

# Processed Milk and Milk Products:

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Milk nourishes and provides immunological protection for the mammalian young. Milk from cow, buffalo, sheep, goat etc. has been used as food by humans since prehistoric times. It has been one of the few foods designed by nature with sole nature being food. Hence, the nutritional value is very high. As per FAO, 85% of all milk is produced from cow.

Many factors affect the composition including breed variation, feed, seasonal variations as well as geographical variations. Fat content is normally taken as a quality standard for milk and this varies cow breed e.g. Holstein-Friesian cow milk has fat about 3.6% whereas Jersey about 5.2%. Species variation shows as follows

	<b>Cow</b>	<b>Goat</b>	<b>Sheep</b>	<b>Buffalo</b>
<b>Protein</b>	3.2%	3.1%	5.4%	4.5%
<b>Fat</b>	3.9%	3.5%	6.0%	8.0%
<b>Carbohydrates</b>	4.8%	4.4%	5.1%	4.9%

Worldwide milk production in 2011 was 730 million tonnes as per FAO. India is the largest milk producing and consuming country, but it neither exports nor imports milk. Among large exporters of milk and milk products are New Zealand, Australia, the US and the EU countries while China and Russia are largest importers. India produced over 50 million tonnes of cow milk and over 62 million tonnes of buffalo milk in 2010.

Milk is preserved by pasteurisation and sterilisation as well as making condensed milk and powders. It has also been processed into dairy products including cream, butter, yogurt, ice cream, cheese, casein, whey protein, lactose, and many other industrial products. According to a report by Global Industry Analysts, Inc. global market for dairy products may reach about 500 billion US dollars by 2015.

Since milk is a highly nutritious substance it can spoil very quickly. There are lactic acid bacteria and some other microbes that are present in it which can grow rapidly and cause changes in milk that make it unacceptable for human consumption. Hence there have been attempts since early times to make it last long. These attempts allowed many different products to be made from milk. Techniques such as heat, cold, drying, fermentation and chemicals have been used to extend the storage period.

## Milk Chemistry

Major component of milk is water, about 85 to 89% in which milk fat globules are present in emulsion form. It contains in dissolved form milk sugar lactose and some whey protein and vitamins and minerals. It also has colloidal suspension of casein micelles, globular proteins and lipoprotein particles. Thus it is a complex structure which looks a uniform turbid liquid at low magnification under microscope, about 5X. At about 500X magnification droplets of fat called fat globules are seen and at very high magnification (50,000X), casein micelles can be seen.

When fat is separated from milk skim milk is obtained. When casein micelles are separated milk serum or whey is obtained. SNF (solids-non-fat) means proteins, lactose, minerals, acids, enzymes, vitamins and total milk solids means fat plus SNF.

Proteins present in milk are of two groups. One that is grouped with caseins which is the major group making about 80% of milk protein and which gets precipitated when acidified and/or acted upon by enzyme rennet. The other roughly 20% is water soluble whey proteins. When caseins are coagulated the whey used to be discarded but now it has been found that they contain proteins with many health benefits especially for growth and muscle development. While caseins are somewhat tolerant to heating whey proteins are very sensitive to heat.

Fat present in milk is important commercially as milk price is based on fat content. Fat is present as emulsion of tiny globule form of the size about 1 to 10µm with mean around 2µm. These globules have a membrane containing phospholipids which stabilises them. When this milk is kept for some time these fat globules collect and rise slowly to the top in the form of cream. When homogenised the fat globules are further divided to about 0.5µm (0.2 to 2µm range) which is tiny enough to resist clustering and forming cream.

When cream is churned the membranes are ruptured and fat globules come together. The emulsion of fat-in-water present in milk now changes to water-in-fat in butter. Butter contains about 20%. When it is heated, this water gets evaporated with the formation of butter oil or ghee.

Milk contains lactose, the milk sugar which is a disaccharide of glucose and galactose. In the intestine lactase enzyme hydrolyses it to glucose and galactose which are then absorbed by our body. If lactase is inadequately produced in some individuals then this hydrolysis does not occur and then in large intestine lactose is used by gut bacteria which produce large amount of carbon dioxide which causes cramps, bloating, diarrhoea, and vomiting etc. the symptoms of lactose intolerance. These individuals need to restrict milk intake or use milk with low lactose. Lactase enzyme is used by manufacturers to treat milk to reduce lactose. To some extent fermented milk products are well tolerated by lactose intolerant individuals as lactic acid bacteria fermenting milk use lactose for growth forming lactic acid.

### Microorganisms in Milk

Milk is sterile in cows' udders unless cow has mastitis disease. Even the sterile milk in udder is contaminated by microbes while milking, handling, storage and other farm activities. So any sample of milk will always have microorganisms. When milking hygiene is very good, the bacteria that are introduced in milk while milking are harmless or even useful with healthful benefits most being of lactic acid bacteria. This group of bacteria is able to ferment lactose in milk to lactic acid and sour the milk.

After milking, if handling and other farm activities are carried out to avoid further contamination and now allow the proliferation of bacteria already present, then milk remains of high quality with low number of harmless microorganisms present in it. Sanitation and hygiene are important in ensuring high quality of milk. Contamination by coliforms is especially undesirable as they are indicator organisms closely associated with presence of pathogens although they themselves may not be pathogenic. They can also cause rapid spoilage of milk. They indicate faecal contamination as they are universally present in large numbers in the faeces of warm-blooded animals. Their presence indicates poor sanitary conditions and possibility of faecal pathogens being present. E. coli is one of the coliform organisms and one serotype E. coli O157:H7 is pathogenic. Other pathogens found in milk are B. cereus, Listeria, Yersinia, Salmonella, Campylobacter, Coxiella, Mycobacterium etc. Some moulds if present may grow in milk and produce mycotoxins.

### Bacterial Types Commonly Associated with Milk

Pseudomonas	Spoilage
Brucella	Pathogenic
Enterobacteriaceae	Pathogenic & Spoilage
Staphylococcus aureus	Pathogenic
Streptococcus agalactiae	Pathogenic
Streptococcus thermophilus	Acid fermentation
Streptococcus lactis	Acid fermentation
Streptococcus lactis-diacetylactis	Flavour production
Streptococcus cremoris	Acid fermentation
Leuconostoc lactis	Acid fermentation
Bacillus cereus	Spoilage
Lactobacillus lactis	Acid production
Lactobacillus bulgaricus	Acid production
Lactobacillus acidophilus	Acid production

Propionibacterium	Acid production
Mycobacterium tuberculosis	Pathogenic

Spoilage of milk describes changes in texture, colour, odour and taste so it becomes unsuitable for human consumption. Spoilage may involve degradation of protein, carbohydrates, and fats by microbes and their enzymes. Microbes involved in milk spoilage are commonly easily destroyed by pasteurisation but some may be stable capable of surviving the process and causing spoilage. So even pasteurised milk unless refrigerated may become spoiled. Some of the lactic acid bacteria are added to pasteurised milk to convert lactose to lactic acid making curd in the process.

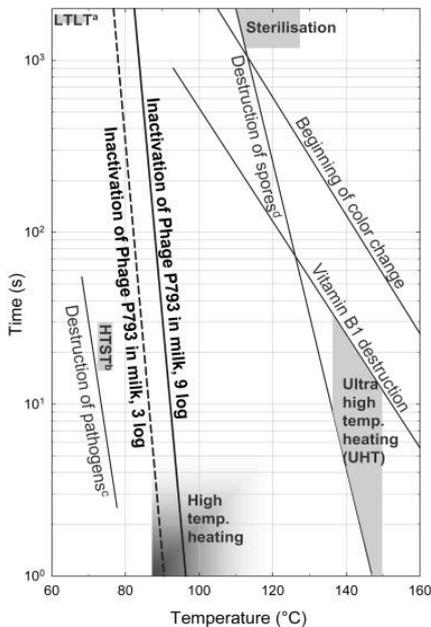
### Heat Processing

Raw milk used to be boiled to make it last longer. Heat kills the microbes present in milk, which if allowed to proliferate will cause spoilage. Reducing their numbers will delay the spoilage. This was first shown by Louis Pasteur, who developed processes for many fruit and vegetable products including wines and later for dairy products to prevent spoilage by microbes. Today, the word pasteurisation for milk is used when the process ensures product to be free of pathogens making it safe. In juices although it predominantly ensures prevention of spoilage but now since there have been many instances of pathogenic strains of E. coli being found in juices pasteurisation also ensures safety.

Earlier processes of pasteurisation of milk used lower temperatures e.g. 63°C for 30 min to make it pathogen-free. However, later higher temperature 72°C for 15 seconds were found to be adequate to pasteurise milk in HTST (High Temperature Short Time) processes, which gave milk of better flavour and nutrient quality. Higher temperatures needed less time to destroy the microbes but the degradation of vitamins was not proportionately higher. HTST processes were possible due to development of continuous heat exchanger equipments like plate and tubular heat exchangers which would quickly bring the temperatures up, hold them for requisite time and cooling exchangers quickly bring them down.

Since pasteurisation of milk ensures destruction of pathogens and although it reduces number of total bacterial load in milk there are still a large number of bacteria present and capable of growing in milk. Hence pasteurised milk needs to be chilled and stored under refrigerated conditions. It may last for a few days before it spoils as these temperatures do not stop growth of bacteria although they slow them down.

More recently UHT (ultra high temperature) processes are being used where temperatures of higher than boiling point of water (about 138°C) for a couple of seconds are used. This would further extend the shelf life of milk to several months as product would be virtually sterile. Milk could be stored at ordinary temperature while pasteurised milk needs to be stored at refrigerated temperature. UHT milk after processing needs to be packed without contamination; it is packed under aseptic conditions using special equipments which will prevent contamination during filling the sterile product into sterile packaging material.



