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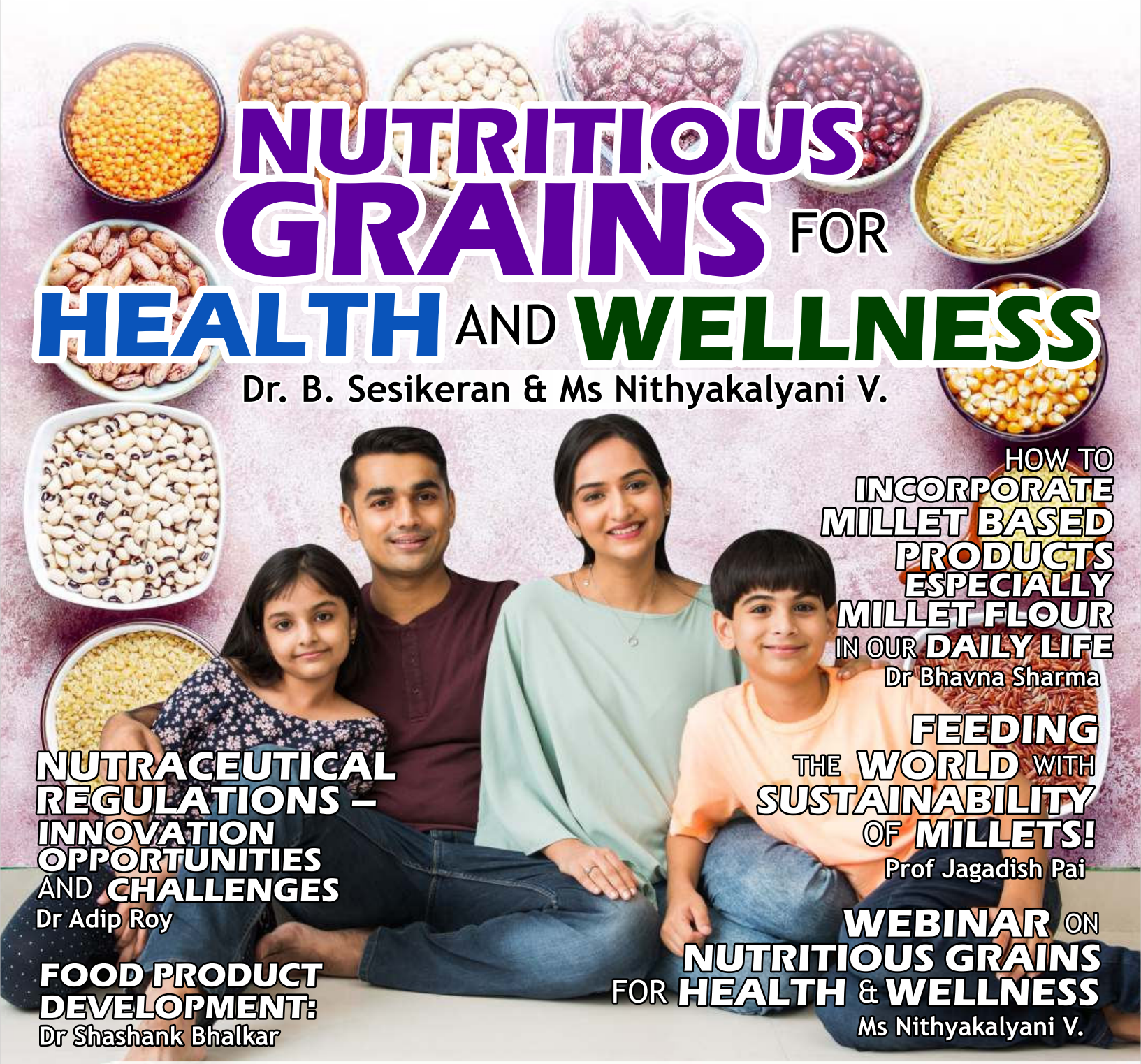

NUTRITIOUS GRAINS FOR HEALTH AND WELLNESS

Dr. B. Sesikeran & Ms Nithyakalyani V.

HOW TO INCORPORATE MILLET BASED PRODUCTS ESPECIALLY MILLET FLOUR IN OUR DAILY LIFE

Dr Bhavna Sharma

FEEDING THE WORLD WITH SUSTAINABILITY OF MILLETS!

Prof Jagadish Pai

NUTRACEUTICAL REGULATIONS – INNOVATION OPPORTUNITIES AND CHALLENGES

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EDITORIAL

In this year of millets, quite a lot of new ideas are coming for popularising the millet consumption globally but more importantly in India. We need to show the world that it is possible to make millets the sustainable cereal.

Many food products have come in the market from cookies to pasta and quite popular ones. It is good to see people are going for millet-based products. This shows that they have started realising the nutritive or health benefits of millets. Since the major millets including jowar, bajra and ragi have been familiar to Indians, there is no need to convince them about the edibility. However, the amounts of millets in most such products are quite low as many other cereals and ingredients are added. This way the consumption becomes quite small, although this is also valuable to increase the awareness and consumption of millets.

What is needed is to make some home cooked foods such as roti, chapatti, and many other baked and roasted products more popular. There are many millet flours and multi-millet flours available. Right now they are more expensive than wheat and rice flour but as we go along when more millet is consumed and more is grown and processed, the prices will fall. Right now the push is needed by everyone.

Currently, two things are needed. Nutritionists and dietitians need to keep telling people that they should consume more millet. There are some antinutritional factors present, some of which could be reduced by a variety of pretreatments like soaking, fermentation, germination etc. People are convinced when dietitians tell them rather than an advertisement. With social media many dietitians have started connecting with people through their pages in which they post nice things telling their followers about food and nutrition.

Second thing that is necessary is familiarise people about millet based foods. In a recent survey, people have shown reluctance to use millets because they do not know how to use them. If they are shown how to make tasty jowar or bajra roti or ragi dosa, they would certainly try them.

These are the foods that use much more millets than cookies.

Right now much of the millets are used for animal feed. We should start consuming more as human food and also grow more so even animals are not starved. Let us make this year a truly International Millet Year.

Prof Jagadish Pai,
Executive Director, PFNDAI

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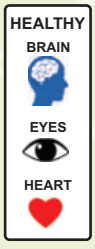

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FOOD FOR THOUGHT OR THOUGHT FOR FOOD

AUTHOR
Dr B Sesikeran,
Former Director,
National Institute of Nutrition (ICMR)
Hon. Scientific Director, PFNDAI

Gluten is a protein present in wheat, rye and barley, is largely responsible for the textural qualities of wheat flour and its amenability and application for a wide range of foods and food products. Despite its extensive use over centuries, there are a small number of people whose digestive tract cannot accept gluten and gluten containing products. The terms gluten sensitivity or gluten intolerance, celiac disease, gluten allergy, gluten hypersensitivity are all being wrongly used with a lot of mix up between terminologies and the actual clinical situations.

Celiac disease (CD) is an autoimmune disorder associated with genetic propensity. Patients with celiac disease have the histocompatibility genes HLA-DQ2 or HLA DQ 8. In a nation-wide study (Ramakrishna BS et al. Am J Gastro) published in 2016 the prevalence of these genes in the population in North and South India was 38.1 and 36.4 % respectively. However the population affected by celiac disease is only 1.2% in north India and around 0.11% in South India. The reason for this difference despite more or less a similar prevalence of the genes is probably due to the fact that the per capita consumption of wheat and wheat products in north India is around 450 grams per day while in the South it is around 25 grams per day. Celiac disease is a multisystem disease , permanent and the patients have Transglutaminase TG 2 antibodies in their blood. Consumption of wheat and wheat products will damage their small intestine and the management involves the consumption of a diet which should be gluten free and even products manufactured or packaged in factories which make other wheat products can lead to contamination of gluten resulting in very serious consequences to these people.

There are other forms of intolerance to wheat, one of which is wheat allergy. This is not a permanent disorder and unlike CD there are no TG2 auto antibodies in the blood or demonstrable damage to the small intestinal mucosa, but there will be higher levels of Immunoglobulins IgE which are also seen in patients with other forms of allergy like milk or egg or Shrimp etc. They do not have an association with the genes seen in CD. The population affected is estimated to be around 0.1% and this is a form of allergy, which can be managed with appropriate anti allergic treatment. Patients with wheat allergy are adviced to avoid the use of wheat and wheat products to the extent possible.

Another entity associated with wheat intolerance is the Non Celiac Gluten Sensitivity (NCGS). This again is not a permanent disorder, there are no demonstrable antibodies either TG2 or IgE. In these patients there is no damage to the intestinal mucosa unlike in CD.There is no association with the HLA genes.Though we do not have any estimates of the prevalence in the population in India, internationally it is estimated that 2 to 6% of the population may be having NCGS. The cause is unknown and the management is by recommending a reduced intake of wheat and wheat products. These patients may be having other disorders like an Irritable Bowel Syndrome (IBS) if clinically managed may result in better tolerance of wheat and wheat products.

It is therefore wrong to club all these entities as gluten intolerance on par with celiac disease and it is also a new found fad that gluten free foods are healthier than the ones with gluten. Gluten is a protein and a macronutrient by nature. It is best for individuals to fully investigate themselves and understand the kind of wheat intolerance they may have, rather than blindly giving up wheat and wheat products, which actually makes day to day food consumption quite difficult.

Sources:
1. Ramakrishna BS et al, Prevalence of Celiac Disease in India, Am J Gastroenterol. 2016 Jan; 111(1):115-23
2. http://celiacindia.org.in/

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REGULATORY VIEWPOINT

AUTHOR
Dr Joseph I Lewis,
Chairman, Regulatory Affairs, PFNDAI

Front of pack labelling (FoPL) debate has reached front and editorial pages of widely read newspapers. It has now shifted from model choice to how much more graphic should the depiction be. Comments are that it needs to be a bit more alarming. The problem with stars is that even one will twinkle - so it's not ok. More punch in the munch is what they want. Through all this rhetoric and catchy punch lines, the statement "citizens have a right to know what exactly they are eating" is most wise. The statement has two parts. One, what foods citizens are exactly eating (high in fat, salt, sugar) and two, their "right to know".

All foods consumed come from two sources: foods prepared at home (or prepared out of home) and foods requiring no preparation (prepackaged). Therefore, citizens must know which of these sources is a major contributor to HFSS. The simple ask is for an exposure assessment required under food law to be made known.

More importantly, citizens should know they are protected by a science-based law and its procedures. And measures taken are required to be effective, proportionate, no more restrictive of trade. Exposure assessment must therefore precede the regulatory option invoked.

Since HFSS diets are associated with increase in non-communicable disease (NCD), governments adopt mitigation measures known as public health goals (PHG). A PHG is typically stated as percent reduction of fat, salt and sugar expected over 5-10 years and the projected decline of the relevant NCD. Salt is a fitting example.

In 2013, WHO Member States agreed to target a 30% relative reduction in mean population intake of salt/sodium by 2025. The global average salt intake is around 10.8g per day, which is higher than the WHO recommendation of 5g. In the UK, the daily average intake is 8.6g. An exposure assessment, estimates that 75% of this salt comes from processed foods, 15% naturally present and 10% added. Similarly, in the US about 71% of the sodium/salt comes from processed and restaurant foods, 14% naturally occurring, 5% added at the table and 6% home cooking. Bread and rolls, while not salty, is a top contributor (7.4%) to daily intake due to its frequency of consumption. Making such information known is how, "citizens know" from where the salt comes.

In western diets major salt intake comes from foods prepared out of home and packaged foods, while in India it is just the reverse. More than 80% salt is purchased and added in home cooking. This is typical when staple foods form a significant part of the daily diet. In a PFNDAI survey of 2977 households (2017) the mean monthly salt purchased and consumed per family was 1.2kg or 343 CU/g, averaging 10.7 - 12 g/day for different socio economic groups. Several surveys and studies provide evidence that main source of dietary salt in India is from salt added to cooked food. Indian dietary practice however, presents a unique opportunity. The "Eat Right India" program informing consumers on controlling salt at home will have the greatest impact. Two significant outcomes will be achieved in reducing salt intake: an Indian public health goal (PHG) and the FAO sustainable development goal (SDG).This is perhaps the brightest star emerging.

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NUTRITIOUS GRAINS FOR HEALTH AND WELLNESS

AUTHORS

Dr B. Sesikeran
Former Director,
National Institute of Nutrition
(ICMR), Hyderabad
& Hon. Scientific Director,
PFNDAI

Ms Nithyakalyani V.
Food Technologist,
PFNDAI

India is a land of diversity with respect to languages, cultures, religions and even food habits. Despite this, it would not be wrong to consider rice, wheat, millets, pulses and lentils as the staple food crops across India.

Table 1: Grains- Cereals in Gm/100Gm Source: IFCT ICMR NIN 2017

GRAIN	PROTEIN	TOTAL FAT	TOTAL FIBER	ENERGY KCALS
Bajra	11	5	12	373
Jowar	10	2	10	350
Maize (dry)	9	4	12	350
Quinoa	13	6	15	344
Ragi	7	2	11	336
Rice raw	8	0.5	3	373
Rice brown	9	1	5	370
Maida	10	0.75	2.8	368
Atta	11	1.5	11.5	335

People often assume that cereals are not good sources of proteins but a look at the following table will prove that this is not entirely true.

All cereals besides maize, raw rice and brown rice have substantial amount of protein with Quinoa beating all of them in levels of protein and fiber which can explain it's popularity in spite of not being an indigenous crop. Raw rice and brown rice provide almost similar calories as bajra but lose out on the protein and dietary fibre content and have a high glycemic index. Whole wheat atta seems the best among all the cereals with good levels of protein, dietary fiber, lower fat and lower calorific value. The fat content in all cereals is not very high. It can be concluded that each cereal has its pros and cons and the consumer needs to be prudent and choose appropriately.

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Table 2: Grains- Legumes Gm/100Gm Source: IFCT ICMR NIN 2017

LEGUME	PROTEIN	FAT	FIBER	ENERGY KCALS
Bengal Gram Dhal	22	5	15	344
Black Gram	23	2	12	339
Lentil Dhal	24	1	10	337
Soya Bean	37	19	23	395

Legumes are good protein sources. A look at the table above confirms that though all the legumes mentioned are good sources of protein and fiber, soyabean scores well above all of them and can serve as a wholesome meal with an option to even defat the bean as per requirement. Bengal gram, black gram, lentil dhal may have high protein levels but lack an essential amino acid methionine, which can be made up by combining a cereal with these dhals for a meal.

Table 3 shows the mineral content of millet, wheat, maize, rice and sorghum.

Millets clearly overpower the other grains in all minerals especially Zinc and Iron and it should be noted that the table represents average value of all millets collectively but certain millets like Ragi have high levels of calcium (Around 344mg/100 gm) which is the highest among all the grains.

NUTRITIONAL IMPACT OF GLOBAL WARMING

Studies have shown that increased temperature and elevated CO2 levels due to global warming can affect the nutrient density of some staple crops, which is a cause of major concern for low-income countries. Increased temperature results into 20% deficiency of Iron and Zinc in crops. This could lead to an additional 175 million and 122 million children being deficient in Zinc and Protein respectively. In addition, there will be around 4% decrease in Iron intakes of vulnerable population especially pregnant, lactating women and elderly.

METHODS TO TACKLE THE NUTRITIONAL IMPACT OF GLOBAL WARMING

1. Shifting from C3 to C4 crops

Plants can be classified as C3 and C4 depending on the photosynthetic pathway they follow. Around 95% of plants are C3 e.g. rice, wheat, oats and only around 5% are C4 e.g. maize, pearl millets, sorghum.

C3 crops have high water needs, lower temperature tolerance and slower CO2 fixation (it is a process by which Co2 is assimilated and converted to organic compounds by plants and autotrophs).With increase in Co2, yield of C3 crops comes down.

C4 crops report better photosynthesis in high temperature and are drought tolerant, display faster Co2 fixation, better N2 use and twice as much photosynthetic capacity.

With increase in average global temperatures, shifting to C4 crops will be beneficial as they are more nutritious and also climate resilient.

2. Biofortification

Methods that can be employed for bio fortification
Hybrid Technology- Climate resilient crops and nutrient rich crop varieties are selected to develop natural hybrids with high climate resilience and enhanced nutrients. According to Harvest Plus, which is part of CGIAR Research Program on Agriculture for Nutrition and Health, bio fortification makes food crop varieties more nutritious and more stable under variety of challenging conditions.

MINERAL	MILLET	WHEAT	MAIZE	RICE	SORGHUM
Phosphorus	2400	1170	990	1030	350
Potassium	2200	1550	1200	1500	240
Magnesium	1000	250	470	350	188
Calcium	100	170	60	60	27
Zinc	34	8	5	17	3
Iron	48	12	11	12	11

Table 3: Minerals in grains mg/kg Source: Cereal grains ed AK Goyal Intech open ebook 2021

From the above tables it can be concluded that millets are rich in proteins, dietary fibre and micronutrients.

