from GMOs that do not contain modified DNA but includes ingredients/additives/processing aids derived from GMOs. GMO means any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology.

"No person shall manufacture, pack, store, sell, market or otherwise distribute or import any food or food ingredient produced from GMOs, except with the prior approval of the food authority," the draft regulations said.

All food products (GMOs intended for food use and food ingredients produced from GMOs that contain modified DNA) must be labelled with the words 'contains genetically modified organisms'. This is subject to the condition that if the product contains one per cent or more of the GM ingredient considered individually. This label must appear on the front of pack of pre-packaged products. This labelling requirement also applies to adventitious or technically unavoidable presence of GM ingredients, FSSAI said. The labelling requirement will not be applicable to GM-food products in which the modified DNA is not detectable.



## FSSAI rules: Here is what packaged food and restaurant menus must mention

The government on November 17, 2020, notified the norms under the Food Safety And Standards (Labelling and Display) Regulations, 2020, for producers, retailers, and servers

### Labelling rules for pre-packaged food

**Name of the food:** The notification said that every food shall carry the name of the food, which indicates the "true nature" of what is inside the pack. It must be displayed on the front of the pack.

**Ingredients:** The label of the food must contain complete details about its ingredients. It should go under a specific title like "ingredients/ list of ingredients." The ingredients must be mentioned in a decreasing order based on their composition by weight or volume. Also, the use of any additive needs to be mentioned on the pack.





be mentioned on the label with the qualifying words "Manufactured by (Mfg by, Mfd by)" or "Marketed by (Mkt by)" or "Manufactured & Marketed by" or "Packed & Marketed by" as the case may be.

Also, the date of manufacturing and expiry needs to be printed on the package.

**FSSAI logo:** The logo of FSSAI and license number must also be mentioned on the label. "In addition, the license number of the manufacturer or marketer or packer or bottler, as the case may be, if different from the brand owner, shall also be displayed on the label," the regulations read.

**Instructions and allergens:** The food package must contain information on the instructions for use and the list of allergens.

**Principal display panel:** The details are required to be mentioned on the principal display panel of the package.

**Labelling rules for restaurants**

**Calorific value:** The package must mention the calorific value against the food item on the menu. It must be accompanied by calorie requirements. "An average active adult requires 2,000 kcal energy per day, however, calorie needs may vary," needs to be printed on the menu.

**Allergen and nature:** The menu must specify if the food



is vegetarian or non-vegetarian. It must also specify the presence of any potential allergen.

**Nutritional information:** The menu must carry the nutritional value of the food item. If the food is organic or not, must also be specified. Although, a "deviation of 25 per cent may be tolerated in case of nutritional information declaration."

**Health messages:** "Nutritional information and/or ingredients information along with health messages shall be displayed where food is served in a manner as may be required and specified by the Food Authority," the regulations said.

## Decoding Sustainability Claims: How Much Do Consumers Care About Climate Change And How Is It Influencing Their Purchase Decisions?

By Elizabeth Crawford  
17-Oct-2022 - Food Navigator Asia

**Sustainability may be a rising priority influencing consumer purchases, but optimistic**



### Nutritional information:

According to the norms, "nutritional information is a description intended to inform the consumer of nutritional properties of the food". Details of "sugars", "added sugars", "fat", "dietary fibre", and "nutrients" must be printed on the pack. The energy and protein details also need to be mentioned on the pack.

### Declaration regarding veg or non-veg:

Every non-vegetarian food must carry a "brown colour filled triangle inside a square with brown outline". For vegetarian food, "the symbol shall consist of a green colour filled circle inside a square with green outline". Food containing only eggs, except vegetarian ingredients, needs to be declared separately with the symbol of non-vegetarian food.

### Declaration regarding food additives:

The notification said, "Every food to which a flavouring agent is added in accordance with Regulation 3.3.1(1) of Food Safety and Standards (Food Product Standards and Food Additives) Regulations, 2011, it shall be declared in the list of ingredients."

**Details of manufacturer:** The complete name and the address of the manufacturer and the brand owner need to

According to consumer research presented by Datassential at the Food Nutrition Conference & Expo (FNCE) in Orlando last week, three-quarters of consumers claim their values are a huge part of their identities and 71% claim their personal values influence their food choices and what they eat. This includes climate change, which has worked its way up into the top five issues on which consumers say food brands and restaurants should take stand, Bridget Hegg, associate director of customer experience at Datassential told FNCE attendees.

“Sustainability is becoming more and more of an important value to consumers,” with a quarter to a third listing it as an issue that food brands and restaurants should address, she said, noting that it comes in close behind other values, including homelessness, human rights, healthcare and hunger & food insecurity. It also edged out labour issues, gender equality, education and some equity issues.