**Fig. Time-Temperature Effect on Microbes & Chemicals**

Working with very high temperatures for just a few seconds requires sophisticated processing equipments. The heat exchangers need to have very small gaps between plates or tubes so only a thin layer of milk is flowing between them. As milk is not a good heat transfer material this is necessary so instantaneously temperature of milk may be brought up to high level above 100°C using steam under pressure. After holding it for a few seconds, it must be cooled again instantaneously to chilling temperature as holding at higher temperature for long will affect both colour and flavour of milk besides causing destruction of heat sensitive vitamins.

Even the processed and cooled milk needs specialised equipment for aseptically packing in sterile containers. Companies have developed these equipments and packaging materials so after packing them the product remains stable for months without spoilage at ordinary temperature without refrigeration. There are also long shelf life products produced using high temperature heating after milk has been bottled. However, the process is quite severe so not only will it be more energy intensive, it affects the sensory and nutritive properties of milk.

### **Lower Fat Milks**

Cow's milk contains about 3.5 to 4% fat while buffalo milk contains up to 8%. Some people prefer to have less fat in their diets as they are worried about their weight as well as heart disease. Although raw milk when allowed to sit for some time cream may separate as fat tends to separate. This may take a long time. If milk is allowed to centrifuge fat separates faster. Cream separators are continuous centrifuges which separate cream and lower fat milk continuously. The amount of fat separated will depend on efficiency of cream separator as well as the speed of its spinning.

Using cream separators skim milk with fat content of just 0.5% can be prepared. Cream separators are not only used for preparing low fat milks and creams but for ensuring the uniform fat content in standard milks. As raw milk fat content varies depending on different conditions consumers are ensured that when they buy milk it should have uniformly same fat content. Blending of milk of different fats or with cream becomes very useful in this.

Cream that is separated from milk may be cultured and fermented and then churned to get butter and buttermilk. Butter contains almost 20% water. While milk is oil-in-water type of emulsion, butter is water-in-oil type of emulsion. Butter has yellowish colour as cows eat green grass and green fodder containing carotenoids which get into the milk and being fat soluble into butter. However, if diet is low in green fodder and mostly grain then butter is paler. In order to maintain uniform colour for the product, natural colour annatto is added giving attractive yellow colour to butter. Also salt is added to prevent any spoilage so commercial butter is usually salty.

Cream will also vary in fat content right from about 10-12% (half & half) up to 36% and even higher in heavy cream. Cream also may be pasteurised and packed as a product for domestic and industrial applications.

### Condensed Milk

Milk is concentrated to prepare either evaporated milk or condensed milk. Condensed milk commonly contains sugar so it does not need to be concentrated as much as evaporated milk to make it stable. Evaporators are used like film evaporators, plate evaporators and scraped surface evaporators to prepare these products. Multiple effect evaporators are more efficient and produce better product. Water is removed from milk so concentration of all components increases.

Condensed milk is a thick product which is sweet and will last for a long time if refrigerated. Canned product is also available which is stable for a couple of years. Sweet product is suitable for sweets so in India it is used industrially as well as in homes as a starting material for various milk-based sweets. Traditionally khoya or khoa is a concentrated product used as raw material for many Indian sweets like pedha and burfi. This is even thicker than condensed and both sweet as well as unsweetened variants are available. There are now scraped surface concentrators available for making khoya.

Evaporated milk is preferred by those who want to reconstitute it to milk by adding water. Evaporation reduced weight and volume for storage and transport so costs are less. Since it does not contain sugar, it may commonly be canned for longer shelf life.

### Milk Powders

Since milk contains proteins and sugar which at high temperature for long would produce brownish colour and cooked flavour it was difficult to remove further water from condensed and evaporated milk without affecting sensory properties in early days. With the development of vacuum drum drying process an acceptable product was prepared where milk or concentrated milk was applied on heated drum kept under vacuum to quickly evaporate water leaving layer or dried milk on surface. This was scraped off and powdered. Later spray drying and fluidised bed drying processes gave better products.

Spray dried powders are most common now. Concentrated milk is sprayed or atomised in a chamber in which hot dry air is also pumped so extremely small particle of wet milk is instantly dries and powder is collected. Although fairly high temperatures are used, because particles quickly dry and are now allowed to remain with hot air the product does not have much nutrient losses. The process is now fairly cost effective and since the product does not require special storage conditions it is a popular way to store excess milk when demand is not high and then when it is required it may be reconstituted to milk with water during summer time when demand exceeds supply.

### Fermentation & Products

Age-old process of fermentation products of milk was used to prolong the shelf life of milk products as well as adds taste and improves digestibility. Lactic acid bacteria in milk convert lactose to lactic acid which lowers the pH. This is inhibitory to many pathogens and spoilage organisms. There are many health benefits of fermented milk.

Raw milk also contains microbes that can ferment and sour the milk but we refer to this as spoilage. The difference between this and fermentation is the microorganisms. Raw milk contains not only lactic acid bacteria but also other microbes capable of utilising lactose to produce acid. However, lactic acid bacteria produce desirable changes in flavour and nutrients while spoilage causes not just undesirable off-odour and off-taste but if pathogens are present may make the milk harmful. Hence before fermentation milk is heated to destroy pathogens and spoilage organisms and then is inoculated with desirable single or mixed cultures of lactic acid bacteria to produce acidified milk, curd, yogurt and many products thereof.

Many of these lactic acid bacteria have been studied with respect to their benefits upon consumption. Gut health, control of diarrhoea, cholesterol reduction, immunity etc. are some of the benefits that have been observed of certain strains of lactic acid bacteria. Those having these established health benefits and being able to lodge in intestines are called probiotics. There are many health benefits of plain curd but these need to be established by research studies. There are also many vitamins especially B vitamins produced during fermentation.

B vitamins in skim milk & yogurt from skim milk (1 cup or 245g)

	Skim Milk	Yogurt
Thiamin (B <sub>1</sub> )	0.1mg	0.1mg
Riboflavin (B <sub>2</sub> )	0.3mg	0.6mg
Niacin	0.2mg	0.3mg
Pyridoxine (B <sub>6</sub> )	0.1mg	0.1mg
Folate	12.3mcg	29.4mcg
Vitamin B <sub>12</sub>	0.9mcg	1.5mcg
Pantothenic acid	0.8mg	1.6mg

When pH of milk is lowered during fermentation, casein precipitates at pH lower than 4.6. The coagulated product is soft and retains good amount of moisture. Curd can also form when enzyme rennet or lemon juice or other acidic substance is added to milk. However, curd formed by fermentation is healthier. Also those having lactose intolerance due to lack of lactase enzyme can digest more easily the fermented curd.

Commercially yogurt is prepared using standard cultures which quickly produce acid and also have good flavour. These may be pasteurised and refrigerated so they can be kept for weeks or months. They may come with variations with fruit or they may have a thinner consistency so one can drink. Some may be flavoured, coloured and sweetened to make them more acceptable. There are now some frozen yogurt desserts also available.

Popular traditional Indian beverages from yogurt or curd are lassi and chhaas or buttermilk. Adding water, spices, herbs, sugar or salt and churning will produce them. Lassi has less water and more fat or cream. These are quite popular in summer.

### [Cheese & Paneer](#)

Cheese is a very popular food and ingredient used in many foods including burger, pizza, spreads and many other foods in which it may be used as garnish as well. There are literally hundreds of types of cheeses produced all over the world having different style, texture, colour and flavour depending on origin of milk, fat content, microbes used for ripening, processing used including aging, and different ingredients like herbs, spices etc. used.

Milk is commonly fermented using bacterial culture and when pH is lowered rennet enzyme is used to coagulate it. Whey is allowed to separate so curd is solidified. This may then be ripened using bacterial or fungal cultures which give distinctive flavour and colour as well as appearance to the cheese. Some cheeses may curdled by adding acidulants like vinegar, lemon juice and may or may not be further ripened. Paneer is made this way without ripening.

For Mozzarella, curd is stretched and kneaded in hot water to make it elastic to be suitable for pizza. Cheddar curd is piled on each other so their weight presses out water and it progressively becomes harder. Edam and Gouda curds are washed with water that lowers acidity making them milder. Blue cheeses like Roquefort and Stilton are ripened with blue mould while Swiss cheese is ripened using Propionibacter that produces gas which is entrapped in cheese producing holes in it.

Very common form is processed cheese which is made using traditional cheese to which additives like emulsifiers, colour and preservatives may be added along with milk, whey and salt. Cheese along with other substances is heated

to melt it. The liquid mass is then stirred to form homogeneous mass of uniform texture and appearance. It is then solidified into different shapes and sizes but most common are slices individually packed, cubes and discs packed in tins. Its texture depends on its moisture and fat content which is adjusted by adding different milk ingredients.

### [Finally](#)

There are many sweetened products that are prepared from milk and the ingredients thereof such as ice cream, custard, frozen desserts and a whole range of Indian sweets based on milk and dairy products including pedha, burfi, rasgulla, gulabjamun, basundi, kulfi, sandesh, shrikhand, kheer and many other products. This would make a separate article.

Milk has been one of the most important part of our diet and starting point of a large number of products that are consumed for the nutrients as well as they have become a part of our culture and in some cases even religion. People have learnt how to make them last for a longer time but also to make them safer and of course highly appealing.



# Foods under Section-22: Framework of Understanding: Part 1

Dr. J. I. Lewis, Chairman, Regulatory Affairs Committee, PFNDAI

Section 22 has now gained considerable notoriety with a host of popular opinions and treatments being advocated for foods lying within its confines.

The purpose of any legislation is to enable compliance and enforcement in a consistent and predictable manner. For this to happen the drafting should provide a clear, easy to understand and unambiguous texts that are simple concise and contain no unnecessary elements. Above all if the Food Business Operator (FBO) and the Food Safety Officer (FSO) are to derive the same understanding of the differences that separate these foods regulations should be precise and leave no uncertainty in the mind of the reader. A reading of the discussion drafts floating for the past 2-3 years does not instil much confidence - on the contrary notifying such a draft it is likely to set off more debate and confusion. Principles of legislation should be presented in a commonsensical manner that brings immediate understanding on what the legislator has intended.