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Some of the bioavailability studies on bio fortified millets can be seen below which show that when bio fortified pearl millet is processed by traditional methods iron and zinc are better absorbed.

Table 4. Bioavailability Studies

- Biofortification of Pearl Millet with Iron and Zinc in a Randomized Controlled Trial Increases Absorption of These Minerals above Physiologic Requirements in Young Children1–3

Bhalchandra S. Kodkany, Roopa M. Bellad, Niranjana S. Mahantshetti, Jamie E. Westcott, Nancy F. Krebs,5 Jennifer F. Kemp,5 and K. Michael Hambidge: The Journal of Nutrition (2013)

- A Randomized Trial of Iron-Biofortified Pearl Millet in School Children in India

Julia L Finkelstein, Saurabh Mehta, Shobha A Udipi, Padmini S Ghugre,Sarah V Luna, Michael J Wenger, Laura E Murray-Kolb, Eric M Przybyszewski, and Jere D Haas

This study demonstrated that feeding Fe-PM is an efficacious approach to improve iron status in school-age children: The Journal of Nutrition, 2015

Some examples of bio fortified millet varieties developed by Harvest Plus by Hybrid Technology:

a) Iron fortified Pearl millet- it survives at 40° C, can survive in areas under 40 cm rainfall and meets 80% RDA of Iron. The iron in iron pearl millet is more bioavailable and well absorbed by the body. Besides the iron content all nutritional parameters are similar to conventional pearl millet so processing techniques remain the same with no difference in taste too.

b) Finger millet (ragi) is highly nutritious with highest calcium content amongst all cereals, it shows great potential to be bred using this technology as an even higher source of calcium and health promoting phytochemicals.

c) Maize is a climate smart crop and Harvest plus has released Provitamin A bio fortified maize hybrids that are highly heat tolerant (up to 45°C) and also resilient to drought conditions. Another bio fortified maize based on "quality protein maize" (QPM) with high levels of Zinc was developed and they also showed higher levels of amino acids.

Bio fortification Through Genetic engineering

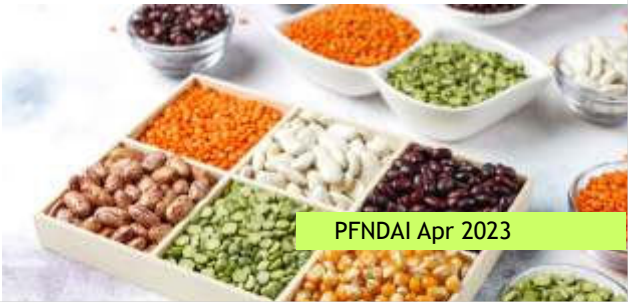
Seen below are different genetic engineering methods employed for bio fortification:

- **Iron binding protein Gene-** Rice stores iron in its seeds so attempts were made to increase the grain iron content and lactoferrin was successfully expressed in dehusked rice, which resulted in 120% increase in iron content.

- **Insertion of iron chelator gene-** Nicotianamine (NA) is known to chelate iron and plays a major role in Iron assimilation and balance within the body. The ferritin gene co-expressed with nicotianamine synthase (NAS) gene in rice shows 6-fold increase in iron content, which is higher, compared to the single gene approach. An increase in iron has also been reported in bio fortified pearl millet (2 times higher than most wheat varieties) along with increase in iron absorption by 5-10% in around 35 million people consuming bio fortified pearl millet.

- **Overexpression of iron reductase gene** Reduction of iron is necessary to incorporate iron into cellular compounds and over expression of iron reductase gene in plant can help increase iron intake from iron deficient soils.

- **Over expression of already present proteins for iron binding and accumulation** Some plant proteins bind with iron in the form of heme, it is not affected by antinutrients and makes it more assimilable for humans. This aspect has to be explored so that such proteins can be expressed in edible parts of the plants.



➢ Insertion of Transport gene

Iron accumulated in the plant has to be transported to edible parts of the plant and this can be facilitated by the transport gene.

➢ Decreasing iron inhibition/antinutrients

Phytic acid is an antinutrient, which inhibits iron and Zinc absorption in humans, so it will be worthwhile to reduce phytate content in staple foods.

➢ Increasing Synthesis of enhancers that enhance iron absorption

Some dietary components such as β carotene, ascorbic acid, α tocopherol and amino acids can help improve absorption of iron. Some transgenic methods to increase over absorption of ascorbic acid in crops in presence of ferritin will help improve the iron absorption. Enhanced absorption of iron has been observed in golden rice with elevated levels of β carotene.

Bio fortification using Gene editing Technology

An approach where an existing gene can be edited or over expressed to serve the purpose to be fulfilled. This technology has been used for:

- Iron bio fortification of wheat
- Improving Zinc accumulation in wheat grains
- Development of plants with lower cytokinin levels as a result of which there is enrichment of Phosphorus, Calcium, Sulphur, Copper, Manganese, Zinc and Iron in the plant biomass.

Results of gene editing technology are quick.

In Conclusion, knowledge of the nutrient levels of grains along with modern technological advances can help improve nutritional value of the staple grains and also tackle the effects of climate change.

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NUTRACEUTICAL REGULATIONS – INNOVATION OPPORTUNITIES AND CHALLENGES

AUTHOR

Dr Adip Roy,

Associate Vice President – Regulatory Affairs
Amway India Enterprises Pvt. Ltd.

Regulations are designed by authoritative bodies to ensure smooth, fair and honest operations within the market through:

- Consumer Safety – Products should not harm users
- Environmental Safety – Products should not directly or indirectly harm the environment
- Ethics and Values – in accordance with principles set in the society
- Right Quality – deliver on the promise of what is claimed for the product

While regulations promote and enhance healthy trade; they also open up new opportunities thus enabling innovations. Organizations while ensuring compliance, could leverage scientific expertise to identify and support innovation for new products. Scientists, within the boundaries of regulations, use novel and disruptive technologies to create differentiated products with demonstrable consumer benefits using safety and sustainability so as to have claimable functional superiority.

The FSSAI Nutraceutical regulations, 2016 was a significant milestone as brought about new opportunities. It defined eight categories of Food – Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Prebiotics, Probiotics, Specialty Food with Botanicals with Safe History of Use, Novel Foods. It provided General requirements related to the categories, use of ingredients and Claims detailed in the regulation.

Additionally, it opened up new opportunities for businesses, which allowed them to provide differentiated offering to consumers, and created a market equivalent to global. There were opportunities to deliver higher levels of vitamins and minerals (more than RDA where there are particular target groups in need of the same due to physiological conditions and in all formats).

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Furthermore, with schedules outlining the use of botanicals (essentially from Ayurveda), goodness of traditional knowledge was a significant inclusion to have the supplements deliver health benefits of traditionally known plants.

The Nutraceutical regulations have however undergone several changes subsequently over the years and while there has been simplification of categories; some modifications have also added to complexities.

Additives Issues:

- Restrictions of use of additives for categories
- Restrictions for formats Should have been allowed across categories and have been safety based
- Toxicological risk assessments would have allowed safe use of additives across categories and would have helped compliance and innovation

Format/RDA Challenges:

- >RDA of vitamins and minerals allowed in FSDU and FSMP for specific physiological needs with prior approval
- Restrictions for formats Should have been allowed across formats and have been safety based
- Toxicological risk assessments would have allowed safe use of additives across categories and would have helped compliance and innovation

Innovative solutions using higher level of nutrients and having better delivery systems being evaluated; and rise of the health-conscious consumer has opened up benefit areas e.g. personalized nutrition, mental health & stress, immune health, bone health, gut health, weight management etc. which can be addressed through supplements. Additionally, regulations if mapped to international guidelines would allow industry develop products at global parity e.g., there are schedule complexities where use of ingredients defines product categories. Use of nutrients and additives should not be a restriction but can be allowed basis their safety. Safety should be the underlying principle for developing products and using toxicological risk assessments would ensure foods placed commercially on the market are safe for the consumer and do not present undue risk.

As innovation is driving value for business, people and consumers by catering to consumer needs for creating products to support health benefitsbacked with scientific support and ensuring compliance; scientific collaboration between industry, academia and regulatorsconducive regulatory environment to support innovation and new product development would provide opportunities in delivering demonstrable benefits to consumers.

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HOW TO INCORPORATE MILLET BASED PRODUCTS ESPECIALLY MILLET FLOUR IN OUR DAILY LIFE

AUTHOR

Dr Bhavna Sharma,
Head, Nutrition
Science Div., ITC Ltd

Historically consumed by the marginalized communities, Millets are now again back into the picture and have recently regained their spotlight for their nutritional, economic and environmental benefits. Millets are small seeded cereals that are traditionally produced and consumed by resource-poor farmers in low- and middle-income countries.

Millets have been an essential food staple in the history of mankind as they were the first crop to be cultivated, and they are now seen as the foods of the future. Millets are the most resilient crops at the moment, for their immense potential to address climate change and food insecurity worldwide.

Besides being a sustainable crop for adverse farming conditions, Millets are now being recognized as Superfoods, for their excellent nutritional profile, with the millets being three to five times nutritionally superior to the other important cereals. 'In 2018 the Indian government notified millets as Nutri-cereals and included them under the POSHAN mission Abhiyan. The United Nations General Assembly declared the year 2023 as "International year of millets" as an initiative to raise awareness about the many health benefits of these cereals and their climate resilience properties.

India is the leading producer of millet worldwide. Millets have been an important part of the Indian diet for centuries, and they are now being revaluated and studied extensively to bring them back in our plates once again and make them a part of our balanced meal. These Nutri-cereals are loaded with vitamins, minerals, essential fatty acids, Phyto-chemicals and antioxidants, that help combat multiple nutritional deficiencies like protein energy malnutrition, iron deficiency anaemia and many other micro and macronutrient deficiencies specifically in certain vulnerable groups like pregnant, lactating women, and children under the age of five years.

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1. open sachet
2. Mix in batter or dough in 1:3
3. Cook as usual

Serving Suggestion

*This product per 100 g is a source of protein, zinc and magnesium and rich in dietary fibre.

Millets are the fundamental cereals of a sustainable food ecosystem; therefore, it is extremely important to increase the awareness and consumption of various types of millets amongst the population. However, when it comes to consumers being able to actually incorporate these in our meals and tiffins - it poses challenges, either due to lack of knowledge on how to cook it or lack of variety of dishes that can be made from any particular millet or simply taste issues. Thus, it becomes critical to find ways on identifying various ways of incorporating millets on regular basis and improve the overall nutritional quality of our food plate. There are some specific meals in a day and some products that can be easily used a prime vehicle for incorporating millets.

Breakfast Cereals: Breakfast is the first and the most important meal of the day and has a major contribution to people's diet. Inclusion of millets in traditional and modern breakfast dishes, shall increase the consumption of millets amongst the population of all age groups. Fermented dishes like Dosa, idli, Uthappam are consumed as traditional breakfasts and snacks in many parts of India. Hence, they act as great medium to incorporate millets in them. Fermentation of millet also enriches the food value by increasing their protein, starch digestibility and bioavailability of minerals. Thus, these fermented dishes can be made from millet flour like Ragi, Proso, Foxtail and Barnyard by substituting the regular cereals. Pancakes and waffles are a favourite option for breakfast, enjoyed specially by children. The all-purpose flour used to prepare them can be substituted/blended with Millet fours like those of Bajra and Ragi to prepare them, which are not only naturally gluten free but also delicious and rich source of protein & calcium.

Staples: The utilization of millet flour can also be increased by blending them with wheat flour for making chapatis and other Indian Breads. The Jowar and Bajra variety of millet are commonly used to make Rotis in Northern and Western parts of India. Incorporation of multigrain flours as a substitute for wheat flour and maida can be another way for incorporating millets in our daily life. Multigrain flours generally incorporate a mix of different types of millets that includes sorghum, pearl millet or/and finger millet. Addition of millet flour, up to 60% in our traditional Indian Papads is also practiced in some parts of Karnataka. Finger millet acts as a good substitute in papads.

Ready to Eat: Today in the market, many processing technologies (for ready-to-eat (RTE) and ready-to-cook (RTC) millet products have been developed and are sold commercially such as Pasta, noodles, vermicelli, health mixes and so on. Noodles and Pasta are one of the most preferred dishes, usually categorised as light meals among all age groups, having longer shelf life and great commercial importance. Addition of millets in these convenience foods attracts a huge population to consume the same. Finger and Proso millet are most commonly used in RTE products. Health mixes are another viable option, where incorporation of millet can be exploited. Health mixes can be made even more healthier and nutritious with the addition of millets in them and is an extremely hassle-free option to include all the millets in our regular diet.

Weaning Foods: Malting of millets is traditionally practiced from time immemorial. Millet malting can be typically used to develop weaning foods. Millets, particularly finger millet has excellent malting properties, where the malt has an acceptable taste, aroma, texture and an increased shelf life.

Malting also significantly improves the bioavailability of nutrients and therefore acts as the most appropriate cereal base for calorie dense weaning and supplementary foods. Finger millet or commonly known as Ragi is the most common millet used in weaning foods owing to its excellent nutritional properties.

Beverages: Consumption of milk extracted from millets is another interesting way of adding millets into our diet. Foxtail, Proso and Barnyard millet are commonly used to extract milk, which can be used to make smoothies, kheer, etc. Millet milk is dairy free, vegan and is a great alternative to cow's milk. The millet malt can also be used to prepare beverages with addition of milk or lukewarm water along with sugar. Millet beverages are mostly consumed in traditional fermented form, which not only increases the nutritional value but also ensures the microbiological safety without the need of additional preservatives.

Treats/Sweets: Consumption of bakery products is quite popular and inclusion of millet flour in them such as biscuits, cookies, cakes is a great way of adding millet flours into our diet through products that is a favourite amongst all. Bakery products are majorly prepared from wheat flour, but addition of millet flour in them can be a great alternative as they reduce the over dependence on wheat and help in developing gluten free bakery products. Finger millet and foxtail millet flour are the most common millet flours used in bakery items like biscuits, nan-khatai, chocolate, cheese, cakes, muffins, etc. Research findings have even revealed that substitution of up to 40% wheat flour with millet flour is possible in baked products, without any alterations in the organoleptic properties. Kheer is a very popular sweet dish in India, traditionally made out of rice, milk and jaggery. With millets, the traditional kheer is getting a makeover where it can be made from Foxtail, Little millets, and Kodo millets, thereby making this dessert gluten free and low carb.

Demand for millets is on a rise in the Indian markets and are getting popularized among the masses. Due to their excellent nutritional characteristics, they are slowly finding a place amongst the traditional cereals in a variety of foods for all age groups. The value addition of millets in our traditional products consumed on a daily basis is one of the easiest and convenient ways to include and bring back millets in our daily diet and make it a part of our diversified rich diet.

It has been our consistent endeavour to address the national nutritional and health priorities emerging from India's commitments towards the UN Sustainable Development Goals (SDG) for 2030, and Mission Poshan 2.0. This is in consonance with the Government of India's overall focus on nutrition and its Seven Sutras to celebrate the magical golden grain in the International Year of Millets.

Millet Recipes: -

1. Name: Jowar upma

Preparation time: 20 minutes
Serving size: 1 serving
Ingredients

Ingredients	Amount	
Jowar	30 g	1/3rd cup
Black gram dal (urad dal)	5 g	1 teaspoon
Carrot	25 g	1/4th cup
Beans	25 g	1/4th cup
Coconut	15 g	1 tablespoon
Oil	5 ml	1 teaspoon

Method:

1. Soak the washed jowar seeds overnight up to 8 hours in room temperature.
2. Rinse the seeds in water and pressure cook with 3/4th cup water and ½ teaspoon salt until tender.
3. Heat oil and add cumin seeds, urad dal, curry leaves and dry red chili till it pops.
4. Mix in the chopped vegetables along with salt to taste and 1/4th teaspoon turmeric and chili powder and cook till tender.
5. Add the cooked jowar seeds and coconut and stir the upma until well combined and cook for 3 minutes before serving hot.

Nutritional composition

Nutrients	Amounts
Energy	243 kcals
Protein	5.6 g
Fat	12 g
Fibre	5.5 g
Calcium	26.5 mg
Iron	2 mg

2. Name: Little millet kheer

Preparation time: 15 minutes
Serving size: 1 serving
Ingredients

Ingredients

Ingredients	Amount	
Little millet	30 g	1/3rd cup
Sugar	15 g	1 tablespoon

Method:
1. Wash and soak the little millet in water and set aside for 15 minutes.
2. Heat 1 cup of water on low heat until it bubbles, add in the soaked millet and cook until millets soften.
3. Add in the sugar and stir till the mixture thickens
4. Garnish with few strands of saffron and serve warm.