While this may not seem like a significant portion of the population, Hegg adds that climate change is more important to younger consumers with 33% of Gen Z listing it compared to 28% and 27% of Millennials and Boomers, respectively, which suggests the issue will likely continue to grow as these consumers come into their full buying power. But despite growing awareness and concern about climate change and who should be held

accountable, it likely will be awhile still before climate change becomes a central value in consumers’ dietary patterns.

According to Datassential, 77% of consumers have never heard of the climatarian diet, which is based on suggested recommendations, rather than strict rules, about how to reduce the environmental impact and carbon footprint through diet. Only 15% of consumers report having heard about the climatarian diet, but haven’t tried it, while a mere 4% have either previously practiced it but don’t any more or currently practice it, Hegg reported. She was quick to add that low awareness and adoption of the climatarian diet doesn’t mean manufacturers and retailers should dismiss the idea. Rather, she again noted that younger consumers and men – two important shopping demographics – are more engaged with the concept.

Of those who have heard of the diet, 25% were Gen Z and 18% of Millennials compared to only 7% Boomers, and men were more likely than women to practice it, according to Datassential. “We need to be prepared as that population starts to get older,” Hegg said. One way to do that is to adopt terms and diets that are adjacent to the climatarian diet, including vegetarian, seasonal, organic and vegan – all of which are top menu terms with which most consumers are aware. And of these, vegetarian and vegan are the fastest growing on



menus – up 4% and 12% from a year ago, and 9% and 98% from four years ago.

Other related terms that are on the rise on menus are meat-free, which is up 7% from a year ago, plant-based (up 25%) and dairy-free (up 12%), according to Datassential. Notably, the overt term ‘sustainable’ is down significantly on menus – dropping 9% in the past year and 11% in the past four years. Animal welfare terms on the rise that are often used to highlight food quality, also play a role in sustainable food production systems and helping to connect the dots between them and climate change could help brands and restaurants better position themselves for when the climatarian diet gains traction.

In the past four years, Datassential found claims on menus for pasture raised are up 45%, humane 200%, cage-free 31%, antibiotic free 13% and hormone free 13%. Other sustainable terms that resonate with consumers include all natural, which 58% of consumers said they loved or liked.





About half said the same for farm raised and 47% said so for organic, Hegg noted.

However, she cautioned, before brands and restaurants embrace sustainability and climate change terms, they need to ensure that what they attribute them to either meet regulated definitions (as in the case of organic) or if they aren't regulated that they aren't accidentally green-washing their products - a mistake that increasingly sophisticated consumers will quickly spot and penalize brands for.

## Clear Choices for Children: South Korea Launches 'Healthy Food Corners' In Convenience Stores

By Pearly Neo 25-Oct-2022 - Food Navigator Asia

The South Korean government has launched specific 'healthy food corners' for kids in major convenience stores near schools. The initiative was conducted as a joint project between the convenience store industry and the South

Korean Ministry of Food and Drug Safety (MFDS), which saw the establishment of 'healthy food corners' at 104 convenience stores located near schools.

Convenience stores are a popular haunt for children and adolescents in South Korea due to the proximity, accessibility and available choices of these - especially stores that are located close to schools. The healthy food corners established were set up with pre-identified products lower in sodium, lower in sugar, lower in fat and so on, which were individually labelled and marketed as better choices.

"The aim of these healthy food corners in convenience stores is to make it easier for children to identify and choose healthy and nutritious foods," MFDS Minister Oh Yu-Kyoung said via a formal statement. "Convenience stores are very important here as data from local surveys have shown that there is an increasing frequency of younger consumers especially adolescents that are replacing meals with convenience store-purchased food at least once a week - as of 2019, this number stood at 69.1%, according to the 15 Adolescent Health Behaviour Survey. So hopefully the healthy food corner will also help children to form correct and healthy eating

habits which are increasingly important as the obesity rate amongst children in South Korea has been found to be on the rise over the past few years."



According to government data, child obesity rates in the country for children aged between six and 18 years old have risen continuously since 2013, from 10% in 2013 to 12.3% in 2018 and in most recently this hit 15.9% in 2020. "As such, the targeted food and beverage products for this healthy food corner include foods with lower sodium content, foods with no added sugar, and [so on], and these have all been certified for quality and safety," she added. "A wide variety has also been included here, from gimbap (rice rolls) to lunch boxes with reduced sodium; beverages without added sugar; healthier items like fruits and salads and so on, all of which can help to protect children's health and drive them to develop correct eating habits which will be crucial for their health now and later in life."