This article seeks in a simple and forthright manner to provide readers with a preview of what separates these foods



under Section-22 (Fig 1): Part 1 deals with the most critical foods namely - Functional Foods, Food Supplements and Nutraceuticals. Some of these terms lie more in the realm of marketing jargon and have little to offer in regulatory practice. The task before the Authority and stakeholders is not to propagate the confusion or uncertainty but to settle it. There is enough evidence to conclude these terms and put them in their place.

**Functional foods** are defined in several articles but the one provided by Health Canada is apt and appropriate. A functional food is similar in appearance to, or may be a conventional food, is consumed as part of the usual diet and is demonstrated to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions.

Apart from indulging in some wordsmithing for style, the construct of meaning is clear. Obvious features that emerge are – it looks like and eaten as a conventional food (with all its sensory attributes) as part of the diet but consumed for its specific physiological benefits and not only for providing nutritional benefits. In a regulatory context these foods have the same oversight as normal or conventional foods that make health or risk reduction claims and are subject to labelling rules regarding the same. The Authority may merely define these foods as above in deference to obligations under the Act inasmuch as to settle any ambiguity that may arise in the future with products claiming to be so.

The essential task of distinguishing functional foods from fortified foods, food supplements and foods for special dietary uses is accomplished by its definition and subjects it to regulations provided for conventional foods. There

are several functional foods existing in the market; popular ones being oats with *beta* glucan or foods containing psyllium husk fiber or soy protein – with the right level of the qualifying ingredient providing the health benefit.

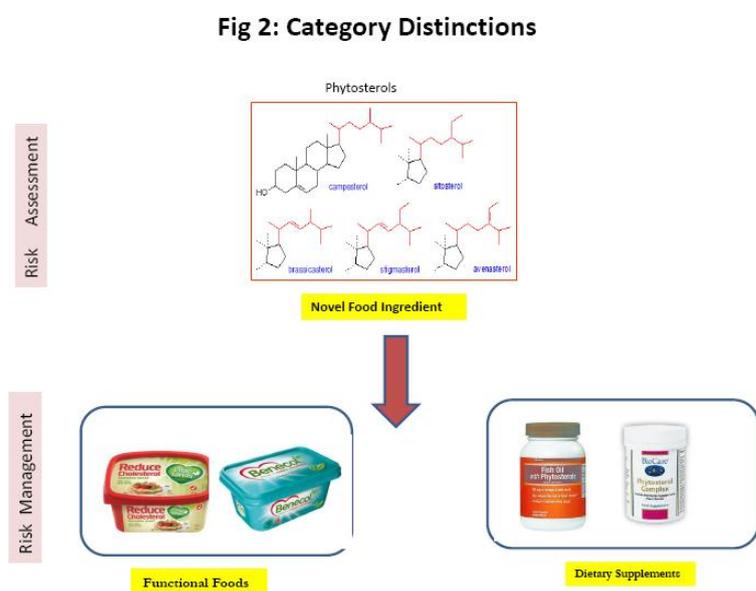
**Food Supplements** (*other than tobacco or prohibited substances*) are products that are primarily intended to supplement the diet by increasing the dietary intake through such foods and are typically concentrated sources of minerals, vitamins, proteins, amino acids or enzymes, plants or botanicals or substances of animal origin or other similar substances with known and established nutritional and physiological effects.

The format in which these foods are offered for sale is specified by legislation and would be held to be in violation of the law if they impinge upon the characteristics of another category. For example phytosterols may be offered for sale either as a food supplement (capsule) or a functional food (conventional food) so long as they follow the distinguishing features of their respective categories (Figure 2). An important point of safety here is the decision to

permit the ingredient namely phytosterols in supplements and/or conventional foods.

Generally safety provisions are directed by policy as specified in the Act(s) existing in the country. Often this factor is overlooked by stakeholders and is a serious lapse in legislative interpretation.

Secondly the format excludes them from being presented as ‘conventional foods’ and are not taken as part of the normal diet. These terms are to be included in totality in the construct of meaning assigned to this category of foods. For regulatory purposes these terms are expected to



distinguish and separate these foods from functional foods and conventional foods. Both the FBO and the FSO should be mindful of this fact.

**Nutraceuticals** was coined from "nutrition" and "pharmaceutical" in 1989. The term nutraceutical is commonly used in marketing parlance but has no regulatory recognition. However as the term is mentioned in the Act it is prudent to settle its regulatory place. A pointer of its close affiliation to food supplements is evident from the following definition “nutraceutical is a product isolated or purified from foods that is generally sold in medicinal forms not usually associated with food. A nutraceutical is demonstrated to have a physiological benefit or provide protection against chronic disease (*Policy Paper of Food Directorate, Health Protection Branch Health Canada*). For the purpose of the regulatory settlement it may be included in the definition of foods supplements as “Food Supplements (including such terms as nutraceutical). No further elaboration in regulation is required.

Food supplements are required to be marketed in pre-dose forms such as capsules, tablets, powders and liquids – a format closely similar to medicines. In a sense they are sandwiched by regulation between functional foods and medicines and walk a thin line.

Further under the Act food supplements should not “ include a drug as defined in clause (b) and ayurvedic, sidha and unani drugs as defined in clauses (a) and (h) of section 3 of the Drugs and Cosmetics Act, 1940 and rules made thereunder. It further states that it shall not include a narcotic drug or psychotropic substance as defined in the Schedule of the Narcotic Drugs and Psychotropic substances. The possibility of food supplements crossing the border into drugs and medicines particularly ayurvedic sidha and unani drugs -excluded by the Act - needs careful examination. What conditions need to be fulfilled in deciding when a product would be considered to transgress the demarcation line? A superficial reading of sections 3(a) and 3(h) are revealing of the scope of this exclusion:

- (3a): Ayurvedic, Siddha or Unani drug” includes all medicines intended for internal or external use for or in the diagnosis, treatment, mitigation or prevention of [disease or disorder in human beings or animals, and manufactured] exclusively in accordance with the formulae described in, the authoritative books of Ayurvedic, Siddha and Unani (Tibb) systems of medicine], specified in the First Schedule.
- 3(h): “patent or proprietary medicine” means, --(i) in relation to Ayurvedic, Siddha or Unani Tibb systems of medicine all formulations containing only such ingredients mentioned in the formulae described in the authoritative books of Ayurveda, Siddha or Unani Tibb systems of medicine specified in the First Schedule, but does not include a medicine which is administered by parenteral route and also a formulation included in the authoritative books as specified in clause (a);

Legal clarification is required as to whether products containing one of more substances from Schedule 1 which because of their properties and use in medicinal products can be used in food supplements. In other words can they have a dual legal nature of being medicinal substances and ingredients for food supplements?

### [Why is defining the product category important?](#)

FBO's will need clear directions from regulations concerning these foods when developing formulae and format. Each category will impose its own set of conditions regarding labelling, sensory attributes and claims. Uncertainty of placement on the market or unpredictability of enforcement can severely impact product development, distribution channels and marketing preparedness.

Regulatory drafts would do well to bring precision in legislative texts rather than generalization if compliance is to reign over confusion. Each category under Section 22 should be notified in a standalone dedicated chapter to discourage field operators from straying into unrelated categories. Drafting of legislative texts require much more diligence than the current practice of agglomerating various texts downloaded from websites. It is highly contentious whether drafting of regulations were contemplated to lie within the role of scientific experts – the Act is clear on this. Industry on the other hand while being more informed on regulations provide poor resolution to circulating draft compelled perhaps by immediate contingency than long term benefits. As a result the quality of final regulations that serves the country's development of the food sector suffers.



# Research in Health & Nutrition

## 8 ways to quell the fire of heartburn

Health Beat from Harvard Medical School November 3, 2012

Heartburn is a common problem. It's caused by the backwash of stomach acid into the esophagus, the tube connecting the mouth and stomach. This is formally called gastroesophageal reflux disease (GERD). More than just a minor discomfort, heartburn can significantly reduce quality of life. "Heartburn can cause damage to the esophagus and even increase the risk of cancer if ignored and untreated," says Dr. William Kormos, editor in chief of *Harvard Men's Health Watch* and a primary care physician at Massachusetts General Hospital.

These eight steps can help ease heartburn.

1. **Eat in a heartburn-smart way.** Large meals put pressure on the muscle that normally helps keep stomach contents from backing up into the esophagus. The more you eat, the longer it takes for the stomach to empty, which contributes to reflux. Try smaller, more frequent meals and don't wolf down your food.
2. **Avoid late-night eating.** Having a meal or snack within three hours of lying down to sleep can worsen reflux, causing heartburn. Leave enough time for the stomach to clear out.
3. **Don't exercise right after meals.** Give your stomach time to empty; wait a couple of hours. But don't just lie down either, which will worsen reflux.
4. **Sleep on an incline.** Raising your torso up a bit with a wedge-shaped cushion may ease nighttime heartburn. Wedges are available from medical supply companies and some home goods stores. Don't just prop your head and shoulders up with pillows. Doing so can increase pressure on the stomach by curling you up at the waist.
5. **Identify and avoid foods associated with heartburn.** Common offenders include fatty foods, spicy foods, tomatoes, garlic, milk, coffee, tea, cola, peppermint, and chocolate. Carbonated beverages cause belching, which also causes reflux.
6. **Chew sugarless gum after a meal.** Chewing gum promotes salivation, which helps neutralize acid, soothes the esophagus, and washes acid back down to the stomach. Avoid peppermint gum, which may trigger heartburn more than other flavors.
7. **Rule out medication side effects.** Ask your doctor or pharmacist whether any of the medications you take might cause pain resembling heartburn or contribute to reflux.
8. **Lose weight if you need to.** Being overweight puts more pressure on the stomach and pushes stomach contents into the esophagus. Tight fitting clothing and belts that come with weight gain may also be a factor.