Nutritional composition

Nutrients	Amounts
Energy	163 kcals
Protein	3 g
Fat	1.1 g
Fibre	2.3 g
Calcium	6.6 mg
Iron	0.4 mg

3. Name: Bajra khichdi

Preparation time: 20 minutes
Serving size: 1 serving
Ingredients

Ingredients	Amount	
Bajra	30 g	1/3rd cup
Green gram dal (moong dal)	5 g	1 teaspoon
Carrot	25 g	1/4th cup
Beans	25 g	1/4th cup
Oil	5 ml	1 teaspoon

Method:
1. Pulse the bajra seeds in a blender to a course powder and rinse a few times with water to remove the husk particles, set aside with water.
2. Heat oil and add cumin seeds, moong dal, curry leaves and dry red chili till it pops.
3. Mix in the chopped vegetables along with salt to taste and 1/4th teaspoon turmeric and chili powder and cook till tender.
4. Add the soaked bajra seeds and stir the khichdi until well combined and cook for 3 minutes.
5. Pressure cook the khichdi till tender and serve hot with garnish of coriander leaves.

Nutritional composition

Nutrients	Amounts
Energy	181 kcals
Protein	5.3 g
Fat	6.8 g
Fibre	5.2 g
Calcium	24.3 mg
Iron	2.4 mg

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FOOD PRODUCT DEVELOPMENT:

AUTHOR
Dr ShashankBhalkar,
Assistant Director,
PFNDAI

As we take a walk in a supermarket, we see a variety of food products on the shelves. The products could be chips with range of flavours, range of infant foods, some nutraceutical, extruded snacks, traditional foods or may be recently appearing vegan foods.

Each of these products involves strenuous work of product development. In real terms, the whole process of product development is the result of team efforts involving various disciplines of an organisation, which do this creation to meet the consumer needs. This requires concerted efforts of R&D scientist who is continuously working and coordinating with all the other teams at various stages of product development. The aim of the whole process is to make a product with good sensory properties, delivering all the desired and claimed physical and chemical attributes, which is (biologically) safe to be consumed till the end of its claimed shelf life.

Product development has typically 5 major steps.

1) Ideation or Product Concept: This is the first very important and key step in new product development for any organisation. The new product idea should be aligned with organisation's existing range of products. The product idea can come from any source. It could be internal source, where it is a result of internal brainstorming and is based on existing range of products. It also could be based on external source and is a result market research, consumer feedback or studying new market trends.

2) Evaluation and screening: After generation of several ideas, the process is to screen and accept only very few, which are the best and can generate profit, adding growth to the business. This is because whole process of development is time consuming and requires cost. Once this is done the next important step is development of the product right from laboratory to manufacturing it at commercial scale. This is the responsibility of R&D, however, will require support from many disciplines. This is also termed as "Formulation Development."

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3) Formulation Development: It is very complex, lengthy process wherein product, which is an idea stage or on papers, turns into reality as a new product in the market for the organisation. This also has different steps. We will try to understand in detail about this part of product development.

i) Preliminary Experiments: In this, R&D tries to convert product idea into more defined product in terms of food category, ingredients, rough estimate of cost, suggested form of product (powder, liquid, biscuit etc).This is the result of a few preliminary experiments on a very small or lab scale and interaction with Materials (availability of new ingredient/ additive), Finance, Regulatory (Product category) departments to draw the desired information. Based on the feedback, top management and Marketing decides about go or no go. This is mainly business decision, and many commercial factors are considered to come to the decision. Once there is final decision on which product to be developed R&D takes up the product development from lab to launch by doing/ coordinating many activities.

ii) Pre formulation: At this stage, R&D starts making small batches of the desired formulation on its final form. If any new additive/ Ingredient is required, Materials department is requested. After many small trials when a good tasting product is developed, samples are sent to Sensory department. In many organisations this "tasting" part is also done by R&D person. Therefore, the R&D scientist needs also to have both Culinary and Sensory skills. The satisfactory samples are then sent to Marketing for the final approval of sensory attributes like flavour, taste and need of any overall improvement. Primary packing materials are also decided at this point. These are procured before next step of development.

R&D plans for bigger batches. This is done at pilot scale facilities of the plant. As the product is new, there are new ingredients to be added, also the nutritional label requirements necessitate the testing of macro-nutrients and as well as micronutrients in case there are label claims. R&D works with Method Development (which is generally part of QA function) to develop analytical methods for the product and new ingredients. Microbiological tests are also developed. All this method development is necessary to be done before the next step of "Stability Testing". The scale-up batches help to decide the process parameters. While scaling up there could be some changes in product characteristics. These are to be rectified based on sensory evaluation and analysis. The analytical/ microbiological specifications are also developed and finalised at this stage.

iii) Stability Testing and shelf-life determination:

This is the most important step in Formulation Development and is based on systematic studies of product under defined conditions of storage. Samples of scale up batches (generally three batches) are stored under controlled conditions of temperature and humidity in the decided primary packing materials. Testing protocol also include storage under accelerated conditions (higher temperature and humidity). The samples are then drawn at various time intervals for testing sensory, physical, chemical, and microbiological parameters. Based on the results, the R&D scientist determines the shelf life of the product. Shelf life is the longest period for which the product can remain in shelf where it meets all its quality parameters (Sensory, physical, microbiological).

Analytical data generated during the product testing is very useful in finalising product characteristics, analytical specifications (chemical and microbial). Lot of other activities parallelly take place which include Vendor visit and approval for new ingredients, label development, product registration and regulatory approvals, getting new equipment if it is required for the product, development of TPM in case the product is to be manufactured at third party. QA makes manufacturing and analytical documents.

iv) Commercial Manufacturing:

After all the pre manufacturing activities are done. Which include, manufacturing and analytical Documentation is ready, desired raw and packing materials are in place, Regulatory formalities complete there are plans to start manufacturing the new product. Technology transfer is done by R&D. First few batches are jointly manufactured by R&D and Manufacturing teams.

4) Market testing: Ideally the new product is ready for commercial launch and can be launched at this stage. However, if it is new product which entirely different than the range of products existing in the market or even otherwise many organisations prefer to do “Test launch”. In this the product is sold in small territories. Based on the consumer response, there could be quick corrections in the formulation.

5) Commercial launch: Based on the response of “Test launch” strategy is decided for commercial launch. Product is manufactured in large scale and distributed to whole market. The successful launch brings in joy to organisation, particularly to R&D team which is instrumental in the creation of the new product.

There are other reasons when the R&D team need to work on development. This could be i) improvement of the products. When the product is sold for a period, there could be many competitors in the market. To boost the sales based on market response, R&D works on the improvement plan. It could be just addition of new flavour or could be improvement in sensory properties like texture, mouthfeel. ii) Cost saving: It is goal of any business to remain competitive and improve bottom-line. When R&D is challenged for improvement of bottom line, this can be achieved by fully/ partly replacing one or many ingredients by cheaper substitutes. This also could be achieved by changing the process of manufacturing, e.g., vacuum dried product to be made by spray drying. The challenge before the R&D is bigger than developing entirely new product. Because the product must mimic all the physical, sensory characteristics of the existing product as well should have same chemical composition. Cost reduction also could be achieved by using cheaper alternative packing material. For example, in case of multilayer laminate, cheaper alternative with same oxygen and moisture barrier properties will work. In case all these activities, product developmental time may be reduced, but they all must undergo stability testing.

After reading this, whenever you find a New Product on the shelf in market, you will realise how much efforts and time is invested in the pack of product you are holding.

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FEEDING THE WORLD WITH SUSTAINABILITY OF MILLETS!

AUTHOR
Prof Jagadish Pai,
Executive Director, PFNDAI

India, being the largest producer of millets, may be regarded as the capital of millets.

It produced over 12.4 million tonnes of millets in 2020, which is 80% of Asia's production and almost 20% of global production of millets (FAO 2020). Except jowar (sorghum), India leads in production of all the millets. Global millet market is valued at $9.95 billion in 2020 (Verified Market Research2020).

Jowar and bajra (pearl millet) constitute over 92% of total millets. Along with ragi (finger millet), they are considered major millets. Minor millets are proso millet, barnyard millet, little millet, foxtail millet, and kodo millet (Assocham 2021).

Table 1: Millets Production in India (Assocham 2021)

Millets Area (000 Hectares) and Production (000 Tonnes)								
Year	Ragi		Jowar		Bajra		Small Millets	
	Area	Production	Area	Production	Area	Production	Area	Production
1950-1951	2203	1429	15571	5495	9300	2595	4605	1750
1960-1961	2515	1838	18412	9814	10695	3283	4955	1909
1970-1971	2472	2155	17374	8105	12493	8029	4783	1988
1980-1981	2525	2420	15809	10431	10579	5343	3976	1574
1990-1991	2171	2340	14357	11681	10900	6649	2447	1190
2000-2001	1759	2732	9856	7529	8897	6759	1424	587
2010-2011	1286	2193	7382	7003	8904	10370	800	442
2018-2019	891	1239	4093	3475	7481	8664	454	333

Source: - Ministry of Agriculture and Farmers Welfare, Govt. of India.

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Samyog Health Foods Pvt. Ltd.

Millets are important in Asia and Africa in the tropical semiarid areas. They are able to grow in dry, high-temperature conditions with short growing season. They are among the oldest cereals known to humans who have been consuming them for thousands of years. Due to growth of wheat and rice during green revolution, people started consuming them rather than millets, which became less important over the decades. However, since the threat of global warming and other environmental changes, they have again gained importance. Under unfavourable conditions, millets have better chance of growing to feed the masses.

Millets are basically healthy cereals with high contents of protein, dietary fibre and minerals including calcium, iron, zinc and some B-vitamins. Because of high dietary fibre content, they are low-GI cereals being ideal for diabetics. They not only control blood sugar levels they help reduce the insulin resistance. Among other health benefits, the millets are gluten-free, help in weight-management, and reduce cholesterol and triglyceride levels. Health professionals highly recommend their intake in spite of the anti-nutritional factors such as phytates, oxalate, goitrogens etc. some of which could be removed by simple pretreatments like soaking, sprouting and fermentation.

However, the more important aspect of millets is that it can grow under unfavourable weather conditions. The population is globally growing. It is difficult to keep pace with food production. The problem is many folds in that people have been consuming animal foods like meat, poultry, eggs etc, which require much more input to produce and they produce greenhouse gas emissions much more than plant foods. However, as changes are taking place in environment due to global warming and pollutions, yields of rice and wheat will go down.

Millets are hardy crops and can grow well in dry and semi-arid zones in less fertile soil. They need less agricultural inputs including fertilisers and pesticides. So in future, they may be more sustainable food crops and so the Indian government has named them the Nutri-Cereals in 2018 and the United Nations has declared year 2023 as the International Year of Millets in order to encourage their production and consumption.

Trend in Cereal Consumption

At one time, millets were among major cereals consumed in India. However, as consumption of rice and wheat increased, there was decline in millets consumption both in rural and urban population. Per capita consumption of sorghum has reduced over several decades from 19 kg in 1974 to mere 2.4 kg in 2012 for rural and from 11 kg to 1.56 kg for urban population (Table 2). In the last decade, total domestic consumption has come down for sorghum from 7.2 million MT to 4.9 million MT, while the other millet have also been reduced from over 10.8 million MT to 9.7 million MT (Table 3).

Table 2: Consumption of Sorghum vs Major Cereals in India (Parthasarathy et al. 2010, Dayakar Rao et al. 2018)

Kg/person/year

Commodity	1973-74	1983 -84	1993-94	2004-05	2011-12
Rural					
Rice	84.0	80.7	85.4	78	71.7
Wheat	42.8	54.3	53.5	51	51.5
Sorghum	**19.0**	**12.5**	**9.7**	**5.16**	**2.4**
Urban					
Rice	65.5	64.7	64.2	57	53.8
Wheat	52.6	58.6	57.4	53	48.1
Sorghum	**11.0**	**6.0**	**4.9**	**2.7**	**1.56**

Source: Various NSSO reports, GOI, and Parthasarathy et al., (2010)

has decreased and besides that, some other factors also contributed to the decrease in production. Last couple of years with some better crop management with fertilisers and pesticides, farmers have been getting more income from these than traditional crops like millets. Millets remained low-profitable and low-remuneration crops. These crops were also grown in kharif season competing with millets.

Table 3: Domestic Consumption of Millets in India (Dayakar Rao et al. 2018)

Year	Domestic Consumption (000 Mt)	
	Sorghum	Other Millets
2004	7200	10840
2005	7500	10900
2006	7100	10300
2007	2900	12400
2008	7200	11300
2009	6600	8800
2010	6800	12600
2011	6000	13000
2012	5150	11100
2013	5200	11500
2014	4900	9700

Along with the drop in consumption, agricultural production has also come down for all millets as seen in the Table 4.

As can be seen, total millet production has reduced from 18.6 million MT in 2011-12 to 14.5 million MT 2015-16. Thus, there has been reduced consumption so the demand encouragement from government and industry initiative, there has been increase in production (Sachan et al. 2023).

Declining Production

Since the green revolution, rice and wheat production has increased tremendously. As the yields have increased because of high-yielding varieties with

Since millets would grow in low-grade land, with very little agri-input, they were neglected even by farmers so their yields also declined. There was lack of incentives for millet production especially small millets. Jowar, bajra and ragi are given MSP higher than rice, wheat and maize and their growing season is much less, but still farmers prefer to grow rice and wheat because their much higher yield and prompt procurement, gives the farmers much better returns than for millets. There must be much better support for millets to encourage farmers to grow them.

There is a need for improved varieties of millets to be developed by agricultural research centres so there are better yields. There are better yields reported outside India so we may try to improve yields using better varieties as

Table 4. Area, Production & Yield of Millet Crops in India from 2011-12 to 2015-16 (Dayakar Rao et al. 2018)

Year	Sorghum			Bajra			Ragi			Small millets			Total Millets		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
2011-12	6245.80	5979.17	957	8776.7	10276.05	1171	1175.78	1929.24	1641	798.78	451.53	565	16996.34	18635.99	1096
2012-13	6214.36	5261.48	850	7297.42	8741.98	1198	1131.02	1574.41	1392	754.09	435.65	578	15396.89	16033.53	1041
2013-14	5793.44	5541.81	957	7610.72	9250.09	1184	1193.64	1982.94	1661	682.3	429.91	630	15460.09	17204.73	1111
2014-15	6161.39	5445.3	884	7317.95	9184.22	1255	1208.06	2060.9	1706	589.59	385.87	655	15276.99	17076.29	1118
2015-16	6077.03	4238.02	697	7128.56	8066.61	1132	1138.32	1821.89	1601	649.9	390.92	601	14993.8	14517.43	968

Source: Directorate of Millets Development (DMD)
Area in '000 Ha, Production in '000 Tonnes and Yield in Kg. / Ha

Declining Consumption

There are many factors for this. Millet products have darker colour and not very appealing taste and flavour. Even bigger deterrent is the cost; millets are more expensive that rice and wheat, especially with government support to latter which are available even in PDS (public distribution system) at a fairly cheaper price for finer grades. There are also shelf life problems for some of the millets, e.g. whole bajra flour has limited shelf life compared to others.

