

## Nutraceutical and Health

Prachi R. kabra \*, Trupti V Beldar and Shweta G Bodke

*Ideal College of Pharmacy, Kalyan, Maharashtra, India.*

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### Abstract

Nutraceutical refers to foods having a medicinal effect on health of human beings. It consists of food supplements, herbal products, probiotics and prebiotics, medical foods meant for prevention and treatment of diseases. Major Nutraceutical possess multiple therapeutic effect with lacking of unwanted effects hence attract more consumer interest. Increase in shift towards preventive therapies and increasing disposable income, favourable pricing environment growth in pharma retail chain and increase in healthcare spending is mainly responsible for increasing market for nutraceutical in India, but lack of standardization and awareness, high pricing, marketing and distribution are some challenges. Nutraceutical market is seeing tidal growth mainly in United States, India and European countries. Faster access to this market is possible through business partnership models, effective regulatory compliance and by evaluating key trends and consumer reference.

**Keywords:** Nutraceutical; Prebiotics; Probiotics; Regulatory compliance

### 1. Introduction

A nutraceuticals word is comprising of 'Nutrient' and 'Pharmaceuticals'. According to AAFCO, 1996, 'Nutrient' means a feed constituent in a form and at a level that will help, support a life of human being or animal while 'Nutraceutical' means any non-toxic food component that has scientifically proven health benefits including prevention and treatment of disease<sup>6</sup>. Products isolated or purified from food are sold in medicinal forms not usually associated with food. A nutraceutical has a physiological benefit that it provides protection against chronic diseases<sup>[3]</sup>

**Table 1** Fortified foods with their Ayurveda nutraceuticals<sup>[3]</sup>

Fortified Foods	Ayurvedic Nutraceuticals
Calcium enriched edli	Antioxidants and bone density
Probiotic fortified yogurt	Enhancer Curcumin
Buttermilk	Fish oil, Brahmi, Senna, Lutein
Omega-3-fortified health drinks and baby foods	Sugar Free Ayurvedic Supplement

Popularity of Indian Ayurveda therapies boost the export opportunities for formulations based on ashwagandha, haldi, ginger, tulsi etc. Vitamin D will see the fastest growth in demand due to increasing clinical evidence of swine flu, cancer, and other preventive medicine benefits. Global demand for herbal and non-herbal extracts is increasing continuously. Green tea for weight loss and cancer treatment, while *Ginkgo biloba* for improving cognitive function, has been widely used as nutraceuticals. Glucosamine generate strongest growth in demand due to its usefulness on treatment of

\* Corresponding author: Prachi R. kabra

Arthritis. The nutraceutical industry in the US is about \$ 86 billion. This figure is slightly higher in Europe and, in Japan, represents approximately a quarter of their \$6 billion total annual food sales – 47 % of the Japanese population consumes nutraceuticals.

## 2. Classification of nutraceuticals

Nutraceuticals are non-specific biological therapies used to promote wellness, prevent malignant processes and control symptoms. They are classified as follows:

### 2.1. Nutrients

Nutrients are substances such as vitamins, minerals, amino acids and fatty acids with established nutritional functions. Most vegetables, whole grain cereals, dairy products, fruits and animal products such as meat, poultry, contain vitamins and are helpful in curing heart diseases, stroke, cataracts, osteoporosis, diabetes and cancer. Minerals found in plant, animal and dairy products are useful in osteoporosis, anaemia and build strong bones, teeth, muscles, improve nerve impulses and heart rhythm. Flax seed and salmon contain fatty acids omega-3 PUFAs, and are potent controllers of the inflammatory processes, maintenance of brain function and reduce cholesterol deposition. The most commonly known nutrients are antioxidant, water and fat-soluble vitamins. Many potential benefits have been attributed to antioxidant use in the form of dietary intake or supplementation. Antioxidants, in general, may be useful in the prevention of cancer and cerebrovascular disease. High dietary intake of vitamin E may prevent Parkinson’s disease