## Skiping Breakfast Leads to Poor Food Choices

November 1, 2012 Food Product Design

People who don't eat breakfast tend to overeat and make poor dietary choices throughout the day, according to new research presented at Neuroscience 2012, the annual meeting of the Society for Neuroscience. Scientists at Imperial College obtained multiple magnetic resonance images (MRIs) of 21 volunteers who had not eaten anything before arriving for the tests. On one visit they were first given a 750-calorie breakfast before the scans began; on another visit they received no breakfast. Lunch was always served after the scans.

In the MRIs of those who had not eaten breakfast, the scientists discovered a variation in the pattern of activity in the orbitofrontal cortex—the area right above the eyes that can affect decisions regarding the pleasantness and reward value of food. The scientists reported that when fasting participants were shown pictures of high-calorie food, this brain area was "activated," a reaction less strong when they had eaten breakfast.

They also noted their ability to use brain MRIs to predict which individuals appear primed to respond strongly to high-calorie foods. This suggests the orbitofrontal cortex may play a vital role in determining how people make

dietary choices. They said the study also adds to previous research that indicates fasting may be a poor way to lose weight as it seems to create a "bias" in the brain toward seeking a high-calorie food reward.

"Through both the participants' MRI results and observations of how much they ate at lunch, we found ample evidence that fasting made people hungrier, and increased the appeal of high-calorie foods and the amount people ate," said Tony Goldstone, MD, PhD, from the MRC Clinical Science Centre at London's Imperial College.



### [Low-Carb, Low-Fat Diets Lower Inflammation](#)

November 6, 2012 Food Product Design

Overweight or obese people who lose weight following a low-carb or low-fat diet have a significant reduction in inflammation throughout their body, as measured by three common markers for inflammation, according to new research presented at the American Heart Association Scientific Sessions.

"Our findings indicate that you can reduce systemic inflammation, and possibly lower your risk of heart disease, no matter which diet—either low-carb or low-fat," said Kerry Stewart, Ed.D., professor of medicine at the Johns Hopkins University School of Medicine and director of clinical and research exercise physiology. "The important factor is how much weight you lose—especially belly fat."

For the study, 60 people, ages 30 to 65 years, who were either overweight or obese with excessive fat around their waist, were randomly assigned to go on a low-fat or a low-carb diet for six months. Each group also participated in exercise training three times a week. Researchers measured the participants' blood levels for three common markers of inflammation—C-reactive protein, interleukin 6 and tumor necrosis factor-alpha—at the beginning and end of the study. They also measured body weight, body mass index (BMI) and total body and belly fat. At the start, both groups were similar in the various measures, including elevated levels of inflammation markers.

Participants on the low-carb diet lost more weight, on average, than those on the low-fat diet—28 pounds versus 18 pounds. The low-carb diet group also had a greater drop in BMI (4.7 versus 2.9), and a greater drop in belly fat (14.3 versus 8.4 pounds). The level of aerobic fitness increased in both groups by about 20%.

"In both groups, there was a significant drop in the levels of all three measures of inflammation," Stewart said, indicating that a diet higher in fat and protein doesn't interfere with the ability to lower inflammation, as long as you are losing weight.



### [Eating Fatty Fish Helps Reduce Stroke Risk](#)

November 1, 2012 Food Product Design

Consuming two to four servings of oily fish, such as salmon, herring and mackerel that are rich in omega-3 fatty acids, may reduce the risk of stroke by 6%, according to a new study published in the British Medical Journal.

Researchers conducted a systematic review and meta-analysis to clarify associations of fish consumption and long chain omega 3 fatty acids with risk of cerebrovascular disease for primary and secondary prevention. They looked at 38 studies involving 794,000 people across 15 countries, and examined participants' fish and long-chain omega-3 fatty acid consumption. During the studies, a total of 34,817 strokes and mini strokes were recorded.

After adjusting for several risk factors, participants eating two to four servings a week had a 6% lower risk of stroke compared with those who consumed one portion or less every week, the study found. They also found fish oil supplements were not significantly associated with a similar reduced risk. In 2009, researchers at Beth Israel Deaconess Medical Center (BIDMC) found eating salmon or other fatty fish rich in omega-3 fatty acids once a week reduced men's risk of heart failure.



## [Food Preservative May Halt Tumor Growth](#)

October 31, 2012 Food Product Design

The common food preservative nisin may stop or slow squamous cell head and neck cancers, according to a new study published in the journal *Cancer Medicine*. The findings may accelerate new cancer therapies since the U.S. Food and Drug Administration (FDA) and the World Health Organization (WHO) approved nisin as safe for human consumption decades ago.

Oral cancer is a leading cause of death worldwide, and oral squamous cell carcinoma accounts for more than 90% of oral cancers. However, survival rates for oral cancer haven't improved in decades, according to the study.

Yvonne Kapila, the study's principal investigator and professor at the University of Michigan, School of Dentistry, said antibacterial agents like nisin alter cell properties in bacteria to render it harmless. However, it's only recently that scientists began looking to antibacterial agents like nisin to see if they altered properties in other types of cells, such as cancer cells or cells in tumors.

"The poor 5-year survival rates for oral cancer underscore the need to find new therapies for oral cancer," she said. "The use of small antibacterial agents, like nisin, to treat cancer is a new approach that holds great promise. Nisin is a perfect example of this potential because it has been used safely in humans for many years, and now the laboratory studies support its anti-tumor potential."

The study, which looked at the use of antimicrobials to fight cancerous tumors, suggests nisin, in part, slows cell proliferation or causes cell death through the activation of a protein called CHAC1 in cancer cells, a protein known to influence cell death. The study is the first to show CHAC1's new role in promoting cancer cell death under nisin treatment. The findings also suggest that nisin may work by creating pores in the cancer cell membranes that allow an influx of calcium. It's unclear what role calcium plays in nisin-triggered cell death, but it's well known that calcium is a key regulator in cell death and survival.

The researchers concluded nisin slows or stops tumor growth by interrupting the cell cycle in "bad" cells but not the good cells; thus nisin stops cancer cell proliferation but doesn't hurt good cells.



## [High-Protein Diet May Aid In Weight Loss](#)

IFT Weekly Newsletter November 7, 2013

A study published in *The American Journal of Clinical Nutrition* shows that dieters who eat more protein might lose a bit more weight than those who get less protein and more carbohydrates.

The researchers analyzed 24 past trials that included a total of 1,063 people. Participants were all put on a reduced-calorie, low-fat diet designed to help them lose weight. About half were prescribed a high-protein version of that diet—containing about 85 g of protein per day for a 150-lb person—and the other half a standard-protein diet, with 49 g per day, on average, for a 150-lb person. Across all trials, high-protein and standard-protein diets were designed to provide the same calorie reduction. Depending on the study, participants lost an average of anywhere from 2.4 to 25.1 lbs.

The researchers found that over an average of 12 weeks, people assigned at random to a high-protein diet lost about 1.8 extra lbs, and more body fat, than those assigned to a standard-protein diet. There was no difference, however, in how much participants' blood pressure, cholesterol levels, or markers for diabetes risk changed based on the protein content of their diets.

The researchers are unclear why a higher protein-to-carbohydrate ratio might help people shed more pounds, and more studies need to be conducted.



### [Timing of Carb Intake Influences Diabetes, CVD Risk](#)

November 13, 2012 Food Product Design

JERUSALEM—People suffering from severe and morbid obesity who consume most of their carbohydrates at dinnertime have increased satiety and a reduced risk for diabetes and cardiovascular disease, according to two papers published in the journal *Obesity* and the journal *Nutrition, Metabolism & Cardiovascular Diseases*.

The diet influences secretion patterns of hormones responsible for hunger and satiety, as well as hormones associated with metabolic syndrome. In this way the diet can help dieters persist over the long run, and reduce risk factors for diabetes and cardiovascular disease.

For the study, researchers at Hebrew University of Jerusalem randomly assigned 78 police officers to either the experimental diet (carbohydrates at dinner) or a control weight-loss diet (carbohydrates throughout the day) for six months. The researchers examined the experimental diet's effect on the secretion of three hormones: leptin, considered to be the satiety hormone, whose level in the blood is usually low during the day and high during the night; ghrelin, considered the hunger hormone, whose level in the blood is usually high during the day and low during the night; and adiponectin, considered the link between obesity, insulin resistance and the metabolic syndrome, whose curve is low and flat in obese people.

"The idea came about from studies on Muslims during Ramadan, when they fast during the day and eat high-carbohydrate meals in the evening, that showed the secretion curve of leptin was changed," the researchers said.

They found the innovative dietary manipulation led to changes in daylight hormonal profiles in favor of the dieters: the satiety hormone leptin's secretion curve became convex during daylight hours with a nadir in the late day; the hunger hormone ghrelin's secretion curve became concave, peaking only in the evening hours; and the curve of adiponectin, considered the link between obesity, insulin resistance and the metabolic syndrome, was elevated. At the same time this dietary pattern led to lower hunger scores, and better anthropometric (weight, abdominal circumference and body fat), biochemical (blood sugar, blood lipids) and inflammatory outcomes compared to the control group.

The findings suggest there is an advantage in concentrating carbohydrate intake in the evening, especially for people at risk of developing diabetes or cardiovascular disease due to obesity.



### [People with Healthier Eating Habits Snack More](#)

November 13, 2012 Food Product Design

More and more consumers view snacking as a way to improve healthy eating habits, and people who follow the healthiest diets snack twice as often compared to those with less healthy diets, according to a new report from the NPD Group.

The report, "Snacking in America 2012", identified and examined the consumers who drive current and future snack consumption, also found those following a "most healthy" diet eat a wider variety of healthy snacks, such as fruit, yogurt and bars.

Consumers with the healthiest diets consume 36% more snack meals a year than the average consumer. This compares to those with moderately healthy diets, who eat 1% fewer snack meals than the average consumer, and consumers with the least healthy diets, who consume 29% fewer snack meals than the average consumer.