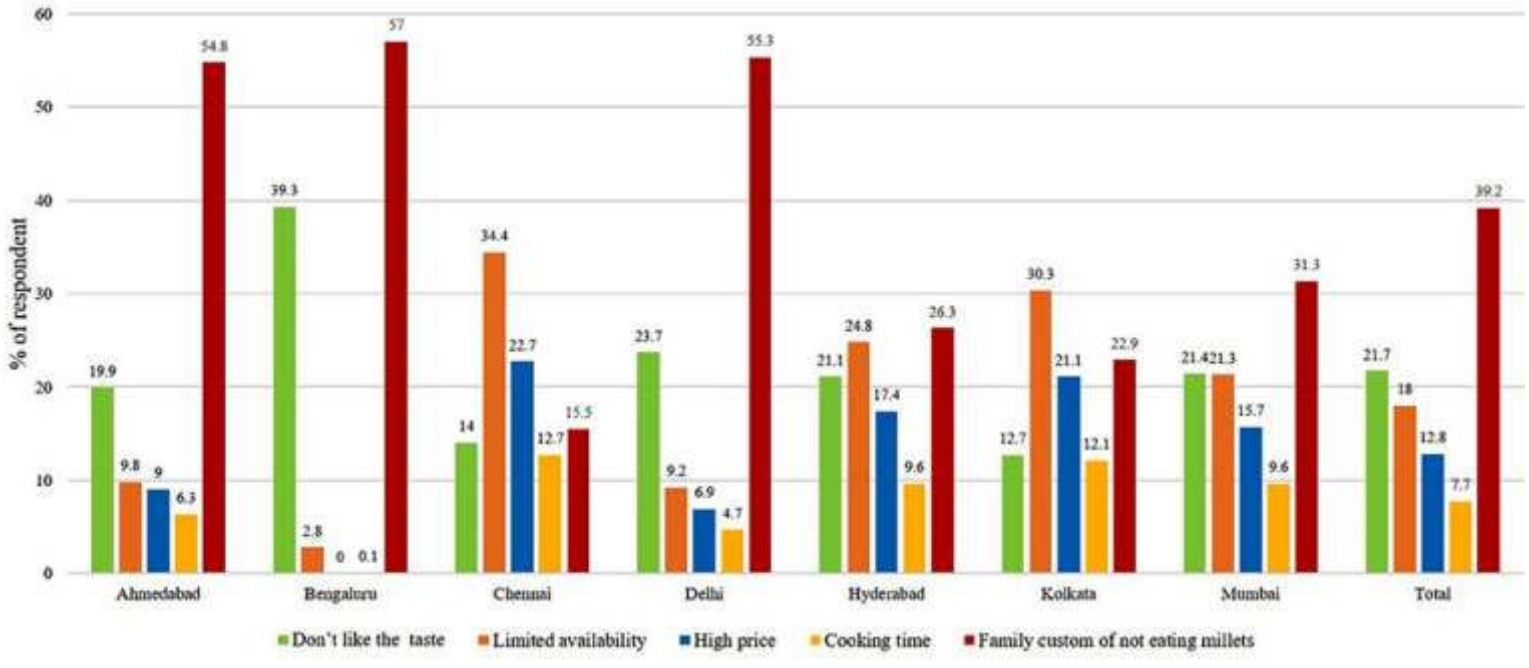
When a survey (Kane-Potaka et al. 2021) was conducted in metro cities about millet consumption, the consumers responded giving following reasons for not wanting millets: don't like taste, limited availability, high price, cooking time and family custom of not eating millets.

The last reason is especially important to note. Thought most Indians were familiar with millets about 60 or 70 years ago, things have changed because of rice and wheat. They not only were cheaper (through government subsidy) but also tasted better and many more products could be made.

Then there was a huge impact of many western foods including bread, cake, biscuits and cookies and toasts and later on of noodles, pasta, burgers, pizzas and donuts and many other products. They were not only tasty but were made much more attractive so people starting consuming them. More recently, substantial urbanisation has created a large number of young professionals, who has more buying power and less time so food was delivered to them and these are mostly made from rice and wheat besides the animal products. This pushes the modest millets even further down.

So we now have a situation where more nutritious and very importantly highly sustainable grains are in a neglected state. There is an immediate need to revive the consumption and production of millets in order to stave off disaster due to environmental changes. Following need to be taken up to improve both production and consumption.

Fig 1: Stated Reasons for Not Consuming More Millets



Steps Necessary

There are some things necessary for the government. They should make it possible for easy marketing for small and medium farmers who may find it difficult to bring the crop to market. Warehousing and supply chain is very critical in helping them.

The government may also find out if better varieties with higher yield, lesser anti-nutritional factors, and better sensory attributes etc. could be developed through agricultural research. It may take time but efforts must be undertaken immediately.

Industry and research institutions can also improve primary processing to remove inedible parts without excessive loss of nutrients. Bran and germ may be in question as they cause problems in edibility of grains. Whether parboiling could be done with some millets may be explored.

Industry also can develop and market primary processed products like milled grains and flour but also some value added products. There are many bakery, pasta and similar products available with addition of millets. The amounts added are small because higher amounts make the product unacceptable as they try to produce substitutes and people will always compare them with products made from wheat or rice. While such attempts should continue there could be totally new or different products which would be tasty and acceptable on their own merit and not because they are as good as original. The substitutes do have a role to popularise or at least make millets familiar to those who have never consumed them.

Industry should tackle the problems of taste, colour and texture of the millet products and try to make them by processing acceptable. Addition of certain ingredients including other grains, pulses or some carbs that would make the texture less hard or chewy. Whether treatment with enzymes to partly break the fibre helps or some other approach could be explored.

The biggest role probably is with health professionals including nutritionists who may convince masses about the health benefits of millets and how people could use them at home to make recipes from roti and dosa and many foods using millets. Indians traditionally used fairly good amount of millets in their daily diet before they moved excessively towards wheat and rice. It is possible to go back partly by consuming grains and flours in various manner taking care to soak, germinate and ferment them before using to reduce the negative aspects. Nutritionists can make a much better impact on the minds of people than others so they have a fairly huge task in front of them.

Hopefully India's efforts to popularise millets, increase production and making them available to all sustainably will pay dividends in the long run. Every stakeholder has a role to play in this and it is possible. It is possible to make this year truly International Millet Year.

WEBINAR ON NUTRITIOUS GRAINS FOR HEALTH & WELLNESS

AUTHOR

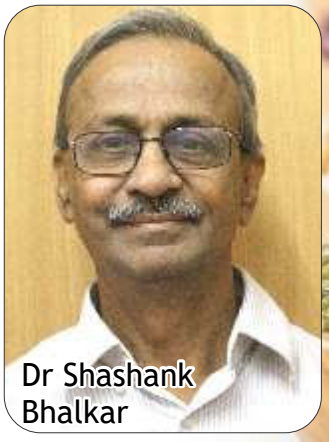
Ms Nithyakalyani V.
Food Technologist,
PFNDAI

Protein Foods and Nutrition Development Association of India held a webinar on Nutritious Grains for Health and Wellness in collaboration with SNDT College of Home Science, Pune on 18th March 2023. The webinar was sponsored by ITC Ltd, Prolicious, Kellogg's and Ingredion.

The webinar was well attended by around 200 delegates. Ms. Dolly Soni, Marketing and Project Manager at PFNDAI welcomed the gathering and introduced the speakers.


Ms Dolly Soni

Welcome address was given by Dr. Bhalkar, Assistant Director PFNDAI. He started by mentioning that the webinar was the first NAA activity in 2023 by PFNDAI. He continued to explain that rice, wheat, millets have been the staple food since old times and also that the whole grains have the bran, endosperm and germ intact due to which fibre, vitamin, minerals are retained to make them highly nutritious and healthy. Whole grains prevent cardiovascular diseases, reduce obesity, give a feeling of satiety, reduces risk of colon cancer and helps elevate constipation. During earlier days, cereals were cooked with minimal processing and millets were also part of the staple diet. But due to lifestyle changes eating habits changed, refined foods started being consumed, which resulted in increase in non-communicable diseases. In the recent times, awareness among people has developed and they are trying to go back to old eating habits, but the real challenge is in making nutritious, tasty whole grain products. He mentioned that he was looking forward to listening to the eminent speakers of the webinar cover the various aspects of whole grain importance and how to make them more tasty so that they can be made a part of the regular diet.


Dr Shashank Bhalkar

Dr. B. Sesikeran, Chairman, Scientific, Advisory Committee and Honorary Scientific Director PFNDAI, Former Director NIN (ICMR), Hyderabad, covered the nutritional aspects of all grains. He explained that cereals are not devoid of proteins, they do have substantial amount of protein and a combination of cereals and legume in the diet would help to make up for some deficient amino acids especially methionine. Quinoa among cereals and soya bean among legumes are highly nutritious and hence are gaining popularity. But with respect to minerals especially iron and zinc, millets are the clear winners. Since all the grains have their pros and cons the consumer needs to be prudent and choose what is appropriate and plan a balanced meal.


Dr Sesikeran

He further explained the implications of global warming which resulted in 20% deficiency of Iron and Zinc in crops, which in turn could lead to an additional 175 million and 122 million children being deficient in Zinc and protein respectively. In addition, there is around 4% decrease in Iron intakes of vulnerable population. He spoke about methods to tackle these effects in which he mentioned moving from C3 to C4 crops as C4 crops report better photosynthesis in high temperature and are drought tolerant, display faster CO_2 fixation, better N_2 use and twice as much photosynthetic capacity. With increase in average global temperatures, shifting to C4 crops will be beneficial as they are more nutritious and also climate resilient.

In the same context, he spoke about bio fortification developed by Harvest Plus using Hybrid Technology, Iron fortified pearl millets that can meet 80% RDA of Iron, can tolerate high temperature and has low water requirement, Provitamin A bio fortified maize hybrids that are highly heat tolerant (up to 45°C)and also resilient to drought conditions are some examples.

He also explained briefly bio fortification through genetic engineering and methods such as Iron binding protein gene,insertion of iron chelator gene, over-expression of iron reductase gene/ already present proteins for iron binding and accumulation, insertion of transport gene, decreasing iron inhibition /antinutrients, increasing synthesis of enhancers. The last method he covered was bio fortification using gene editing where an existing gene can be edited or over-expressed which is used for iron bio fortification of wheat, improving zinc accumulation in wheat grains and for development of plants with higher levels of calcium, iron, phosphorous, sulphur and similar minerals.


Ms Chandan Manroa

Results of gene editing technology are quick due to lesser regulatory hurdles. He concluded that, a knowledge of the nutrient levels of grains along with modern technological advances can help improve nutritional value of the staple grains and also tackle the effects of climate change.

Ms. Chandan Manroa- Head Nutrition, Prolicious spoke on “New and Trendy Products –The Millet Way”. She mentioned about increased awareness among people with respect to the food they eat be it nutrition, food safety, packaging or sourcing. The current lifestyle demands healthy meal options that boost energy and immunity, which millets and traditional grains can fulfil when added to the regular diet. Millets have high fibre, are heart healthy, micronutrient-rich, have no cholesterol, are gut friendly

and have high protein content which can help in avoiding lifestyle diseases. New age millet recipe innovations need to combine taste and health. She pointed out that millets are versatile ingredients that can be used to increase nutrition, make the product more delicious and can easily blend into popular food products like adding millet flour to wheat flour to improve flavour, aroma, protein, fibre, iron and zinc content of baked goods. Millets are beneficial for people with celiac disease as they are gluten free, and diabetic friendly due to low glycemic index and also have antioxidant properties.

She went ahead and introduced the RTC and RTE Millet products including flours from which quick beverage for breakfast, rotis, wraps etc. can be prepared. Millet noodles, millet pasta, millet dosa mixes, millet vermicelli may make a good meal for children the ever favourite biscuits, cookies, cakes, brownies, bread, buns made with millets.


Ms Nadiya Merchant

Nadiya Merchant- Associate Director Kellogg's India Private Ltd, spoke about "Power of Grains". She started by mentioning that grains are integral part of the Indian diet which includes wheat, rice, maize, finger millet, sorghum, foxtail millet and many others. Cereal, millets and pulses work complementary to each other when combined to provide most of the amino acids. She pointed out that cereals and millets are recommended by NIN to provide at least 40% of energy per day. She further compared whole grains, which have bran, endosperm and germ intact with refined grains. Whole grains are rich source of B vitamins, minerals, fibre, starchy carbohydrates, some proteins, Vitamin E, phytochemicals and healthy fats. Refined grains lose their nutrients as the bran and germ are stripped off during refining. Cereals help to prevent cardiovascular diseases, obesity, some types of cancers and Type 2 Diabetes by decreasing body fat and cholesterol and managing sugar levels. Substantial decrease in blood lipids was also noticed due to whole grain consumption owing to presence of viscous soluble fibre, nutrients like magnesium, folate and variety of phytochemicals and polyphenols.

She added that according to many studies, diet rich in whole grains can reduce progression from impaired glucose tolerance to Type 2 Diabetes by up to 58%. Whole grain components like antinutrients phytic acid, saponins, amylase inhibitors decrease circulating glucose and insulin. High fibre in whole grains provides satiety and helps in controlling the weight. She suggested that to get maximum benefit, 3 servings of whole grains, in every meal will help in cognitive performance, promote overall metabolic health in addition to other health benefits mentioned earlier. So a cereal breakfast may be convenient to prepare and a good option to start the day with. She concluded that whole grains are environmentally friendly using less energy, land, water and have lower greenhouse gas intensities than animal foods. In response to a query about pseudo-cereals she mentioned quinoa, amaranth etc. are pseudo-cereals which have amazing nutrient profile and people need to read up about different varieties of cereals available in the market and wisely incorporate them in the diet.


Mr Ayan Bhattacharya

Mr. Ayan Bhattacharya- Business Development Manager (India) Ingredion, spoke about "Health and Taste with Innovative Ingredients". He spoke about how Ingredion is leveraging upon grains to deliver taste at the same time maintaining the health aspects of food. He explained that since texture impacts taste, innovative cost effective texturization solution using a wide portfolio of starches is

what the organization indulges in. Ingredion is an expert in providing protein fortification with pulse-based proteins to formulate non-soy based, gluten free meat and dairy analogues and also for providing sweetness replacement options without sacrificing taste and texture. The key focus areas for growth of the organization based on consumer trends are using natural, organic, non-GMO ingredients, with added protein, fibre and nutrition, reduced sugar.

The organization believes in lowering manufacturing costs to make the products more affordable, working on process stability and extended shelf life of the product. He added that the organization strives for creating value in wholesome, clean label space which they achieve by using simple labels that consumer understands, natural, simple ingredients that consumers trust, process stability and excellent shelf life. He mentioned a few examples of innovations with healthy indulgent options that Ingredion has developed
-Rice based starch ingredients to replace TiO_2 in chewing gum formulations.
-Novelose is a high fibre product that they have formulated from rice and comes at a low cost with no impact on taste and texture, is process stable, gluten free, with low calories and easy to handle. It can be added to white bread to increase the fibre content.
-Quinoa flour, quinoa is a super food with benefits of all 9 essential amino acids and 5 times more fibre than rice. The product has improved shelf life and freeze thaw stability.
He concluded saying that processed food industry can help to deliver health beneficial products mimicking the benefits of whole grains without compromising on the taste aspect, which is very important for customer acceptance.

Responding to a query on millet flours being dark coloured may make the food unappealing he opined that nutritional aspect of millets should not be compromised to make it visually appealing.

Mr. Ayan replied to another question on source of Novolose fibre saying that it is insoluble dietary fibre of resistant starch grade 4 obtained from rice/tapioca.


Dr Dhruti Bal

Dr. Dhruti Bal, Nutrition Lead, R&D, Britannia Ind. Ltd., spoke on “Healthy Snacking”. She explained that snacking is the food/drinks taken between main meals to keep one full up to the next meal, to prevent overeating during the main meal and to make up for food groups missed out in the main meal. Healthy snacking varies with age, gender and physical activity status. She specified that children require protein, complex carbohydrates, calcium, iron zinc, vitamins for overall development with protein taking the top spot. Their snacking diet has to be based on this. They can have whole grain bread, dhokla, millet roti, makhana, thepla, multi-pulse sundal, some Britannia products like cheese, whole wheat/multigrain bread, Nutrichoice seeds can also be used as snacking options for children. Snacking requirement for adults depends on whether their lifestyle is sedentary, moderate or active and also on energy input and output. Unlike children, their order of requirement will be complex carbohydrates, Vitamins, minerals, Antioxidants and protein will come last in the list. The can have snacks similar to children, in addition they can also indulge in digestive biscuits, probiotic dahi, atta biscuits, seed herbs mixes some of which are Britannia products. According to Dr. Dhruti, snacking healthy is not difficult. Plan a snacking meal at home to include groups not taken in main meal like seasonal fruits, nuts, multi-grains, multi-millets, multi-pulses. While shopping, choose products made of whole grains atta/millet with low or no added sugar and enriched with vitamins and minerals.


Ms Anuja Kinikar


Ms Chanda Gokhale


Mr Devendra Chawla

Ms.Anuja Kinikar, Head of the department FSN, SNDT college of Home Science, Pune announced the names of the winners of the poster competition.

Theme was "Maintaining Health with Millets".

The poster competition was judged by Ms. Chanda Gokhale, Assistant Professor (retired) Visiting Faculty, Department of FSN, S.N.D.T Women's University, Mumbai and Mr. Devendra Chawla, Founder, Samyog Foods.

The winners were:

First Prize: Samiksha Nitin Shewalkar, SNDT college of Home Science, Pune

Second Prize: Aditi Gaikward, MIT ADT University

Third Prize: Zahra Hozaifa Batliwala, SNDT college of Home Science, Pune.

Consolation prizes were won by Anuja Ankush Bhise, Savani Ranjit Pharande, Payal Konde all from SNDT college of Home Science, Pune .

The session came to a close with a vote of thanks proposed by Ms. Dolly Soni.