"We are no longer as averse to snacking as we used to be—instead, snacking may be viewed as one way to improve healthy eating habits," said Darren Seifer, NPD food and beverage industry analyst. "This way of thinking about snacking provides an opportunity for manufacturers to make health and wellness innovation part of their product development and marketing strategy."



### [Probiotic May Lower LDL, Total Cholesterol](#)

IFT Weekly Newsletter November 14, 2013

A study presented at the American Heart Association's Scientific Sessions 2012 shows that two daily doses of a probiotic may lower key cholesterol-bearing molecules in the blood as well as LDL and total cholesterol. In previous studies, a formulation of the bacteria, known as *Lactobacillus reuteri* NCIMB 30242, has lowered blood levels of LDL or "bad" cholesterol.

In this study, researchers investigated whether the same probiotic could lower LDL and reduce blood levels of cholesterol esters—molecules of cholesterol attached to fatty acids, a combination that accounts for most total blood cholesterol and has been tied to cardiovascular disease risk. Researchers tracked cholesterol esters bound to saturated fat, which have been linked to dangerous arterial plaque buildup and occur at higher levels in coronary artery disease patients.

The study involved 127 adult patients with high cholesterol. About half the participants took *L. reuteri* NCIMB 30242 twice a day, while the rest were given placebo capsules. Those taking the probiotic had LDL levels 11.6% lower than those on placebo after nine weeks. Furthermore, cholesterol esters were reduced by 6.3% and cholesterol ester saturated fatty acids by 8.8%, compared with the placebo group.

For the first time, research shows that the probiotic formulation can reduce cholesterol esters "and in particular reduce the cholesterol esters associated with 'bad' saturated fatty acids in the blood," said Mitchell L. Jones, lead author of the study and a research assistant in the Faculty of Medicine at McGill University in Montreal.

Furthermore, people taking the probiotic had total cholesterol reduced by 9.1%. HDL—"good"—cholesterol and blood triglycerides, a dangerous form of fat in the blood, were unchanged.

Based on correlations between LDL reduction and bile measurements in the gut, the study results suggest the probiotic broke up bile salts, leading to reduced cholesterol absorption in the gut and less LDL. The probiotic worked at doses of just 200 mg a day, far lower than those for soluble fiber or other natural products used to reduce cholesterol.

Because of the small number of patients involved in the study, researchers aren't sure if the impact of the probiotic differs between men and women or among ethnic groups.



### [Vitamin D May Prevent Clogged Arteries In Diabetics](#)

IFT Weekly Newsletter November 14, 2013

A study published in the *Journal of Biological Chemistry* shows that low vitamin D levels may increase the risk for heart disease in diabetics. In earlier research, researchers found that vitamin D appears to play a key role in heart disease. This new study takes that research a step further, suggesting that when vitamin D levels are low, a particular class of white blood cells is more likely to adhere to cells in the walls of blood vessels.

Vitamin D conspires with immune cells called macrophages either to keep arteries clear or to clog them. The macrophages begin their existence as white blood cells called monocytes that circulate in the bloodstream. But when monocytes encounter inflammation, they are transformed into macrophages, which no longer circulate.

In this study, the researchers examined vitamin D levels in 43 people with type 2 diabetes and in 25 others who were similar in age, sex, and body weight but didn't have diabetes. They found that in diabetes patients with low vitamin D—less than 30 nanograms per milliliter of blood—the macrophage cells were more likely to adhere to the walls of blood vessels, which triggers cells to get loaded with cholesterol, eventually causing the vessels to stiffen and block blood flow.

“We took everything into account,” said author Amy Riek, Washington University in St. Louis. “We looked at blood pressure, cholesterol, diabetes control, body weight, and race. But only vitamin D levels correlated to whether these cells stuck to the blood vessel wall.”

The researchers are unsure whether giving vitamin D to people with diabetes will reverse their risk of developing clogged arteries, a condition called atherosclerosis. They now are treating mice with vitamin D to see whether it can prevent monocytes from adhering to the walls of blood vessels near the heart, and they also are conducting two clinical trials in patients.



### [Vitamin D Slows Progression of Cancer Cells](#)

November 27, 2012 Food Product Design

Vitamin D slows the progression of cells from premalignant to malignant states, keeping their proliferation in check, according to a new study published in the journal Proceedings of the National Academy of Sciences.

Researchers at McGill University discovered the active form of vitamin D acts by several mechanisms to inhibit both the production and function of the protein cMYC, which drives cell division and is active at elevated levels in more than half of all cancers.

“For years, my lab has been dedicated to studying the molecular mechanisms of vitamin D in human cancer cells, particularly its role in stopping their proliferation,” said lead author Professor John White. “We discovered that vitamin D controls both the rate of production and the degradation of cMYC. More importantly, we found that vitamin D strongly stimulates the production of a natural antagonist of cMYC called MXD1, essentially shutting down cMYC function.”

The researchers also applied vitamin D to the skin of mice and observed a drop in the level of cMYC and found evidence of a decrease in its function. Other mice that lacked the specific receptor for vitamin D were found to have strongly elevated levels of cMYC in a number of tissues, including skin and the lining of the colon.

“Taken together, our results show that vitamin D puts the brakes on cMYC function, suggesting that it may slow the progression of cells from premalignant to malignant states and keep their proliferation in check. We hope that our research will encourage people to maintain adequate vitamin D supplementation and will stimulate the development of large, well-controlled cancer chemoprevention trials to test the effects of adequate supplementation,” White said.



## [Antioxidants Prove Promising in Alzheimer's Research](#)

Report by Joanna Cosgrove in *Nutraceuticals World* October 29, 2012

According to the Alzheimer's Association, there are 5.4 million Americans currently living with Alzheimer's disease, the most common form of dementia. A progressively debilitating disease, it ranks as the sixth-leading cause of death in the U.S. and is the only cause of death among the top 10 in the U.S. that cannot be prevented, cured or even slowed.

The cost of care is astronomical: more than 15 million Americans provide unpaid care for persons with Alzheimer's and other dementias valued at \$210 billion, and actual payments for care were estimated to be \$200 billion in the U.S. in 2012. Researchers have worked for decades to find ways to prevent the disease, or at the very least, slow its progression. A study conducted in Germany took a close look at the effect of antioxidants on dementia and the work was recently published in the *Journal of Alzheimer's Disease*, adding more weight to the promising role of antioxidants in the fight against dementia.

Around 700,000 Germans are diagnosed with Alzheimer's disease, presenting with symptoms that include lack of orientation, cognitive decline and absentmindedness, triggered by amyloid beta plaques, degeneration of fibrillae and synapse loss. In an effort to get to the bottom of potential risk factors, researchers at the University of Ulm, led by Professor Gabriele Nagel and neurology Professor Christine von Arnim, evaluated 74 Alzheimer's patients and 158 healthy controls between the ages of 65 and 90 who were gender matched. After conducting various neuropsychological, blood and BMI evaluations, the researchers discovered that the serum concentration of the antioxidants vitamin C and beta-carotene were much lower in patients with mild dementia than in the control subjects. For all other examined antioxidants (vitamin E, lycopene, coenzyme Q10) no corresponding difference was detected, despite having included other potential confounding factors such as civil status, education and consumption of alcohol and tobacco in the statistical analysis.

Study results, according to the researchers, may have been impacted by the storage and preparation of food and patient stress, warranting more research. "Longitudinal studies with more participants are necessary to confirm the result that vitamin C and beta-carotene might prevent the onset and development of Alzheimer's disease," commented Dr. Nagel.

Despite the interest in further research, the results of the University of Ulm study indicated that it was possible to influence the pathogenesis of this neurological disorder through the use of dietary antioxidants or a change in diet. The researchers acknowledged that oxidative stress contributed to the development of Alzheimer's disease and believed that antioxidants could potentially protect the body against neurodegeneration.



## [Low Prevalence of Type 2 Diabetes Among Regular Black Tea Drinkers](#)

Nov. 7, 2012 *Science Daily*

The prevalence of type 2 diabetes is low in countries where consumption of black tea is high, suggests a mathematical analysis of data from 50 countries, published in the online journal *BMJ Open*.

The global prevalence of type 2 diabetes has increased six-fold over the past few decades, and the International Diabetes Federation calculates that the number of those with the disease will soar from 285 million in 2010 to 438 million in 2030.

The authors systematically mined information on black (fermented) tea consumption in 50 countries across every continent, based on 2009 sales data collected by an independent specialist market research company. And they analysed World Health Organization data for those same countries on the prevalence of respiratory, infectious, and cardiovascular diseases, as well as cancer and diabetes.

Ireland topped the league table for black tea drinkers, at more than 2 kg/year per person, closely followed by the UK and Turkey. At the bottom of the table were South Korea, Brazil, China, Morocco and Mexico, with very low consumption.

A statistical approach, called principal component analysis (PCA), was used to tease out the key contribution of black tea on each of the health indicators selected at the population level. This showed an impact for black tea on rates of diabetes, but not on any of the other health indicators studied. The link was confirmed with further statistical analysis, which pointed to a strong linear association between low rates of diabetes in countries where consumption of black tea is high.

The authors acknowledge several caveats to their findings, however. They caution that the quality and consistency of data among all 50 countries are likely to vary, as will the criteria used to diagnose diabetes. And what may seem positive at the population level may not work as well as the individual level.

They also point out that various factors are likely to have contributed to the dramatic rise in diabetes prevalence, and that a link between black tea consumption and the prevalence of the disease does not imply that one is caused by the other. But their findings do back those of previous research, they say.

"These original study results are consistent with previous biological, physiological, and ecological studies conducted on the potential of [black tea] on diabetes and obesity" ...and they provide "valuable additional scientific information at the global level," they write.

In recent years, a great deal of interest has focused on the health benefits of green tea, which contains simple flavonoids called catechins, thought to have anti-inflammatory properties, say the authors.

But the fermentation process, which turns green tea black, induces a range of complex flavonoids, including theaflavins and thearubigins, to which several potential health benefits have been attributed, they add.



## [An Egg a Day to Keep Allergies Away?](#)

Nov. 9, 2012 Science Daily

Avoiding sweet treats like pumpkin bread and cookies this holiday season might not be necessary for children with egg allergies. New studies presented at the American College of Allergy, Asthma and Immunology (ACAAI) Annual Scientific Meeting found 56 percent of allergic children can tolerate baked hen's egg, while 55 percent outgrow their egg allergy entirely.

"More than half of egg allergic children can tolerate hen's eggs when they are baked at 350 degrees in products such as cakes and breads," said allergist Rushani Saltzman, M.D., lead study author and ACAAI member. "Dietary introduction of baked egg by an allergist can broaden a child's diet, improve quality of life and likely accelerate the development of an egg tolerance." The median dose tolerated was 2/5 baked hen's egg. The products tested were all baked at 350 degrees for a minimum of 30 minutes.

In a separate study also presented at the meeting, Ruchi Gupta, M.D., lead study author and pediatrician, found that out of the eight common food allergens, children most commonly outgrew egg allergy.

"Food tolerance was observed in one in four children, with 55 percent outgrowing their egg allergy by age seven," said Dr. Gupta. "Developing an egg tolerance is the most common for children, followed by milk. A small proportion outgrew shellfish and tree nut allergies."

If children have shown a severe reaction to eggs in the past they are less likely to outgrow the allergy, according to researchers. Severe symptoms include rapid swelling of the skin and tissue, difficulty breathing and life-threatening anaphylaxis.

"While these studies show many positive findings for children with egg allergy, parents must practice caution," said allergist Richard Weber, M.D., ACAAI president-elect. "Introducing an allergen back into a child's diet can have severe consequences, and only should be done under the care of a board-certified allergist."



## [Drinking Green Tea with Starchy Food May Help Lower Blood Sugar Spikes](#)

Nov. 9, 2012 Science Daily

An ingredient in green tea that helps reduce blood sugar spikes in mice may lead to new diet strategies for people, according to Penn State food scientists.

Mice fed an antioxidant found in green tea -- epigallocatechin-3-gallate, or EGCG -- and corn starch had a significant reduction in increase in their blood sugar -- blood glucose -- levels compared to mice that were not fed the compound, according to Joshua Lambert, assistant professor of food science in agricultural sciences. "The spike in blood glucose level is about 50 percent lower than the increase in the blood glucose level of mice that were not fed EGCG," Lambert said. The dose of EGCG fed to the mice was equivalent to about one and a half cups of green tea for a human.

Lambert, who worked with Sarah C. Forester, postdoctoral fellow, and YeyiGu, graduate student, both in food science, said EGCG was most effective when the compound was fed to the mice simultaneously with corn starch. For humans, this may mean that green tea could help them control the typical blood sugar increases that are brought on when they eat starchy foods, like breads and bagels that are often a part of typical breakfasts.

"If what you are eating with your tea has starch in it then you might see that beneficial effect," Lambert said. "So, for example, if you have green tea with your bagel for breakfast, it may reduce the spike in blood glucose levels that you would normally get from that food."

The EGCG had no significant effect on blood sugar spikes in mice that were fed glucose or maltose, according to the researchers who released their findings in the online version of *Molecular Nutrition and Food Research*. Lambert said that the reason blood sugar spikes are reduced when the mice ate starch, but not these sugars, may be related to the way the body converts starch into sugar.

An enzyme called alpha-amylase that is produced in both the mouth and by the pancreas helps break down starch into maltose and glucose. EGCG may inhibit the enzymes ability to break down the starch, the researchers indicated, since they also found that EGCG reduced the activity of alpha amylase in the pancreas by 34 percent.

If the mechanism holds in humans, this may mean that people who want to limit the blood sugar spike should skip adding sugar to their cup of green tea. "That may mean that if you add sugar into your green tea, that might negate the effect that the green tea will have on limiting the rise in blood glucose level," Lambert said.

Lambert added that the green tea and the starch would need to be consumed simultaneously. For example, drinking a cup of tea well after eating a piece of toast would probably not change the blood sugar spike.

For the study, researchers separated mice into several groups based on body weight. After a fasting period, the mice were given common corn starch, maltose, or sucrose. One group of mice received EGCG along with the feed, while a control group was not fed the compound. The researchers then tested the blood sugar levels of both groups.

Lambert said the researchers next step is to test the compound on people. "The relatively low effective dose of EGCG makes a compelling case for studies in human subjects," the researchers said.



## [Arginine and Proline Enriched Diet May Speed Wound Healing in Diabetes](#)

Nov. 15, 2012 Science Daily

Chronic wounds such as foot ulcers are a common problem for diabetics and are the cause of more than 80 percent of the lower leg amputations in these patients. There is currently no effective way to improve healing of these types of wounds, but new research offers hope.

French researchers found that diabetic rats on a high protein diet with arginine and proline -- specific molecules found in protein -- showed better wound healing over rats fed either standard or high protein food without arginine and proline supplementation.

The article is entitled "Arginine plus proline supplementation elicits metabolic adaptation that favors wound healing in diabetic rats." It appears in the online edition of the *American Journal of Physiology -- Regulatory, Integrative and Comparative Physiology* published by the American Physiological Society.

Researchers divided 18 rats into three groups that were either fed a standard diet, a high-protein diet, or a high protein diet supplemented with arginine and proline (ARG+PRO). On the first day of the experiment, each rat was given an incision, under which a sponge was placed in order to collect wound-healing fluid. To assess skin regrowth and healing, researchers also removed two full-thickness sections of skin from the rats' backs each day from day 1 until day 5, when the experiment ended.

At the end of the experiment, the rats' blood was analyzed for blood sugar, insulin, and amino acid concentrations. The wounds on their backs were examined for skin regrowth and development of new blood vessels. And, finally, macrophages were collected from the sponges and analyzed for indications of cytokine stimulation and pro-inflammatory activity.

Rats on both high protein diets had better nitrogen balance than those on the standard diet. However, the wounds of the rats on the ARG+PRO diet showed more new blood vessel growth on day 5. New blood vessel growth is an essential part of wound healing as the blood vessels supply nutrition and oxygen to growing tissue.

Furthermore, the macrophages in the ARG+PRO group showed less cytokine stimulation and pro-inflammatory activity than the other groups. This indicates a better environment for promoting wound healing, as inflammation slows the healing process.

The researchers did not find a difference in skin regrowth between groups, but their findings may be limited because of the small number of rats in the study. Additionally, researchers did not measure markers of collagen deposition in the wound, and the study cannot confirm the beneficial effect of arginine on collagen deposition and wound breaking strength reported in previous research.

This study suggests that arginine and proline supplementation could offer new hope for effective treatment in diabetic patients with chronic wounds. This is a promising new area of research where there are no existing effective treatments for these patients.



## [Fetus Suffers When Mother Lacks Vitamin C](#)

Nov. 16, 2012 Science Daily

Maternal vitamin C deficiency during pregnancy can have serious consequences for the fetal brain. And once brain damage has occurred, it cannot be reversed by vitamin C supplements after birth. This is shown through new research at the University of Copenhagen just published in the scientific journal *PLOS ONE*.

Population studies show that between 10-20 per cent of all adults in the developed world suffer from vitamin C deficiency. Therefore, pregnant women should think twice about omitting the daily vitamin pill.

"Even marginal vitamin C deficiency in the mother stunts the fetal hippocampus, the important memory centre, by 10-15 per cent, preventing the brain from optimal development," says Professor Jens Lykkesfeldt. He heads the group of scientists that reached this conclusion by studying pregnant guinea pigs and their pups. Just like humans, guinea pigs cannot produce vitamin C themselves, which is why they were chosen as the model.

"We used to think that the mother could protect the baby. Ordinarily there is a selective transport from mother to fetus of the substances the baby needs during pregnancy. However, it now appears that the transport is not sufficient in the case of vitamin C deficiency. Therefore it is extremely important to draw attention to this problem, which potentially can have serious consequences for the children affected," says Jens Lykkesfeldt.

Too late when damage is done The new results sharpen the focus on the mother's lifestyle and nutritional status during pregnancy. The new study has also shown that the damage done to the fetal brain cannot be repaired, even if the baby is given vitamin C after birth. When the vitamin C deficient guinea pig pups were born, scientists divided them into two groups and gave one group vitamin C supplements. However, when the pups were two months old, which corresponds to teenage in humans, there was still no improvement in the group that had been given supplements. The scientists are now working to find out how early in the pregnancy vitamin C deficiency influences the development of fetal guinea pigs. Preliminary results show that the impact is already made early in the pregnancy, as the foetuses were examined in the second and third trimesters. Scientists hope in the long term to be able to use population studies to illuminate the problem in humans.

Vulnerable groups There are some groups that may be particularly vulnerable of vitamin C deficiency: "People with low economic status who eat poorly -- and perhaps also smoke -- often suffer from vitamin C deficiency. Comparatively speaking, their children risk being born with a poorly developed memory potential. These children may encounter learning problems, and seen in a societal context, history repeats itself because these children find it more difficult to escape the environment into which they are born," says Jens Lykkesfeldt. He emphasises that if pregnant women eat a varied diet, do not smoke, and for instance take a multi-vitamin tablet daily during pregnancy, there is no reason to fear vitamin C deficiency. "Because it takes so little to avoid vitamin C deficiency, it is my hope that both politicians and the authorities will become aware that this can be a potential problem," concludes Jens Lykkesfeldt.



### [New Diet Can Help Battle Child Obesity](#)

09 Nov 2012 Medical News Today

All around the world obesity rates among children have increased three-fold in the last 20 years, and there are a few available options that are effective for treating obesity in these kids. Now, new hope is surfacing for children having a hard time keeping a healthy weight, according to a new study published in *Molecular Metabolism*.

Calorie restriction dieting is not usually a successful method because children tend to gain and lose the weight back and forth, called the "yo-yo diet". The new technique concentrates on the energy balance circuit of the brain, which plays an important part in helping maintain the body's natural healthy weight. It works similar to a thermostat - if it is turned up, a person's weight decreases, and if it is turned down, weight increases.