Winners of the Recipe Competition


1st Prize
Ms Samiksha Nitin Shewalkar


2nd Prize
Ms Aditi Gaikwad


3rd Prize
Ms Zahra Hozaifa Batliwala


Consolation Prize
Ms Anuja Ankush Bhise


Consolation Prize
Ms Savani Ranjit Pharande


Consolation Prize
Ms Payal Konde

PFNDAI

Protein Foods & Nutrition Development Association of India
in collaboration with
SNDT College of Home Science, Pune, Maharashtra
Organizes Webinar on

Nutritious Grains for Health & Wellness

Held on 18th March 2023

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Dr. Dhruti Bal


Dr. Jagdish Pai


Mr. Ayan Bhattacharya


Dr. Shashank Bhalkar


Ms. Anuja Kinikar


Ms. Dolly Soni

REGULATORY ROUND UP

AUTHOR
Dr Shashank Bhalkar,
Asst Director, PFNDAI
assistantdirector@pfndai.org

Dear Readers, Following are notifications /orders after last Round Up.

Action against unauthorised use of artificial fruit ripening agents. The order dated 3rd April suggest action against unauthorised use of Calcium Carbide or Ethylene powder or Gas. FBOs are directed to strictly follow SOP developed by FSSAI. All the Commissioners, Directors and Central Licensing authorities are requested for strict actions against wrong practices.

Draft notification in the FSS (Foods for Infant Nutrition) Regulations, 2020 This notification dated 29th March 2023 is amendment which suggest changes in requirements of some of the micronutrients. They are Selenium, Iron, Biotin and Manganese. Any objections/ suggestions are to be sent to CEO, FSSAI.

Gazette notification for accredited laboratories. The notification (23rd March 2023) says N. D. International Laboratory in Kolkata is accredited for Biological and Chemical Testing for the Eastern Region. This is only for information to the readers in that region.

Committee for Rapid Analytical Food Testing (RAFT) kits/ Equipment/ Methods. The committee, formed on 15.06.2020, is now reconstituted with seven members from various research institutes

Order of 29th March 2023 gives list of recognised National Reference laboratories (NRL) and Ancillary National Reference laboratories (ARL) with specific area mentioned for each laboratory. For example, CFTRI will be responsible for "Nutritional information and labelling", Export Inspection Agency will be for "GMO Testing", etc. There are eleven ARLs and Export Inspection Agency Chennai and Kolkata are ANRLs which act as a support to NRLs.

Clearances of imported consignments of Food grains including pulses and Crude oil (Edible Grade). This order dated 7th March 2023 requests Authorized Officers (AO) for timely processing and clearance of these goods. Accordingly, all AOs are directed not to delay the clearance of imported consignments.

Order further describes that when the importer gives declaration in the desired format, the AOs will issue provisional NOC based on satisfactory visual inspection and drawing the samples. AO shall issue final NOC after receiving analytical report. This is welcome step by authorities to facilitate clearances as it will help ease of doing business and will be relief when there is scarcity pulses and edible oils in the country.

Validity of Food Testing Laboratories. (Order dated 9th March 2023) List of FSSAI recognised Food Testing Laboratories was published which is updated for validity as on 6th March 2023. FBOs should check the list for validity before sending the samples for testing.

RESEARCH IN HEALTH & NUTRITION

Time-Restricted Eating Reshapes Gene Expression throughout the Body

Science Daily January 3, 2023

Numerous studies have shown health benefits of time-restricted eating including increase in life span in laboratory studies, making practices like intermittent fasting a hot topic in the wellness industry.

However, exactly how it affects the body on the molecular level, and how those changes interact across multiple organ systems, has not been well understood.

Now, Salk scientists show in mice how time-restricted eating influences gene expression across more than 22 regions of the body and brain. Gene expression is the process through which genes are activated and respond to their environment by creating proteins.

The findings, published in Cell Metabolism on January 3, 2023, have implications for a wide range of health conditions where time-restricted eating has shown potential benefits, including diabetes, heart disease, hypertension, and cancer.

For the study, two groups of mice were fed the same high-calorie diet. One group was given free access to the food. The other group was restricted to eating within a feeding window of nine hours each day. After seven weeks, tissue samples were collected from 22 organ groups and the brain at different times of the day or night and analyzed for genetic changes.

Samples included tissues from the liver, stomach, lungs, heart, adrenal gland, hypothalamus, different parts of the kidney and intestine, and different areas of the brain.

The authors found that 70 percent of mouse genes respond to time-restricted eating. Nearly 40 percent of genes in the adrenal gland, hypothalamus, and pancreas were affected by time-restricted eating. These organs are important for hormonal regulation.

Hormones coordinate functions in different parts of the body and brain, and hormonal imbalance is implicated in many diseases from diabetes to stress disorders. The results offer guidance to how time-restricted eating may help manage these diseases.

Interestingly, not all sections of the digestive tract were affected equally. While genes involved in the upper two portions of the small intestine -- the duodenum and jejunum -- were activated by time-restricted eating, the ileum, at the lower end of the small intestine, was not. This finding could open a new line of research to study how jobs with shift work, which disrupts our 24-hour biological clock (called the circadian rhythm) impact digestive diseases and cancers.

Fewer Cases of Melanoma among People Taking Vitamin D Supplements

Science Daily January 9, 2023

Fewer cases of melanoma were observed among regular users of vitamin D supplements than among non-users, a new study finds.

People taking vitamin D supplements regularly also had a considerably lower risk of skin cancer, according to estimates by experienced dermatologists. The study, conducted in collaboration between the University of Eastern Finland and Kuopio University Hospital and published in Melanoma Research, included nearly 500 people with an increased risk of skin cancer.

For the study, conducted under the North Savo Skin Cancer Programme, 498 adult patients estimated to have an increased risk of a skin cancer, such as basal cell carcinoma, squamous cell carcinoma or melanoma, were recruited at the dermatological outpatient clinic of Kuopio University Hospital. Experienced dermatologists at the University of Eastern Finland carefully analysed the patients' background information and medical history and examined their skin. The dermatologists also classified the patients into different skin cancer risk classes, namely low risk, moderate risk and high risk. Based on their use of oral vitamin D supplements, the patients were divided into three groups: non-users, occasional users and regular users. Serum calcidiol levels were analysed in half of the patients and found to correspond to their self-reported use of vitamin D.

A key finding of the study is that there were considerably fewer cases of melanoma among regular users of vitamin D than among non-users, and that the skin cancer risk classification of regular users was considerably better than non-users'. Logistic regression analysis showed that the risk for melanoma among regular users was considerably reduced, more than halved, compared to non-users. The findings suggest that even occasional users of vitamin D may have a lower risk for melanoma than non-users.

Why Obesity Is More Dangerous For Men

Science Daily January 9, 2023

A newly published study from York University sheds light on the biological underpinnings in sex differences in obesity-related disease, with researchers observing "striking" differences in the cells that build blood vessels in the fatty tissue of male versus female mice.

Men are more likely than women to develop conditions associated with obesity such as cardiovascular disease, insulin resistance and diabetes, says York Professor Tara Haas with the Faculty of Health's School of Kinesiology and Health Science.

The team used software to help sift through thousands of genes to zero in on the ones that would be associated with blood vessel growth. They discovered that processes associated with the proliferation of new blood vessels were high in the female mice, whereas the males had a high level of processes associated with inflammation. The researchers also examined the behaviour of the endothelial cells when they were taken out of the body and studied in petri dishes.

"Even when we take them out of the body where they don't have the circulating sex hormones or other kinds of factors, male and female endothelial cells still behave very differently from each other," Haas explains.

Female endothelial cells replicated faster, while male endothelial cells displayed greater sensitivity to an inflammatory stimulus. By comparing with previously published data sets, the researchers found endothelial cells from aged male mice also displayed a more inflammatory profile compared to female cells.

Aware or Not Aware: You Are Affected By Food Cues Either Way

Science Daily January 10, 2023

Controlling your food intake can be even more difficult than you think. Osaka Metropolitan University scientists show that visual food cues can affect your eating behaviour even when you are not aware of them. Their findings were published in PLOS ONE.

Obesity is one of the major pathological conditions that constitute lifestyle-related diseases and is known to be associated with myocardial infarction, stroke, and carcinogenesis. Approaches to regulate eating behaviour are widely used in an effort to control obesity, but it has been reported that about half of those who receive dietary guidance return to their original weight within five years.

To explain the limited effectiveness of such guidance, one hypothesis suggests that not only conscious neural processes, which the dietary guidance targets, but also unconscious neural processes play an important role in controlling eating behaviour. However, there were no studies directly examining the validity of this hypothesis at the level of neural activity.

The research team led by Professor Takahiro Yoshikawa from the Graduate School of Medicine at Osaka Metropolitan University has revealed that in the inferior frontal gyrus, a region of the brain's frontal lobe that controls eating behaviour, neural activity differs in response to visual food stimuli, or food images, depending on whether those images are presented consciously or unconsciously. Using a questionnaire to assess the study participants, the team found that this difference was associated with their scores on eating behaviours, including emotional eating and cognitive restraint of food intake. These results indicate that eating behaviour cannot be understood without taking into account both unconscious and conscious neural processes.

"If we can learn more in future research about how eating behaviour is controlled by unconscious neural processes, we can combine that understanding with our current knowledge of conscious neural processes to potentially develop more effective methods for regulating eating behaviour," stated Professor Yoshikawa.

School Garden-Based Interventions Can Improve Blood Sugar, Reduce 'Bad' Cholesterol in Children

Science Daily January 10, 2023

School garden-based interventions can improve metabolic parameters such as blood sugar and cholesterol in children, according to a new study from UTHealth Houston.

A cluster randomized controlled trial conducted by researchers with UT Health Houston School of Public Health and The University of Texas at Austin found that Texas Sprouts -- a gardening, nutrition, and cooking intervention implemented in elementary schools in Austin -- improved glucose control and reduced bad cholesterol in high-risk minority youth. The results were published today in JAMA Network Open.

"The Dietary Guidelines for Americans recommends 2.5 cups of vegetables per day for children 9 to 13 years old," said Adriana Pérez, PhD, senior author of the study and professor of biostatistics and data science with the Michael & Susan Dell Center for Healthy Living at UT Health Houston School of Public Health. "Texas Sprouts incorporates nutrition, gardening, and cooking components that improved glucose control and reduced bad cholesterol in children."

From 2016 to 2019, researchers analyzed 16 low-income elementary schools in the greater Austin area with majority Hispanic student populations. The schools were randomly assigned to either Texas Sprouts intervention or delayed intervention.

Texas Sprouts spanned the nine-month school year and involved the formation of a Garden Leadership Committee; a quarter-acre outdoor teaching garden; a series of 18 student gardening, nutrition, and cooking lessons taught by trained educators throughout the school year; and nine monthly parent lessons. The delayed intervention was implemented the following academic year and received an identical intervention.

The team measured students' height, weight, and body mass index (BMI) parameters, as well as their glucose, insulin, insulin resistance, and lipid panel -- a blood test that measures the amount of certain fat molecules known as lipids in the blood -- via an optional fasting blood draw.

Compared to schools in the control group, Texas Sprouts schools saw a 0.02% reduction in HbA1c, or mean blood sugar levels over the past three months, and a 6.4 mg/dL reduction in bad cholesterol, indicating a reduced risk of diabetes and prediabetes among this population. There were no intervention effects on glucose, insulin, insulin resistance, or other lipid parameters.

Based on the study results, Perez said more elementary schools should incorporate garden-based interventions.

"Small increases in dietary fibre and vegetable intake, as well as reductions in added sugar intake, may have combined effects on lowering bad cholesterol and improving glucose control," said Pérez, who is based in Austin.

Vitamin D Benefits and Metabolism May Depend on Body Weight

Science Daily January 17, 2023

People with higher body mass index had a blunted response to vitamin D supplementation, explaining observed differences in outcomes such as cancer, diabetes, and autoimmune disease.

Researchers from Brigham and Women's Hospital, a founding member of the Mass General Brigham healthcare system, have found new evidence that vitamin D may be metabolized differently in people with an elevated body mass index (BMI).

The study, appearing in JAMA Network Open, is a new analysis of data from the VITAL trial, a large nationwide clinical trial led by Brigham researchers that investigated whether taking vitamin D or marine omega-3 supplements could reduce the risk of developing cancer, heart disease, or stroke.

Vitamin D is an essential nutrient involved in many biological processes, most notably helping our body absorb minerals, such as calcium and magnesium. While some of the vitamin D we need is made in the body from sunlight, vitamin D deficiencies are often treated with supplementation. Evidence from laboratory studies, epidemiologic research and clinical research has also suggested that vitamin D may play a role in the incidence and progression of cancer and cardiovascular disease, and it was this evidence that prompted the original VITAL trial.

The VITAL trial was a randomized, double-blind, placebo-controlled trial in 25,871 U.S. participants, which included men over the age of 50 and women over the age of 55. All participants were free of cancer and cardiovascular disease at the time of enrolment. While the trial found little benefit of vitamin D supplementation for preventing cancer, heart attack, or stroke in the overall cohort, there was a statistical correlation between BMI and cancer incidence, cancer mortality, and autoimmune disease incidence. Other studies suggest similar results for type 2 diabetes. The new study aimed to investigate this correlation.

The researchers found that vitamin D supplementation increased most of the biomarkers associated with vitamin D metabolism in people, regardless of their weight. However, these increases were significantly smaller in people with elevated BMIs.

"We observed striking differences after two years, indicating a blunted response to vitamin D supplementation with higher BMI," Tobias said. "This may have implications clinically and potentially explain some of the observed differences in the effectiveness of vitamin D supplementation by obesity status."

This study sheds light on why we're seeing 30-40 percent reductions in cancer deaths, autoimmune diseases, and other outcomes with vitamin D supplementation among those with lower BMIs.

Reducing Total Calories May Be More Effective For Weight Loss than Intermittent Fasting

Science Daily January 18, 2023

The frequency and size of meals was a stronger determinant of weight loss or gain than the time between first and last meal, according to new research published today in the Journal of the American Heart Association.

This study evaluated the association between times from the first meal to last meal with weight change. Nearly 550 adults (18 years old or older) from three health systems in Maryland and Pennsylvania with electronic health records were enrolled in the study. Participants had at least one weight and height measurement registered in the two years prior to the study.

Overall, most participants (80%) reported they were white adults; 12% self-reported as Black adults; and about 3% self-identified as Asian adults. Most participants reported having a college education or higher; the average age was 51 years; and the average body mass index was 30.8, which is considered obese. The average follow-up time for weight recorded in the electronic health record was 6.3 years.

Participants with a higher body mass index at enrolment were more likely to be Black adults, older, have Type 2 diabetes or high blood pressure, have a lower education level, exercise less, eat fewer fruits and vegetables, have a longer duration from last mealtime to sleep and a shorter duration from first to last meal, compared to the adults who had a lower body mass index.

Based on the timing of sleeping and eating each day recorded in the mobile app, researchers were able to measure:

• The time from the first meal to the last meal each day;
• the time lapse from waking to first meal; and
• The interval from the last meal to sleep.

They calculated an average for all data from completed days for each participant.

The data analysis found:

• Meal timing was not associated with weight change during the six-year follow-up period. This includes the interval from first to last meal, from waking up to eating a first meal, from eating the last meal to going to sleep and total sleep duration.
• Total daily number of large meals (estimated at more than 1,000 calories) and medium meals (estimated at 500-1,000 calories) were each associated with increased weight over the six-year follow up, while fewer small meals (estimated at less than 500 calories) was associated with decreasing weight.
• The average time from first to last meal was 11.5 hours; average time from wake up to first meal measured 1.6 hours; average time from last meal to sleep was 4 hours; and average sleep duration was calculated at 7.5 hours.
• The study did not detect an association meal timing and weight change in a population with a wide range of body weight.

As reported by Bennett, even though prior studies have suggested intermittent fasting may improve the body's rhythms and regulate metabolism, this study in a large group with a wide range of body weights did not detect this link. Large-scale, rigorous clinical trials of intermittent fasting on long-term weight change are extremely difficult to conduct; however, even short-term intervention studies may be valuable to help guide future recommendations.

Study Explores Effects of Dietary Choline Deficiency on Neurologic and System-Wide Health

Science Daily January 17, 2023

Reaching adequate dietary choline intake is critical to offset organ pathologies and may help protect the brain against Alzheimer's disease.

Choline, an essential nutrient produced in small amounts in the liver and found in foods including eggs, broccoli, beans, meat and poultry, is a vital ingredient for human health. A new study explores deficiency in dietary choline adversely affects the body and may be a missing piece in the puzzle of Alzheimer's disease.

Lack of adequate choline is also linked with profound changes in the brain associated with Alzheimer's disease. These include pathologies implicated in the development of two classic hallmarks of the illness, amyloid plaques, which aggregate in the intercellular spaces between neurons, and tau tangles, which condense within the bodies of neurons.

The new research, led by scientists at Arizona State University, describes pathologies in normal mice deprived of dietary choline as well as choline deficient transgenic mice, which already exhibit symptoms associated with the disease.

In both cases, dietary choline deficiency results in liver damage, enlargement of the heart and neurologic alterations in the AD mice typically accompanying Alzheimer's disease, including increased levels of plaque-forming amyloid-beta protein and disease-linked alterations in tau protein.

Further, the study illustrates that choline deficiency in mice causes significant weight gain, and alterations in glucose metabolism, (which are tied to conditions such as diabetes), and deficits in motor skills.

What Makes Brown Rice Healthy? Decoding the Chemistry of Its Nutritional Wealth

Science Daily January 19, 2023

Researchers have found that the ester compound cycloartenyl ferulate is chiefly responsible for the health-promoting effects of brown rice.

Asian diets feature rice as a staple grain, contributing towards nearly 90% of the world's rice consumption. Brown rice, in particular, is known to have several health benefits. As a regular addition to the diet, it can help reduce body weight, lower cholesterol, and suppress inflammation. The ability of brown rice to neutralize reactive oxygen species and prevent cellular damage is vital to many of its health-promoting effects.

Although previous studies have shown that the antioxidant compounds in brown rice can protect cells against oxidative stress, knowledge regarding which major compound contributes towards these beneficial properties has long remained a mystery.

In a recent study led by Professor Yoshimasa Nakamura from the Graduate School of Environmental and Life Science, Okayama University, researchers from Japan have identified cycloartenyl ferulate (CAF) as the main "cytoprotective" or cell-protecting compound in brown rice. CAF is a unique compound owing to its hybrid structure. As Professor Nakamura explains, "CAF is a hybrid compound of polyphenol and phytosterol and is expected to be a potent bioactive substance with various pharmacological properties, such as antioxidant effect and blood fat-lowering effect."

According to the study's estimates, the amount of CAF in the whole grain of brown rice is five-fold higher than that of other antioxidant compounds found in brown rice. Further, CAF increases the concentration of heme oxygenase-1 or HO-1, an enzyme that facilitates the production of antioxidants. "We demonstrated here that CAF significantly increased the mRNA level of HO-1, the small molecular weight antioxidant-producing enzyme, at concentrations similar to that required for cytoprotective effects in resistance to oxidative damage," Professor Nakamura explains.

The researchers further explored this mechanism of action through experiments where blocking HO-1 activity using inhibitors reduced the antioxidant effect of CAF considerably. The high abundance and unique mechanism of action are evidence that CAF is the major contributing antioxidant in brown rice.

Why a High Fat Diet Could Reduce the Brain's Ability to Regulate Food Intake

Science Daily January 26, 2023

Regularly eating a high fat/calorie diet could reduce the brain's ability to regulate calorie intake.

New research in rats published in The Journal of Physiology found that after short periods of being fed a high fat/high calorie diet, the brain adapts to react to what is being ingested and reduces the amount of food eaten to balance calorie intake.

The researchers from Penn State College of Medicine, US, suggest that calorie intake is regulated in the short-term by cells called astrocytes (large star-shaped cells in the brain that regulate many different functions of neurons in the brain) that control the signalling pathway between the brain and the gut. Continuously eating a high fat/calorie diet seems to disrupt this signalling pathway.

Dr Kirsteen Browning, Penn State College of Medicine, US, said, “Calorie intake seems to be regulated in the short-term by astrocytes. We found that a brief exposure (three to five days) of high fat/calorie diet has the greatest effect on astrocytes, triggering the normal signalling pathway to control the stomach.

Over time, astrocytes seem to desensitise to the high fat food. Around 10-14 days of eating high fat/calorie diet, astrocytes seem to fail to react and the brain’s ability to regulate calorie intake seems to be lost. This disrupts the signalling to the stomach and delays how it empties.”

Astrocytes initially react when high fat/calorie food is ingested. Their activation triggers the release of gliotransmitters, chemicals (including glutamate and ATP) that excite nerve cells and enable normal signalling pathways to stimulate neurons that control how the stomach works.

This ensures the stomach contracts correctly to fill and empty in response to food passing through the digestive system. When astrocytes are inhibited, the cascade is disrupted. The decrease in signalling chemicals leads to a delay in digestion because the stomach doesn’t fill and empty appropriately.

Coffee with Milk May Have an Anti-Inflammatory Effect

Science Daily January 30, 2023

Can something as simple as a cup of coffee with milk have an anti-inflammatory effect in humans? Apparently so, according to a new study from the University of Copenhagen. A combination of proteins and antioxidants doubles the anti-inflammatory properties in immune cells. The researchers hope to be able to study the health effects on humans.

Whenever bacteria, viruses and other foreign substances enter the body, our immune systems react by deploying white blood cells and chemical substances to protect us. This reaction, commonly known as inflammation, also occurs whenever we overload tendons and muscles and is characteristic of diseases like rheumatoid arthritis.

In a new study, researchers at the Department of Food Science, in collaboration with researchers from the Department of Veterinary and Animal Sciences, at University of Copenhagen investigated how polyphenols behave when combined with amino acids, the building blocks of proteins. The results have been promising. The study has just been published in the Journal of Agricultural and Food Chemistry.

Twice as good at fighting inflammation

To investigate the anti-inflammatory effect of combining polyphenols with proteins, the researchers applied artificial inflammation to immune cells. Some of the cells received various doses of polyphenols that had reacted with an amino acid, while others only received polyphenols in the same doses. A control group received nothing.

The researchers observed that immune cells treated with the combination of polyphenols and amino acids were twice as effective at fighting inflammation as the cells to which only polyphenols were added.
"Our result demonstrates that the reaction between polyphenols and proteins also happens in some of the coffee drinks with milk that we studied. In fact, the reaction happens so quickly that it has been difficult to avoid in any of the foods that we've studied so far," says Marianne Nissen Lund.

Infant probiotics enter the spotlight for baby gut health and immunity benefits

12 Jan 2023 Nutrition Insight

As gut health interest grows, infant nutrition specialists highlight probiotics for their properties in boosting immunity and digestive benefits in the first years of life.

NutritionInsight speaks with suppliers Fonterra, DSM and Lactalis on the latest developments in this space, while investigating a noted downward trend in the global baby food market attributed to a dip in birth rates, among other influential macroeconomic trends.

"While probiotics are still seen as most strongly connected with gut and digestive health, we know that parents also continue to rank immune protection for their children as a top concern. The demand for immunity support and gut health solutions will continue to drive probiotic ingredient demand," says Angela Rowan, head of innovation at Early Life Nutrition Fonterra. "Other more niche trends driving demand for infants and children include probiotics that support skin health or eczema and targeted digestive issues," she adds.

Parents set the trend

Rowan says that new product launches for infant formula and young children's foods and supplements have picked up in spite of the market slowdown. "Future growth is expected across all major infant probiotic formats, including powders, capsules, gummies, liquids, and infant and child milk formulas containing probiotics," she says.

Laetitia Servajean, product manager at Lactalis Ingredients, details that "parents' expectations shape infant nutrition market trends," while underscoring that clean-label and plant-based products are currently in the spotlight. "Clean-label offerings continue to be a top priority for parents, who mostly look for 'free-from' claims such as GMO-free and natural claims related to the absence of artificial ingredients and additives and organic certifications," says Servajean.

She further details that in developed markets, the concept of "clean-label" has evolved beyond ingredients to tackle risk factors in sourcing, such as downstream agricultural activities. "Brands can focus on transparent and ethical sourcing to assuage parents concerned about the safety of agricultural practices."

Rowan continues: "Parents looking for probiotics for their children want to know that they are safe, manufactured by a reputable company and are science-backed. Based on these

credentials, we expect to see increasing use of probiotics into a broader range of food and supplement formats as encapsulation technologies enable greater stability across wider applications."

"The applications will need to be believable, as well as meet parents' needs for convenience, taste acceptability, and ease of consumption, plus the probiotics will still need to provide a benefit aligned to parents' needs for their children," she details.

By Beatrice Wihlander

Coffee Uncovered: Experts Identify What Makes the Bean Effective Against Fatty Liver Disease

13 Jan 2023 Nutrition Insight

Scientists in Portugal have pinpointed flavonoids and alkaloids as essential compounds behind coffee's effects against non-alcoholic fatty liver disease (NAFLD), including in those with Type 2 diabetes.

Researchers from the University of Coimbra write that coffee is well-known for "modest but significant" protection against NAFLD.

NutritionInsight speaks with John Griffith Jones, co-author of the study, about the components of coffee's impact on the liver and how the health benefits are explained. "The salient point is that caffeine and non-caffeine components such as trigonelline and polyphenols confer the benefits. This means that decaffeinated coffee, which does not contain caffeine but does have the other components, can confer benefits," says Jones.

"These components may partially alleviate the fatty liver disease by acting as antioxidants and anti-inflammatory agents. Caffeine is known to inhibit the onset of liver fibrosis, scarring that is a key milestone in NAFLD progression," he says.

Published in Nutrients, the study included overweight middle-aged males and females with Type 2 diabetes. Triglyceride – a type of fat found in the blood – and cholesterol levels were higher than normal, and low-density lipoprotein was also "well above a healthy range."

While investigating different components of coffee on NAFLD, Jones says that their research is the first to observe that higher cumulative amounts of caffeine and non-caffeine metabolites in urine are associated with reduced severity of NAFLD in overweight people with Type 2 diabetes.

"Due to changes in modern diet and lifestyle, there is an increase in obesity rates and incidence of both Type 2 diabetes and NAFLD, which can ultimately develop into more severe and irreversible conditions, burdening healthcare systems," he notes.

By Beatrice Wihlander

The Mighty Millet: Scientists Investigate Superfood Crop's Mineral Richness as Malnutrition Remedy

23 Jan 2023 Nutrition Insight

International scientists have released a study on the potential of millets to tackle malnutrition due to its mineral richness.

Since millets also have high dietary fibre content – known to reduce the bioavailability of the minerals – the study explored the stability of dietary fibres and how they impact the minerals, hoping to find a solution to the stagnating issue of mineral deficiency and malnutrition.

Grown mainly in Asia and Africa, millets are cereal crops defined as a superfood because of their density in such minerals as zinc, calcium, potassium and others. According to the researchers, millets might hold the potential to combat mineral deficiency.

"Our research will pave the way for the discovery of millet types rich in bioavailable minerals. Such millets will be able to promote bone health in old and young people and address mineral deficiencies," says Dr. Apramita Devi, a researcher at the University of California.

They continue to detail that mineral deficiency is especially prevalent in developing countries. In India, the government is prioritizing widening millet consumption to fight malnutrition. Finger millets contain high calcium levels and have recently gained much attention.

A battle of nutrients?

Although the superfood is high in minerals, it's also high in dietary fibre. The scientists argue that dietary fibre has been demonstrated as harming mineral bioavailability – the amount of mineral content that is assimilated by the human body – and that there is a lack of data on how foods rich in both minerals and dietary fibre affect human metabolism.

Published in the journal Solutions for Sustainable Development in Asia, the study included computational modelling tools to find answers to the impact on bioavailability.

The primary dietary fibre in millets, arabinoxylan, was one of the main focuses of the study to provide insights into how developing countries can battle mineral deficiencies and observe its interaction with calcium, zinc and potassium.

Edited by Beatrice Wihlander

Experts Reveal Diverse Diet and Regular Exercise Can Help Fight HPV

26 Jan 2023 Nutrition Insight

Higher intake of fruits and vegetables and regular physical activity can play a vital role in protecting against human papillomavirus (HPV). HPV is a virus that can lead to the development of several types of cancer and is the main cause of cervical cancer.

The findings come from a recent study in China that investigated the link between lifestyle factors and the risk of HPV infection.

Most HPV infections in the study (83%) involved a sole HPV serotype – a distinct variation of the HPV virus. There are about 200 serotypes of HPV, with only two types causing about 70% of cervical cancer cases.

A balanced and varied diet was the most significant difference between sole and multiple HPV infections. More physical activity also reduced the risk of infection among participants. However, there was no significant difference regarding infection rates and sleep quality, depression or anxiety.

Following the study, researchers advise consuming an "appropriate amount of dairy products and animal food products with vitamin A as well as more fruits (e.g., tomatoes) and vegetables." The research was performed by BGI Genomics, a precision medicine company headquartered in Shenzhen, China and published in Sec. Gynecological Oncology.

The study recruited 495 women aged 18 to 59 years through a digital eHealth platform. Participants were assessed for physical activity, diet balance and HPV infection through questionnaires and HPV genotyping assay tests. Physical activity was evaluated using self-reported questionnaires, where participants were asked about their frequency and duration of physical activity in the past year.

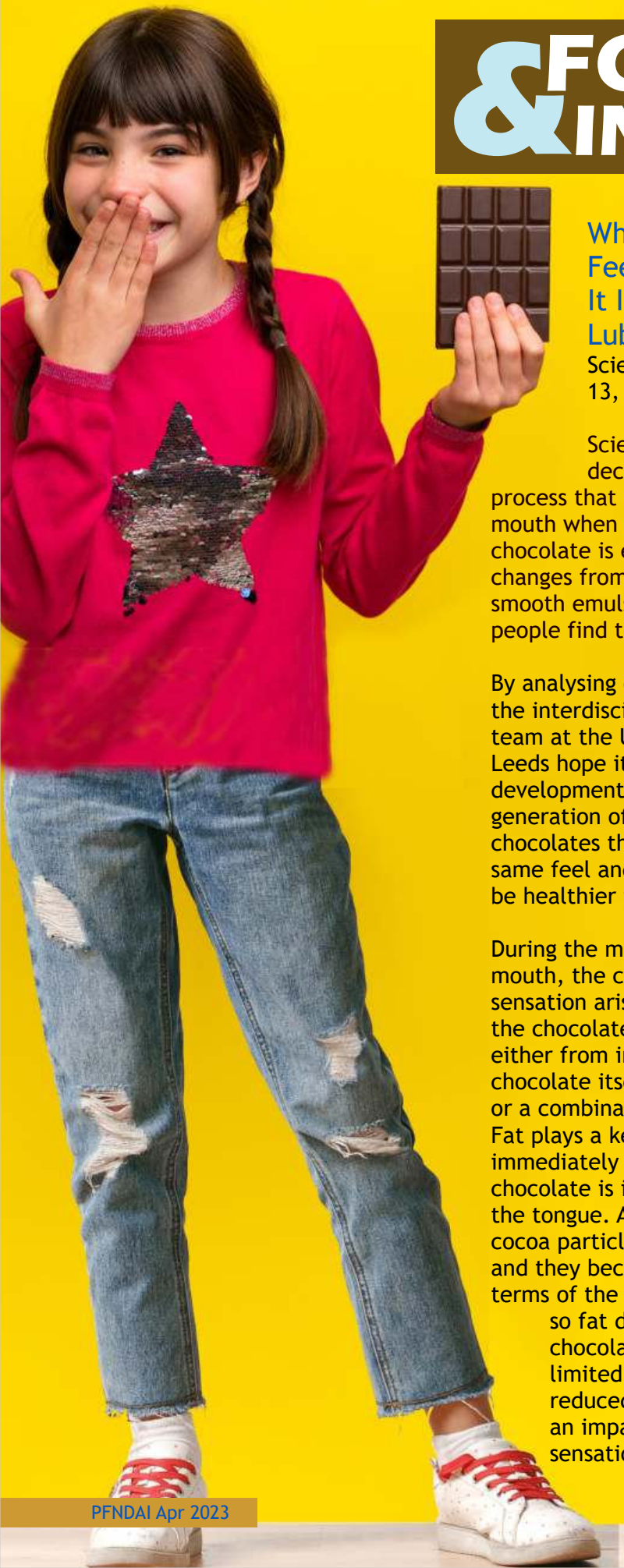
Participants were then classified into three levels of physical activity: low, moderate and high. The high-activity group included women who reported engaging in more than 300 minutes of moderate-intensity or more than 150 minutes of vigorous-intensity physical activity per week.

The study also found that patients with a high level of physical activity were less likely to be infected with HPV than participants with a low level of physical activity. This suggests that regular physical activity also protects against HPV infection.

Diet balance was assessed using a validated food frequency questionnaire. This data was used to calculate the dietary diversity score (DDS) for each participant, which is a measure of the variety of different food groups consumed. A higher DDS indicates a more balanced diet.

The study found that the prevalence of HPV infection was significantly lower in women with a higher DDS than women with a lower DDS. A diet with a higher intake of fruits and vegetables and a lower intake of fat and sugar, therefore, may have a protective effect against HPV infection.

By Missy Green



& FOOD SCIENCE INDUSTRY NEWS

Why Chocolate Feels So Good -- It Is All Down to Lubrication

Science Daily January 13, 2023

Scientists have decoded the physical process that takes place in the mouth when a piece of chocolate is eaten, as it changes from a solid into a smooth emulsion that many people find totally irresistible.