Prior research revealed that unhealthy diets can actually harm this brain circuit. Now, the new research confirms that the harm forces the "thermostat" on the energy balance circuit to be turned up, which results in weight increase. It is possible, according to the researchers, to reverse this damage by using calorie restriction with the "thermostat setting" on low, which can eventually treat the obesity. However, different diets have different results.

The findings revealed that an unhealthy diet, even if a person does not eat a lot, can result in weight loss. However, the energy balance circuit is not turned down. When an individual stops dieting, weight will jump back to what it was before the treatment. On the other hand, healthy diets and eating less not only cause weight loss, but turn down the energy balance circuit as well.

A 2012 study said that it is more important to teach children how to eat, not how to diet. For example, teaching them about healthy food options is effective in preventing obesity.

John Speakman, commented: "Rebound weight gain after dieting is a major problem. These data point to a potential reason why some individuals bounce back much further than others, and provide a clue as to how to minimise the problem. The result is really exciting." Healthy diet treatment does not result in "yo-yo" weight gain when the diet is over, explaining why calorie restricted diets only work for some people.

David McNay, co-researcher of the study, said "We've known for some time that over-eating an unhealthy diet causes obesity, but we've not been sure if it was the overeating or the unhealthy diet that is the problem. This research shows that every calorie is not equal and that successful treatment of obesity requires both eating less and eating healthier."

"Helping children to keep to a healthy weight could decrease their risk of developing serious, long-term health problems and free them from the stigma that often comes with growing up with obesity," concluded Caroline Johnston, Research Evaluation Manager at Action Medical Research.



## Food Science & Industry News

### [Drinking thick beverages may bolster satiety](#)

IFT Weekly Newsletter November 7, 2013

A study published in *Flavour* shows that thicker drinks are more likely to make you feel full and keep feeling that way longer for the same amount of calories than thin drinks. Creaminess also boosted people's ratings of how full a drink would make them, but didn't have an impact on expectations about satiety in comparison to solid food. Figuring out how to make drinks feel more filling without increasing their caloric content could help minimize that disconnect and possibly mitigate the impact on weight, the researchers theorized.

The researchers first tested how sensitive untrained people were to thickness by presenting them with a fruit yogurt drink to which varying amounts of tara gum had been added to alter its viscosity. Across the 16 different gradations, people perceived greater thickness, creaminess, and stickiness with rising amounts of the thickener.

Next, the experiments expanded to test the effect of combinations of thin, thick, creamy, and high or low calories on satiety. The 25 university staff and students participating (none were obese) sampled eight different versions of the yogurt drink and rated them by how big a serving of pasta with tomato sauce they thought it could replace for lunch, to have the same impact on hunger. Thickness and creamy flavor both had an impact on how filling the drink was expected to be, without significant interaction between the two factors. The actual energy content of the drinks didn't correlate with ratings of how filling the drink was expected to be, nor were there interactions with thickness or creaminess.

When it came to satiety measured in pasta-equivalents, the thicker drinks got higher ratings than the thin versions. Creamy flavor didn't boost the expected impact on hunger, nor did calorie content make a difference in analyses adjusted for multiple comparisons.

These results suggest that "creamy" alone isn't enough for the general consumer, the researchers pointed out. They cautioned, though, that the creamy drinks were rated as thicker as well, "so we cannot rule out the possibility that the creamy drinks were instead expected to be more filling, based on their enhanced perceived thickness."

Another possible explanation for the unexpected disconnect between satiety and filling is that texture was a more relevant cue for satiety when asked to imagine it in comparison to a plate of pasta, whereas creaminess went overlooked as a factor not generally associated with pasta and tomato sauce.



## [EU Report Recommends Healthy Eating Policies](#)

November 8, 2012 Food Product Design

While many international policy campaigns to encourage healthier diets have been put in place, few have been evaluated for their impact in changing actual behavior. A new report presented at the 5th Annual European Public Health Conference on Nov. 8 suggests more and better evidence of the effectiveness of healthy eating policies needs to be collected, and should be considered as an integral part of all policies.

The report was derived from the EATWELL project (Interventions to Promote Healthy Eating Habits: Evaluation and Recommendations) that was launched in April 2009 and will conclude in March 2013. Funded by the European Commission under Framework Programme 7, its primary objective was to improve nutrition policy in the EU and Member States by providing scientifically sound evidence on the effectiveness of past interventions.

This EU-funded project looked at 111 national-level interventions, and used validated and advanced quantitative evaluation models conducted fresh analysis of secondary data bases. This showed, for example, that the UK Food Standards Agency's salt campaign in 2004 resulted in a 10% reduction of salt intake on average in the UK population, with young women demonstrating the biggest behavior changes toward reduced salt intake. The initiative combined an advertising awareness campaign, to inform the public of the health issues of consuming too much salt, and working with the food industry to encourage reformulation to reduce salt in food products.

Similarly, a project analysis of the 5-a-day fruit and vegetables campaign in the UK, which started in 2003 and encouraged the increase in fruit and vegetable consumption through social marketing, found a significant increase in fruit and vegetable intakes between 0.2 and 0.7 portions per day especially in the lower- and middle-income classes.

"We used secondary data to carry out our own analyses of these initiatives. Continued evaluation of finished, ongoing and new interventions is necessary to form an even better picture of the impact of policies on actual eating behavior", said project coordinator Professor Bruce Traill of the University of Reading.

Based on the evaluations of the 111 interventions and an online survey of more than 3,000 interviews with European citizens, gauging public acceptance of healthy eating interventions, the project has made several proposals to aid in the development of future policies to encourage healthier eating.

Of the analyzed policies, 82 support informed choice by providing information or education, such as nutrition labeling and advertising controls. These policies have small but positive effects on healthy eating. They are relatively cheap, generally cost-effective and accepted by the public. For example, incorporating key success factors of commercial marketing into public information campaigns and investing in longer term campaigns could encourage healthier behavior. "However, it's also important to take into account here that informed choice does not necessarily equal making a healthier choice; many factors influence what people ultimately choose to eat," Traill said.

The remaining policies seek to change the market environment and are those which change the choice set facing consumers either by enhancing the availability of healthier foods, restricting the availability of less healthy foods or nutrients, or changing relative prices of food through taxes and subsidies. These measures have the potential to bring about substantial changes in food choices and offset the social costs of unhealthy diets.

Evidence of effectiveness is lacking in many cases owing to the short time span since the introduction of some of the measures, but when evaluated, they were found to be cost effective, but with the down side that the public finds them intrusive and are less likely to accept them. "Fiscal interventions to promote healthy eating are highly cost-effective. The precise nature of any tax should be informed by the careful evaluation of recent measures in

Denmark, France, Finland and Hungary, while the revenues generated should be used on other cost-effective measures to encourage healthier diets," Traill said.



## [Mintel Spotlights Potential of Chocolate Market in India](#)

[Nutraceuticals World November 12, 2012](#)

India is the fastest growing market globally for chocolate, posting the largest increase in volume sales with 21% growth between 2008 and 2011, according to new research from Mintel.

Chocolate consumption in India has almost doubled since 2008, with sales of chocolate increasing from \$418 million in 2008 to \$857 million in 2011. Volume has grown strongly too in the past few years, to reach 88,000 tons in 2011, up from 50,000 tons in 2008. This equates to a per capita consumption of 70 grams in 2011, up from 40 grams in 2008.

While domestic consumption in India is currently low if compared with other more mature markets, such as Germany at 8 kg per head, or the U.K. and France at 6 kg respectively, there is huge potential for the Indian chocolate market to grow even further.

DeepaDsouza, trend and innovation consultant at Mintel, said, "Chocolate consumption in India has seen an incredible growth rate in the past few years, especially in urban and semi-urban areas. Until few years ago, chocolate confectionery was considered a premium in comparison to sugar and gum confectionery, but major players in the market have found channels to manufacture and distribute their products at more affordable prices than before. This has given the Indian consumer an array of choices whilst giving manufacturers a level game field to compete, especially in the premium and affordable premium segments. Local companies are much smaller in volume and operate at more regional levels."

The chocolate confectionery industry has been quick to respond to this untapped market opportunity. Looking at new product launches in India, premiumization as a claim has seen a 100% growth over the last three years, from 4% of launches in 2008 to 6% in 2011.

Also, seasonal launches have proven to be particularly dynamic across the market, with a 300% increase between 2008 and 2011, accounting for 7% of total launches in 2011 vs. 2% in 2008.

"Consumers are trading up to luxury and premium chocolate, which has given an opportunity to international brands to enter the Indian market and increase their penetration by creating an affordable premium space for the aspirers. Many Indian consumers consider chocolate assortment boxes to be premium and to be more hygienic and longer-lasting than traditional Indian sweets. This mindset has contributed to increased sales as the popularity of seasonal gifting of chocolate, particularly during Diwali, has grown in recent years," DeepaDsouza explains.

However, all is not as sweet as it appears. The chocolate confectionery market in India is facing challenges, such as keeping costs low for mass markets and health issues.

"The key challenges that the chocolate market is facing in India are inflationary pressures on raw material prices, lack of government initiative, high entry barriers due to duopolistic markets and price-sensitive consumers. Rising sugar and cocoa prices are also putting pressure on companies to innovate with ingredients and packaging to offer better prices for the mass market," DeepaDsouza concludes.

Moreover, as the chocolate confectionery category suffers from being associated with negative health, brands are working to manage this perception and introduce elements of enhanced health messaging. Indeed, according to Mintel's research, new product development with antioxidant claims grew 400% in the past four years (2008-2011) and low/no/reduced trans fat, low/no/reduced calorie and diabetic claims all posted 200% growth in the same period, suggesting that the prospects for market growth in this segment are very positive.

While the Indian chocolate confectionery industry is thriving, more mature chocolate markets across Europe are

experiencing a slowdown. For example, in Germany volume consumption declined from 770,000 tons in 2008 to 700,000 tons in 2011, and in the U.K. it fell from 362,000 tons in 2008 to 350,000 tons in 2011.

Other key markets for the chocolate confectionery industry posted steady but slow growth, as for example in Italy where the market grew from 98,000 tons in 2008 to 104,000 tons in 2011.

Marcia Mogelonsky, director of insight at Mintel Food and Drink, said, "India is a major focus of interest for chocolate confectionery manufacturers as the more mature western markets begin to slow. Major players, including Mondelez, Nestle, and Mars, are making efforts to establish a strong presence in the Indian market."



### [Technique Dramatically Reduces E. coli on Spinach](#)

29 Nov 2012 Medical News Today

University of Illinois scientists have found a way to boost current industry capabilities when it comes to reducing the number of *E. coli* 0157:H7 cells that may live undetected on spinach leaves. "By combining continuous ultrasound treatment with chlorine washing, we can reduce the total number of foodborne pathogenic bacteria by over 99.99 percent," said HaoFeng, a U of I professor of food science and human nutrition.

According to Feng, the USDA is looking for proposed technologies that can achieve a 4 to 6 log reduction in pathogen cells (a 6 log reduction would achieve a million-fold reduction in pathogenic bacteria). The food processing industry can now achieve a 1 log or tenfold reduction. In comparison, the U of I technique yields a 4 log reduction.

"Combining technologies is the key to bridging the gap between our current capacity and what USDA would like to see. The use of ultrasound exposure during chlorine washing gives the industry a way to significantly enhance microbial safety," he said.

Feng's pilot-scale system uses three pairs of large-area ultrasonic transducer boxes to form a channel through which ultrasound is provided to spinach leaves that are undergoing a continuous-flow chlorine wash. Spatial uniformity of ultrasound distribution was confirmed by tests using metallic foil.

The scientist said that continuous flow and uniformity of the field are key elements in the success of the process. "Previous work with ultrasound used a tank or a medical-style probe, which doesn't provide consistent and even distribution," he noted.

System design is important for another reason, he said. "Placement of the produce as it makes its way through the channel turns out to be very important. We had to find ways to make sure that leaves received similar exposure to ultrasound, taking care to minimize the chance that one leaf would block a nearby leaf's exposure to the sound waves."

If even part of a leaf escaped the full ultrasonic treatment, it could contaminate the rest of the produce, he said. Feng and his team have used the technique on iceberg and romaine lettuce as well as spinach with similar results.



# Regulatory & Safety News

## [Global Food-Safety Testing Sector Will Hit \\$19 Billion by 2018](#)

November 6, 2012 Food Product Design

Driven by the continuous rise in product recalls due to contamination by bacteria and other microorganisms, increased awareness and the implementation of new regulatory specifications, the global market for food-safety testing is projected to reach \$19.7 billion by 2018, according to a new report from Global Industry Analysts (GIA).

According to the "Food Safety Testing—A Global Strategic Business Report," the United States represents the largest regional market worldwide. Expansion and diversification of the U.S. food testing market can be attributed to extensive media reports covering product recalls and illness and death resulting from contaminated foods. In order to address the risks posed by global food supply, food processors demand comprehensive testing procedures to improve and develop newer and sophisticated processing, preservation and packaging techniques to make food safer and less perishable.

Federal regulations are also forcing food processors to test food products for hazardous material or microorganisms. Asia-Pacific represents the fastest-growing market for food-safety testing in the world. The region suffers due to lack of adequate regulations for ensuring food safety, and the lax implementation of such regulations, particularly in highly populous countries of India and China.

Pathogen testing segment garners a lion's share of the food-safety testing market. GMO testing represents the fastest-growing segment in the global food-safety testing market. In terms of end-use segments, processed foods industry represents the largest end use market for food-safety testing products. The United States represents the largest regional market for food-safety testing products in processed foods industry. Fastest growth is expected from the meat industry, which has witnessed growing demand for testing products with innovative biochip and microchip technologies, owing to their ability to detect the presence of new pathogen varieties in food particles.



## [Tapping India's Potential](#)

**[New regulations and focus on prevention open a new chapter in the Indian supplement market.](#)**

[From article by Dr.AnuragPande in Nutraceuticals World November 1, 2012](#)

India is one of the largest suppliers of herbal extracts and raw material for the dietary supplement market worldwide. However, even though it holds such a strong position as a supplier, the nutraceutical market in India is still quite nascent. There are various reasons for the slow start or poor development of the nutraceutical market, which this article will address on the road to the future.

The term nutraceutical is quite young, with some sources attributing the coining of the term to Stephen De Felice in 1979. The nomenclature and regulatory classification of nutraceuticals may vary from country to country, although generally they are treated as being a class of foods.

The Foods Safety and Standards Acts (FSSA) was introduced in India in 2006. This act replaced the Prevention of Food Adulteration (PFA) Act of 1954. The Food Safety and Standards Authority of India Regulations and Rules posted the acts in the Gazette of India, the authorized agents of Government of India publications, in 2011. However, the rules are still not in force and the government is still seeking suggestions on the draft. The idea behind this act was to consolidate the laws relating to food by regulating the manufacture, storage, distribution, sale and import of food and food articles.

For the first time, this law recognizes the term “nutraceuticals,” or “functional foods,” defined as foods that are specially processed or formulated to satisfy particular dietary requirements that exist because of particular physical or physiological conditions or specific diseases and disorders.

#### [The law also states that such categories contain the following:](#)

- Plants or botanicals or their parts in form of powder or extracts;
- Minerals, vitamins, proteins, metals, their compounds, amino acids or enzymes;
- Substance from animal origin;
- Dietary substance for use by human beings to supplement the diet by increasing the total dietary intake.

The law is very similar to the Dietary Supplement Health and Education Act (DSHEA) of 1994 that regulates dietary supplements and health claims in the U.S. Indian law states nutraceuticals, food for special dietary uses, functional foods or health supplements cannot claim to cure or mitigate any specific disease, disorder or condition except for certain health benefits or such promotion claims as may be permitted by regulations under this act.

By recognizing the term nutraceutical for functional foods and dietary supplements, this act opens a new chapter in the Indian supplement market.

#### [India's Market & Health](#)

The global nutraceutical market in 2008 was estimated to be \$117 billion, of which India's share was only 0.9%. The global market is estimated to reach \$177 billion by next year, growing at a healthy CAGR of 7%. With increasing penetration of preventative healthcare products in the Indian market, growing health awareness, higher disposable income and other factors, the Indian nutraceutical industry has shown a promising CAGR of 18% in the last three years. According to one report, the total Indian nutraceutical market in 2015 is expected to be roughly \$5 billion. Fast moving consumer goods (FMCG) companies, and pharmaceutical companies are major players in Indian nutraceutical market.

The world's largest democracy, India has diverse problems when it comes to the healthcare sector. On one hand, the health problems related to malnutrition are still widespread. In India, nearly 20% of the adult population and 44% of young children under the age of five were found to be undernourished, according to 2009 Ernst & Young data). On the other hand, a sizable population has higher than recommended calories intake, but often inadequate nutrient intake, and are hence considered to be “overfed but undernourished.”

Today diabetes rates remain high. According to International Diabetes Federation reports, there were more than 55 million people with diabetes in 2010. At this rate, by 2025 one out of every two diabetics in the world will be Indian. Similarly, with changing dietary patterns, there has been a surge in the number of people suffering from obesity. This trend is more worrisome in school-aged children. In fact, according to a study published in 2011, more than 15 million children would be overweight and 4 million abdominally obese in urban India.

#### [Growth Factors](#)

With the major nutraceutical markets like Japan and the U.S. reaching maturity, manufacturers are looking at India with great interest. With the world's second largest population, increasing disposable income and greater health awareness, India is becoming a major market for nutritional companies. There is a definite shift in the Indian health system. What was until now based on sick care, has begun to move toward preventive care due to rising costs. With growing penetration of media, the accessibility and awareness of preventive healthcare products has definitely

increased.

Knowledge of Ayurveda, the traditional medical modality in India for several thousand years, is also one of the growth factors. Though the traditional medicines in Ayurveda, and other ancient medical philosophies, Unani and Siddhi, have been left out of the definition of nutraceuticals in the Food Safety and Standards Act, these traditional systems can play a substantial role in the nutraceutical market. Customized formulations using conventional delivery systems (capsules, tablets, gels, syrups) using Ayurvedic herbs and supplements can be one way manufacturers may provide consumers the best of both the worlds. Because of consumer's cultural familiarity with these medical systems, they are predisposed to accept and trust herbal and food based remedies.

### India's Future

At present, functional foods have the largest share of the Indian nutraceutical market, followed by dietary supplements. This is an interesting trend that will drive the market for fortified foods and probiotics. With increasing occurrence of obesity in urban Indians, weight management products will also be in high demand. Similarly anti-diabetic, blood glucose balance and cholesterol management products will become popular.

Sports supplements such as rehydration drinks and whey protein supplements represent another major market. The recent successful Indian launch of SamiDirect's LeanGard protein mix, which contains a unique "digestive intolerance blend" to increase the digestibility of whey protein, is one example of an emerging trend. With the current health scenario, dietary supplements designed to provide digestive support, joint support and cardiovascular health will also do well in the future.

With the opening of the Indian market to foreign brands, there will be healthy competition. New product innovations, strict quality control and proper labeling and advertising can help consumers choose the right products. Currently, the FSSA does not allow health claims on functional foods, supplements or nutraceuticals. However, it will be important to see if the Indian regulatory body will allow health claims based on scientific data for nutraceuticals as the market grows. This could follow the same line as Japan's Food for Specified Health Uses (FOSHU), which is composed of functional ingredients that affect the structure/function of the body and are used to maintain specific health conditions.

Overall, the Indian nutraceutical market is emerging with strong growth potential. With escalating health awareness, and the shift toward preventative health care and increased regulatory clarity, India's future looks promising, for both manufacturers and consumers.