By analysing each of the steps, the interdisciplinary research team at the University of Leeds hope it will lead to the development of a new generation of luxury chocolates that will have the same feel and texture but will be healthier to consume.

During the moments it is in the mouth, the chocolate sensation arises from the way the chocolate is lubricated, either from ingredients in the chocolate itself or from saliva or a combination of the two. Fat plays a key function almost immediately when a piece of chocolate is in contact with the tongue. After that, solid cocoa particles are released and they become important in terms of the tactile sensation, so fat deeper inside the chocolate plays a rather limited role and could be reduced without having an impact on the feel or sensation of chocolate.

Anwesha Sarkar, Professor of Colloids and Surfaces in the School of Food Science and Nutrition at Leeds, said: "Lubrication science gives mechanistic insights into how food actually feels in the mouth. You can use that knowledge to design food with better taste, texture or health benefits.

"If a chocolate has 5% fat or 50% fat it will still form droplets in the mouth and that gives you the chocolate sensation. However, it is the location of the fat in the make-up of the chocolate which matters in each stage of lubrication, and that has been rarely researched.

"We are showing that the fat layer needs to be on the outer layer of the chocolate, this matters the most, followed by effective coating of the cocoa particles by fat, these help to make chocolate feel so good." The study -- published in the scientific journal ACS Applied Materials and Interface -- did not investigate the question of how chocolate tastes. Instead, the investigation focused on its feel and texture.

When chocolate is in contact with the tongue, it releases a fatty film that coats the tongue and other surfaces in the mouth. It is this fatty film that makes the chocolate feel smooth throughout the entire time it is in the mouth.

Milk's Packaging Influences Its Flavour

Science Daily January 27, 2023

The dairy industry strives to preserve the quality and safety of milk products while maintaining the freshest possible taste for consumers.

To date, the industry has largely focused on packaging milk in light-blocking containers to preserve freshness, but little has been understood about how the packaging itself influences milk flavour. However, a new study in the Journal of Dairy Science, published by Elsevier, confirms that packaging affects taste -- and paperboard cartons do not preserve milk freshness as well as glass and plastic containers.

Milk is more susceptible to packaging-related off-flavours than many other beverages because of its mild, delicate taste." Besides light oxidation, "milk's taste can be impacted by the exchange of the packaging's compounds into the milk and by the packaging absorbing food flavours and aromas from the surrounding refrigeration environment.

To quantify the flavour impacts of packaging, the researchers examined pasteurized whole and skim milk stored in six half pint containers: paperboard cartons, three plastic jugs (made from different plastics), a plastic bag, and glass as a control. The milk was stored in total darkness to control for light oxidation and kept cold at 4 C (39 F).

The samples were tested on the day of first processing, then again at 5, 10, and 15 days after. A trained panel examined the sensory properties of each sample, and the research team conducted a volatile compound analysis to understand how the packaging was intermingling with the milk. Finally, the samples underwent a blind consumer taste test on day 10 to see whether tasters could tell any difference between milk stored in the paperboard carton or the plastic jug compared with milk packaged in glass.

The results showed that package type does influence milk flavour, and skim milk is more susceptible to flavour impacts than whole milk. Of the different packaging types, paperboard cartons and the plastic bag preserved milk freshness the least due to the paperboard's absorption of milk flavour and the transfer of paperboard flavour into the milk. Milk packaged in paperboard cartons, in fact, showed distinct off-flavours as well as the presence of compounds from the paperboard. The final results show that, while glass remains an ideal container for preserving milk flavour, plastic containers provide additional benefits while also maintaining freshness in the absence of light exposure.

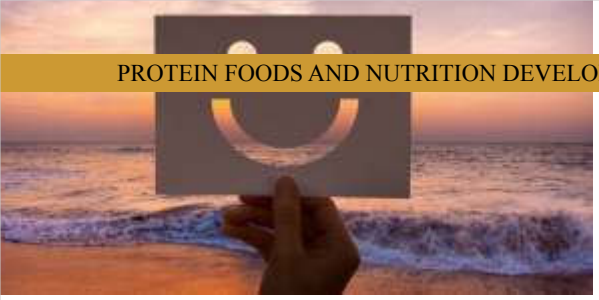
Algae May Be the Future of Sustainable "Superfoods"

By Andrei Ionescu, Earth.com
19 Jan 2023

Scientists have long known that current agricultural practices are a major source of greenhouse gas emissions and environmental pollution, which threaten long-term food security for billions of people around the globe.

Now, a team of researchers from the University of California, San Diego (UCSD) has argued that microalgae – a term encompassing the thousands of microscopic algal species and other photosynthetic organisms found in aquatic environments, such as cyanobacteria – could be a new kind of "superfood" due to their high protein and nutrition content.

Moreover, the experts highlighted the current technologies for commercially developing and growing microalgae, along with the scientific and economic challenges to scaling production.



"Many of us have known the potential of algae for food for years, and have been working on it as a food source, but now, with climate change, deforestation, and a population of eight billion people, most everyone realizes that the world simply has to become more efficient in protein production," said study co-author Stephen Mayfield, a professor of Biology at UCSD.

By reviewing previous studies, the researchers found that algae can produce 167 times more useful biomass than corn annually while using the same amount of land. Moreover, existing algae strains could potentially replace 25 percent of European protein consumption and 50 percent of the total vegetable oil consumption if grown on available land not currently used for traditional crops.

"The biggest advantage is the protein production per acre. Algae simply dwarf the current gold standard of soybean by at least 10 times, maybe 20 times, more production per acre," Mayfield reported.

In addition, since some species of algae can be grown easily in brackish or salty water – and, sometimes even in wastewater from dairy operations – freshwater can be reserved for other needs. Finally, algae are rich in vitamins, minerals, and various macronutrients that are essential for human health, such as omega-3 fatty acids and amino acids.

The scientists also described the various scientific tools available to produce the most desirable traits for commercially viable algal products. For instance, targeted genetic mutations can enhance astaxanthin (an antioxidant known to have major health benefits), as well as biomass yield and protein content.

According to Mayfield, the commercial development of a superior algal crop would most likely involve a combination of traditional breeding with molecular engineering.

However, the biggest challenge for commercial development remains the ability to scale production globally. "You just can't know all the challenges of going to world scale, until you do. But the world has done this [with] smartphones, computers, photovoltaic panels, and electric cars – all of these had challenges, and we overcame them to take these 'new' technologies to world scale, so we know we can do it with algae," Mayfield concluded. The study is published in the journal Frontiers in Nutrition.

Supplements Market Expands Post-Pandemic as Holistic Well-Being, Transparency and Convenience Inspire Innovation

23 Jan 2023
Nutrition Insight

The supplement market's proliferation is being driven by mega-trends toward holistic well-being, beauty-from-within and immunity support in the aftermath of a global pandemic. Supplements offer numerous health benefits, from energy boosts and cardiovascular and digestive health support to sleep, mood and stress relief.

Innova Market Insights found that supplement launches have doubled since 2017, with 26% average annual growth. Europe brought 40% of new products to market between 2021-2022, followed by North America (33%) and Asia (16%).

Primarily, consumers are more interested in recognizable and trusted ingredients such as vitamins and minerals to gain reassurance over products' health claims. Notably, Innova Market Insights found that the ever-popular vitamin C remains the leading ingredient in new supplements globally, included in 27% of launches (2021/22).

According to Isabel Gómez, global marketing manager at Lubrizol Life Science, building trust and transparency in product launches through established procedures remains necessary for brands to excel in the supplements space. “Using branded science-based ingredients to validate health benefits is an excellent way to offer consumers reassurance over health claims,” she says.

Innova Market Insights highlights that the most frequent claims in supplement launches in 2021/22 were immunity health (33%), followed by brain-mood health (25%). The fastest-growing claim in supplement launches is mental acuity (81%), ahead of insomnia (54%) (2017-2022).

Although vitamins remain dominant in the supplements category, other ingredients like collagen are making waves in nutrition, fuelled by its wide range of applications and uses – including skin health, bone health and muscle and joint support. “As more consumers begin to understand the positives of adding collagen supplements to their diet, collagen-based products are expected to become even more popular,” notes Jaume Reguant, healthcare director at Bioiberica.

“Formulations that blend efficacious ingredients, like collagen, hyaluronic acid, glucosamine and chondroitin sulfate with vitamins and botanicals, for instance, are increasingly making their way into consumers’ shopping baskets.”

However, consumer trust in the age of growing climate change fears extends beyond personal well-being to environmental sustainability. “Manufacturers that are transparent about their production processes and use high-quality, sustainably sourced and upcycled ingredients are more likely to gain customers’ trust, and with it – market share,” notes Florencia Moreno Torres, health and nutrition global business development manager at Rousselot.

While the modern-day consumer requires supplements that deliver on health claims and support the natural environment, they also demand greater levels of convenience to support their busy, on-the-go lifestyles. The convenience trend is driving new innovation in quick and easy delivery formats. “Smaller pills and capsules and tasty, convenient gummies are trending as they’re easy to consume as part of a busy daily routine,” explains Sophie Zillinger, global marketing lead for Biotis at FrieslandCampina Ingredients.

Biotis GOS is a dairy-derived prebiotic shown to influence the balance of the gut microbiota for beneficial effects on gut health and mental well-being. Gut health supplements – like probiotics – are gaining prominence as science digs deeper into their potential for mental and physical well-being, including athletic performance.

Reguant at Bioiberica echoes that consumers increasingly opt for novel supplement formats beyond pills, capsules and softgels, paving the way for gummies. “Gummy formats continue to gain market share,” he says. “They are viewed as a convenient and tasty way of taking nutrients that help to relieve pill fatigue, leading to supplements being ‘gummified,’ like those for hair, skin and nails.” Innova Market Insights recorded 54% average annual growth in global supplement launches tracked in gummy format between 2017-2022.

By Joshua Poole

Nutraceutical and Nutrition Industry “Resilience” Remains Steady as Recession Looms

30 Jan 2023 Nutrition Insight

The World Economic Forum (WEF) says that two-thirds of chief economists predict a global recession in 2023 and 18% said that it’s “extremely likely,” a percentage that has doubled since September 2022.

Moreover, economic volatility and supply chain disruptions have affected the nutrition and nutraceuticals industry.

PharmaLinea takes us through its industry future forecast and emphasizes steady growth. However, a recent study demonstrates that, due to inflation, many consumers are turning to low-nutrient foods to keep costs low.

"Our industry has proven resilience to various market conditions, including the recession in 2008 when there was only a slight decline in growth. We are now expecting a similar situation. Consumers will, without a doubt, be more prudent when making purchasing decisions, demanding proof of efficacy, and adding value products," Anton Oražem, CEO at PharmaLinea, tells NutritionInsight. "However, consumers value their health, so we don't expect a big decline in growth in our industry, especially for companies that offer products and services with clear added value."

The WEF also says that not all of the news is bad. "Economists often point to the strength of household finances, slowing inflation and resilient labour markets. The cost-of-living crisis may be reaching its peak, and 68% of the economists say it will be less severe by the end of 2023." The WEF further details that the energy crisis is expected to improve.

Economy and the industry

Oražem says that the global economic situation has affected the nutrition industry in many ways, one of the more notable ones being inflation. "Interestingly, not all categories have been affected in the same way. In February 2022, inflation rates varied from 4-10%, depending on the category. The data also varies depending on the market. Between January 2021 and October 2022, it shows a 4.5% price increase for multivitamins in Indonesia and a 7.8% increase in South Korea. Meanwhile, the price of multivitamins in Germany has only increased by 0.4%," he says. On the other hand, we can notice a price drop for vitamin D in Indonesia, while in Germany, the price for the same ingredient has increased by 10.4%."

By Beatrice Wihlander

Ethiopian Sorghum Varieties Hold Traits for Drought Tolerance

December 14, 2022, ISAAA Inc

By planting different accessions from the Ethiopian sorghum landrace, scientists from the Addis Ababa University, Ethiopian Institute of Agricultural Research, and the Swedish University of Agricultural Sciences have initially identified novel sources of germplasm that can be used for breeding drought tolerant sorghum.

The team conducted multi-environment field trials in three drought-prone sites in Ethiopia during the 2019 crop-growing season using 320 sorghum landraces and four improved varieties. They meant to determine the responses of different drought tolerance related traits by examining targeted traits such as chlorophyll content at flowering and maturity stages, green leaf number at flowering, stay-green, flag leaf area, peduncle length, and panicle exertion.

The scientists found that the Ethiopian sorghum landrace accessions hold important phenotypic variation for all drought-tolerance related traits, thereby easing the identification of novel drought tolerant sorghum varieties in the Ethiopian sorghum gene pool, which have not been previously evaluated for drought tolerance. Moreover, succeeding analyses and indexing of the data indicate that several sorghum landraces outperformed improved varieties in three traits.

These landraces could then be used for future breeding programs to develop drought tolerant sorghum. Multi-environment field trials and genome-wide accessions studies were recommended to determine reliable top performing, stable sorghum genotypes.

More details can be found in Frontiers in Plant Science.

Keeping kids keen: Growth in India's children's snacking market driven by convenience, health and safety

By Pearly Neo 01-Nov-2022 – Food Navigator Asia

Convenience for parents and guaranteed food safety for children are the primary drivers of growth for the kids' snacking market in India today, with the category evolving to become an increasingly important dietary occasion in the country.

Globally, the snacking sector benefitted from habits developed during the COVID-19 pandemic and its related lockdowns.

In India, the children's snacking market in particular has been seeing significant growth, with parents increasingly seeing children-targeted snacks as a convenient yet important part of their diets – with the caveat that no compromise is made on the health, nutrition and food safety aspects.

"Here in India we have definitely seen that the importance of snacking has been going up, and as mothers the occasions and frequency of providing these snacks to the kids has also been increasing," kids' snacks brand Snack-A-Doodle Co-Founder Simer Dhall told FoodNavigator-Asia .

"This was accelerated by COVID-19, and became very apparent in 2021 [amidst all the lockdowns] – initially mothers here have always looked at snacks as a 5pm thing previously, but after that these became increasingly important as a food that was easy and convenient to give to our children any time of the day.

"It's really common to see children, like my own son for example on a Saturday when he's off from school wanting a snack at 11am, 3pm, 6pm and this was exacerbated by everyone being stuck at home and basically wanting to constantly eat – so much so that the snacking culture essentially became habit for both parents and kids."

Dhall emphasised that the most important thing to consider for children's snacks in not just the convenience for the parents but also the food safety factor for the children, particularly in a market like India which has had more than its fair share of food safety scares.

"This is why one of the main selling points of our products is to be safe, both in terms of allergen risks but also additives – so we have committed to being gluten-free, not adding any processed sugar, not adding artificial colouring, not using nuts and so on," said Dhall.

"The no nuts part is quite important here as there is a rising trend of allergies locally, so much so that some schools have even banned the presence of nut-containing food products on the premises, so we have gone in line with those policies."

When it comes to getting healthy children's snacks out to the masses though, Dhall highlighted that some challenges still remain in terms of many parents' awareness with regards to what is healthy and what is not, which is concerning as this could lead to long-term consequences for the child.

"It is extremely important to educate all parents with regard to healthier products and the importance of health and nutrition – looking at the numbers, India is one of the largest countries in terms of childhood obesity," she said.

"So educating the parents on how necessary it is to start healthy eating and healthy snacking at an early age so that later on the child gets used to that -and is not always indulging in junk food- is very crucial."

Dhall's partner and fellow Co-Founder Radhieka Pandeya concurred, and added pricing as an additional challenge the firm has been facing.

"Some consumers are not used to buying snacks for the somewhat higher pricing we have due to our more nutrient-dense products, and will ask say why our pricing is much higher than general trade local cookies," she said.

"That is a very common question and a very difficult one, and explaining it, at least in a market like India, has been a big challenge for us, but it does boil back down to education."

Fight to curb food waste increasingly turns to science

By DEE-ANN DURBIN, AP News, December 10, 2022

Hate mealy apples and soggy french fries? Science can help.

Restaurants, grocers, farmers and food companies are increasingly turning to chemistry and physics to tackle the problem of food waste.

Some are testing spray-on peels or chemically enhanced sachets that can slow the ripening process in fruit. Others are developing digital sensors that can tell — more precisely than a label — when meat is safe to consume. And packets affixed to the top of a takeout box use thermodynamics to keep fries crispy.

Experts say growing awareness of food waste and its incredible cost — both in dollars and in environmental impact — has led to an uptick in efforts to mitigate it. U.S. food waste start-ups raised $4.8 billion in 2021, 30% more than they raised in 2020, according to ReFed, a group that studies food waste.

"This has suddenly become a big interest," said Elizabeth Mitchum, director of the Postharvest Technology Center at the University of California, Davis, who has worked in the field for three decades. "Even companies that have been around for a while are now talking about what they do through that lens."

In 2019, around 35% of the 229 million tons of food available in the U.S. — worth around $418 billion — went unsold or uneaten, according to ReFed. Food waste is the largest category of material placed in municipal landfills, according to the U.S. Environmental Protection Agency, which notes that rotting food releases methane, a problematic greenhouse gas.

REGULATORY NEWS

Removing PFAS with magnets: University of Queensland researchers develop water safeguarding technique

23 Jan 2023 Nutrition Insight

Researchers at the University of Queensland, Australia, have developed a novel solution for removing the "forever chemicals" PFAS from water – something the study authors say is "urgently needed" to combat common public health risks like liver and kidney disease.

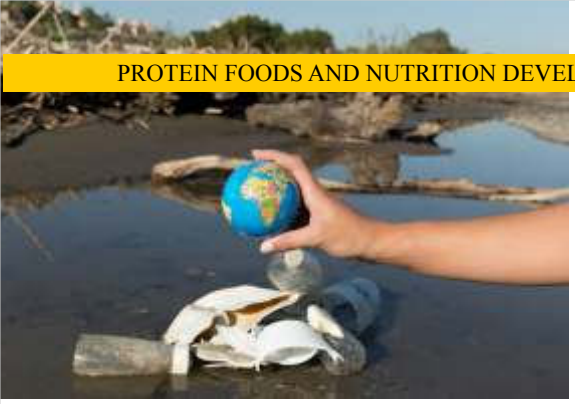
PFAS is commonly used as a grease-repellent barrier in fibre-based packaging like fast food containers. Mounting evidence that the chemical group is persistent and damaging to human and environmental health has spurred a recent wave of industrial action to find alternative solutions, including improved waste management techniques.

Polymer chemist Cheng Zhang and Ph.D. candidate Xiao Tan at the Australian Institute for Bioengineering and Nanotechnology cleared 95% of PFAS from a small amount of contaminated water in less than a minute. "In this work, novel magnetic fluorinated polymer sorbents were designed to allow efficient capture of PFAS and fast magnetic recovery of the sorbed material," explain the researchers. "The new sorbent has superior PFAS removal efficiency compared with the commercially available activated carbon and ion-exchange resins."

Magnetic sorbet

The solution coats PFAS particles and then uses a magnet to attract, isolate and remove them, Zhang explains. He reportedly explains that existing PFAS removal methods require types of machinery like pumps, which consume a lot of time and resources. "The new method shows it is possible to remove more of these chemicals in a way that is faster, cheaper, cleaner, and simple. Because our process does not need electricity, it can be used in remote and off-grid communities."

The solution itself can be reused up to ten times. The research team will now scale up the testing and says it hopes to have a commercially available product ready in the next three years. The study is published in Angewandte Chemie.



Action against PFAS

The study comes as political pressure is mounting against the use of PFAS in packaging around the world. As of January 1, the US state of New York has officially banned all PFAS chemicals under the Hazardous Packaging Act, and applies to any packaging products designed for direct food contact. Last year, Flinders University materials researchers in Australia and One-Five, a German biomaterials developer, began using seaweed extracts to develop biopolymer coating materials to replace current foodservice packaging.

The researchers developed a prototype coating from seaweed that they state meets the functional requirements of conventional grease-resistant packaging materials. Using seaweed creates a circular solution, allowing the grease-resistant film to be biodegradable, deriving from natural ingredients.

Edited by Louis Gore-Langton

FSSAI Guidelines for Restaurants & Eateries

06 Dec 2022
Nutrition Insight

There are no such things as unsafe or unhealthy food, but food preparation in an unhygienic manner can make the food sick when consumed. Various diseases can infect a consumer who consumes unhealthy food.

Prevalent infections are vomiting, headaches, dizziness, and shivering. All restaurants and eateries have to follow the following FSSAI guidelines to ensure the safety of their consumers in addition to obtaining FSSAI registration. This article discusses the hygiene of food, workers, and the workplace, and the cleanliness and disposal of food.

Personal Hygiene of Employees

Before going to work, the worker should ensure that he brushes his teeth, bathes, and trims his nails, hair, and beard. The employer must ensure that the employee involved in the food preparation is hygienic and that he wears clean clothes. In case an employee is injured, he must bandage all his wounds so that there are no germs that would spread from his injury.

Some of the don't (s) that a worker should keep in mind are:

- Employees (s) should not handle food when they are ill.
- Employee(s) should not scratch his skin or prick his nose and pimples.
- Employee(s) should not have long nails and no nail enamels applied to them.
- Employee(s) should not wear dirty clothes and should not wear accessories while handling food.

In addition to this, a worker, before he enters a kitchen, should wear an apron, gloves, and headcover. Finally, workers should wash their hands before work and wear clean and covered clothes.

Food Premises and Facilities

The walls and ceilings in the food preparation area should be clean, and the walls should be smooth, light-coloured, non-absorbent, and should be easy to clean. The walls should be painted neatly and adequately, and there should be no paint flaking.

The windows in these rooms should be covered with wire mesh and shatterproof glasses. The doors should have tight air filters or curtains so that dust particles do not enter the room. The ceiling should be kept clean with no wires or electrical fittings hanging. Proper handwashing areas should be provided along with covered garbage bins in the food preparation area so that the food does not get infected by the germs. Spraying of insecticides during food preparation should be strictly prohibited from these premises.

Handling of Food

The receiving area should be kept clean and sanitized. The food should be received in clean containers. There should be separate containers for vegetarian and non-vegetarian foods and cooked and uncooked foods. There are specific instructions to be followed in the food storage place to handle the foods correctly. The site should be cleaned frequently, and it should be well-lit.

The products should be stored at temperatures depending on the products. The containers stored with food should be at least 15 cm from the ground.

Food Serving Area

Food should be served with the appropriate equipment, and touching food with bare hands should be avoided. If food is maintained at room temperature, it should be consumed within 4 hours. Hot food that is served should be stored above 60-degree Celsius, and cold food should be kept below 5 degrees Celsius.

Steps and Facilities for Wash

The workers and consumers must keep their hands clean at all times. It is recommended that a person always wash their hands after touching animals, blowing their nose or sneezing, touching a sick person, handling waste, using the bathroom, and exchanging money.

According to the setting, two arrangements can be made as part of the hand washing facilities. The two settings are the permanent setting and a temporary setting. In a permanent setting, there should be a washbasin, soap or a hand wash, towels or tissues, and a waste paper basket. There should be a water container or a bucket with water, a discarding bucket, paper towels, and soap in the temporary setting.

Specific steps are to be followed to have a proper hand wash. This would ensure the consumer and worker's safety when they come in contact with food. They are as follows.

- Make sure the hands are wet, and then soap has to be applied
- Palms should be rubbed together in such a way lather is formed
- Palms should be rubbed over the back of the hands and in between the fingers, thumbs, and wrists and then fingertips to palms
- Finally, please wash your hands with clean water and dry them with clean towels.

Cleanliness and Sanitation

The kitchen floor should be smooth and cleaned every day so that it helps in avoiding contamination of food. The plates should be scraped and rinsed to remove loose food and detergent should be used to remove the stuck food. Proper drainage amenities would help in the prevention of contaminated water and steps should be taken to see that there are no drainage problems in and around the area. It is recommended to have separate dustbins for both food wastes and non-food wastes so that the food wastes can be sent for biodegrading and the non-food wastes can be sent for recycling. The dustbins should not be overfilled and should be cleaned and disposed of regularly.

Pest Control

Pest control should be done regularly, and if there are any pests in the area, immediate action should be taken to eradicate pests from the area so that there is no harm to the food processor.

FSSAI Notifies Regulatory Standards for Basmati Rice

12 Jan 2023, Live Mint, Priyanka Sharma

These regulatory standards for basmati rice shall also be applicable to brown basmati rice, milled basmati rice, parboiled brown basmati rice and milled parboiled basmati rice

New Delhi: The Food Safety and Standards Authority of India (FSSAI) has specified the identity standards for basmati rice. The comprehensive regulatory standards will be enforced from 1 August, the union health ministry said on Thursday.

According to FSSAI, these regulatory standards for basmati rice shall also be applicable to brown basmati rice, milled basmati rice, parboiled brown basmati rice and milled parboiled basmati rice vide Food Safety and Standards (Food Products Standards and Food Additives) First Amendment Regulations, 2023 notified in the Gazette of India.

"It shall possess the natural fragrance characteristic of basmati rice and be free from artificial coloring, polishing agents and artificial fragrances. The standards aim to establish fair practices in trade of Basmati rice and protect consumer interest, both domestically and globally. As per these standards, Basmati rice shall possess natural fragrance characteristic of basmati rice and be free from artificial colouring, polishing agents and artificial fragrances," the government statement said.

These standards also specify various identity and quality parameters for basmati rice such as average size of grains and their elongation ratio after cooking; maximum limits of moisture, amylose content, uric acid, defective/damaged grains and incidental presence of other non-basmati rice etc," the health ministry release said. The standards are aimed at establishing fair practices in the trade of basmati rice and protecting consumer interest, both domestically and globally.

Basmati rice is a premium variety of rice cultivated in the Himalayan foothills of the

Indian sub-continent and is universally known for its long grain size, fluffy texture and unique inherent aroma and flavour. Agro-climatic conditions of the specific geographical areas where Basmati rice is grown; as well as the method of harvesting, processing and ageing of the rice contributes to the uniqueness of Basmati rice.

Due to its unique quality attributes, basmati is a widely consumed variety of rice both domestically and globally and India accounts for two thirds of its global supply. Being a premium quality rice and fetching a price higher than the non-basmati varieties, Basmati rice is prone to various types of adulteration for economic gains which may include, among others, undeclared blending of other non-basmati varieties of rice. Therefore, in order to ensure supply of standardised genuine Basmati rice in domestic and export markets, FSSAI has notified regulatory standards for Basmati rice that have been framed through extensive consultations with the concerned government departments / agencies and other stakeholders as well.

GM Food in India: Debate Reignited After Food Security and Trade Concerns Drive Government to Assess Rules

14-Dec-2022 – Food Navigator Asia

The Indian government appears to be softening its stance as 'no-GMO' country in light of ongoing food security and trade disputes – sparking fresh debate in the country.

India has traditionally been a 'no-GMO' country particularly when it comes to the food sector, with this being reinforced in 2021 with the announcement of a long list of foods requiring GM-Free certificates, covering many major food commodities from rice to beans to fruits and vegetables and more.

Although this has been the stance of the government for some years, things seem to be evolving as most recently in October 2022 the local Genetic Engineering Appraisal Committee (GEAC) housed under the Ministry of Environment, Forest and Climate Change India made the historic decision to allow for open-fiend evaluation of GM mustard, a first in the country.
According to University of Delhi's Professor Deepak Pental, the creator of the GM mustard variant DMH-11, the crop has already undergone the necessary food safety testing but environmentalists have filed various petitions against this, going so far as to take the GEAC to court over this issue.

"[A key factor behind this decision is that] increased domestic production of edible oil due to deployment of GM mustard hybrids will reduce [India's] dependency on other exporting countries," the government said via a formal statement to the Supreme Court.

"The present rate of edible oil consumption in India surpasses the domestic production rate and, at present, India meets nearly 55% to 60% of its edible oil demand through imports."

In addition to the food security reasoning, India's demand for GM-Free certificates has caused it a great amount of strife in the international trade community, having been brought in front of the World Trade Organisation (WTO) several times over this.

In the WTO November 2022 SPS (Sanitary and Phytosanitary Measures) Committee meeting discussing India's requirement for GM-Free certificates – tagged as Specific Trade Concern501 – the United States reopened its complaint that India's actions had negatively impacted US exports to the country such as apples and rice.

"Despite numerous requests from the United States and multiple trading partners, India has provided neither scientific justification nor a risk assessment supporting this measure", the US stated via its complaint document.

" India has previously asserted that the order is not trade restrictive and cited both the compliance of various trading partners and the lack of approvals for [GM products] by its Genetic Engineering Appraisal Committee as evidence.

"The United States stresses that [these] do not provide appropriate or adequate justification for the Order, but rather highlight the negative impacts on trade and inefficient bio-safety regulation in India.
"[We wish to] urge India to immediately withdraw this temporary measure in favour of an alternative approach that is less trade-restrictive and more consistent with international best practices."

This time, it appears that India may be more receptive to the idea as local food authority Food Safety and Standards Authority of India (FSSAI) has published a fresh set of draft regulations regarding GM foods, and instead of the various bans previously set out the it is now looking at procedures to grant approvals to applicants that abide by its standards.

"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 FSSAI – the food manufacturer of importer of any GM-food must submit an application as per the format prescribed by FSSAI along with necessary documents and fee to [obtain this approval],"FSSAI CEO S Gopalakrishnan said via a formal statement.

"FSSAI shall verify that the particulars and documents submitted by the applicant are in accordance with the information sought and examine whether the food is safe for human consumption. "[We] shall endeavour to respect a time limit not exceeding six months from the receipt of a valid application.

"GMOs with a 'Unique Identifier Nine-digit Code' of the Organisation for Economic Cooperation and Development (OECD) that is approved for food use by FSSAI will require no further approvals. However, if it is to be used as seed or other plant-propagating material, approval is required from GEAC."

No blanket bans of any food items were mentioned in the new draft regulations, although all GM-foods are still required to carry the label 'Contains genetically modified organisms' on the front of all pre-packaged products if the product contains 1% or more of GM ingredients.

It is also apparent that India's motivation for this reconsideration is in light of trade concerns, as in its announcement of its draft regulations on the website it specifically highlighted that these were to invite comments or suggestions from member countries in the WTO-SPS committee or the WTO-TBT (Technical Barriers to Trade) agreement.

Australia Tightens Rules for Imports Containing Meat, Dairy and Eggs

By Pearly Neo 12-Dec-2022
Food Navigator Asia

Australia has implemented more stringent regulations to govern imported retorted foods and beverages that contain meat, dairy or egg content, requiring an additional manufacturer's declaration to be displayed prior to entry.

The country has a strong reputation for strict rules in the bio-security department, recently making global headlines when Australian customs fined a passenger inbound from Singapore US$1,820 for an undeclared unfinished Subway sandwich in her purse.
The incident divided both the internet and the food industry alike, particularly after Subway stepped in to offer the passenger a Subway gift card for the value of her fine which drew ire from trade bodies such as the Red Meat Advisory Council (RMAC).

"It's a national disgrace that Subway has thumbed their nose at Australia's bio-security arrangements and potentially encouraged a dangerous precedent for others to do the same," RMAC Independent Chair John McKillop said in a formal statement.

"This is an appalling mockery of Australia's bio-security laws."

The Australian Department of Agriculture, Fisheries and Forestry (DAFF) has also issued a statement highlighting that the passenger was indeed in violation of the local Bio-security Act,

and the passenger herself has admitted her mistake – but given the large amount of publicity this brought DAFF seems to have decided to step up its bio-security measures to close any loopholes, this time for imports of retorted products.

"Effective November 15 2022, all retorted goods for non-personal use containing less than5% meat will now need to present a Manufacturer's Declaration statement on the product packaging to demonstrate compliance with bio-security requirements," DAFF stated via a separate statement.

"In this statement, the declarations must be made that the goods contain less than 5% meat, less than 10% dairy and less than 10% egg by dry weight, and there is no discernible pieces of egg.

"The statement must also include declarations that the product is commercially manufactured and packaged, that the retorted product container has not been opened since the retort process was completed and that it is commercially sterile and shelf stable without any requirements for refrigeration or freezing prior to the package being opened.

"It is also compulsory for the product name to be included in the declaration."

These retorted goods do not need to apply for a DAFF import permit as long as the Manufacturer's Declaration statement is complied with.

For imports from New Zealand, this is the same for retorted products with less than 5% of animal product content, but the focus is primarily on avian meat and pork if it contains 5%or more animal product.

"Although a DAFF import permit is not required for retorted avian or pork meat from New Zealand, the goods mist have been hermetically sealed in a container before being heat treated to a minimum core temperature of 100°C and the final product must be imported in this same container it was retorted in," said DAFF.

"The product carry a New Zealand Ministry for Primary Industries (MPI) certificate [that]declares this import condition has been met with, in addition to statements regarding the species of origin of the meat and that the animals are from Australian or New Zealand origin only; and a statement that this meat has been processed in premises under the supervision of and in accordance with MPI requirements."

For retorted goods from all other markets that contain 5% or more animal product and are meant for human consumption, manufacturers will need to apply for and obtain the DAFF import permit prior to import.

This will require the submission of a relevant health certificate, further details of the retort process and a statement that the final product is imported in the hermetically sealed airtight container in which it was retorted.