### 2.2. Herbals

Herbals are as old as human civilization and they have provided a complete storehouse of remedies to cure acute and chronic diseases. The knowledge of herbals has accumulated over thousands of years so that today we possess many effective means of ensuring health care. Nutraceuticals holds a great promise to improve health and prevent chronic diseases with the help of herbals. Some examples are willow bark (*Salix nigra*), having active component as salicin, which is anti-inflammatory, analgesic, antipyretic, astringent and antiarthritic. Parsley (*Petroselinum crispum*) contains flavonoids (apiol, psoralen) and is diuretic, carminative and anti-pyretic. Peppermint (*Mentha piperita*) contains menthol as an active component and cures cold and flu. Lavender (*Lavandula angustifolia*) contains tannin which is helpful in curing depression, hypertension, stress, cold, cough and asthma. Cranberries (*Vaccinium erythrocarpum*) contain proanthocyanadin and are found to be useful in cancer, ulcers and urinary tract infections. Dietary Supplements are products administered through mouth that contain a dietary ingredient intended to add something to the foods you eat. As defined by the Dietary Supplement Health and Education Act (DSHEA, 1994), “a product that contains one or more of the dietary ingredients such as vitamin, mineral, herb, or other botanical, and amino acid (protein) also includes any possible component of the diet as well as concentrates, constituents, extracts or metabolites of these compounds.” Examples of dietary supplements are black cohosh for menopausal symptoms, o biloba for memory loss and glucosamine/chondroitin for arthritis. They also serve specific functions such as sports nutrition, weight-loss supplements and meal replacements. Supplement ingredients may contain vitamins, minerals, herbs or other botanicals, amino acids, enzymes, organ tissues, gland extracts, or other dietary substances. They are available in different dosage forms, including tablets, capsules, liquids, powders, extracts and concentrates.

## 3. Nutraceutical categories:[3]

**Table 2** Fortified food with ayurveda nutraceuticals

Dietary Supplements including botanicals: Health bars with added medication Transgenic Plants for Oral Vaccination	a) Vitamins, minerals, co-enzyme Q, carnitine disease b) Ginseng, Gingko Biloba, Saint John's Wort, Saw
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### 3.1. Functional Foods

A food product that is part of usual diet but has beneficial effects that go beyond the traditional nutritional effects.

#### Examples

- Yogurts - Probiotics for intestinal health.
- Foods/cereals/snacks enriched with soluble fibres, vitamins and minerals.
- Omega-3 milk in prevention of heart disease

- Canola oil with lowered triglycerides for cholesterol reduction.
- Oats, bran, psyllium and lignin's for heart disease and Colon cancer.
- Prebiotics - oligo fructose for control of intestinal flora
- Stanols (Benecol) in reduction of cholesterol adsorption.

**Table 2** Nutraceutical ingredients with their therapeutic Applications [3]

<b>Nutraceutical Ingredients</b>	<b>Therapeutic Applications</b>
Probiotics, Prebiotics	Bone and Joint Health
Vitamins, Antioxidants	Cancer Risk Reduction
Soya based ingredients	Cardiovascular Health
Minerals	Maternal and Infant Health
Nutritional lipids and oil	Immune system
Fibres and carbohydrates	Energy and Eye Health
Dairy base ingredients	Skin Health, Respiratory Health
	Weight Management
	Cognitive and Mental function
	Cholesterol Reduction



**Figure 1** Relation between Nutraceutical and Pharmaceutical and Nutritional Supplement



**Figure 3** Nutraceutical products in India

WHO estimates that 60 % of the cardiac patients in the world will be Indians by 2030? Asia is expected to have 190 million diabetes cases, more than half of them are in India and China<sup>15</sup>. Scientists say that the percentage of overweight/obese people in India is on track to rise from 9% in 1995 to 24% in 2025. In addition, use of nutraceutical products are increasing continuously because of some

Alarming facts as discussed below:

### 3.2. Alarming facts about India

- Walking decreased by 60 %.
- Exercise and jogging decreased by 50 %.
- Game and sports are recreational activities decreased by 50%.
- Low activity entertainment such as computer, DVD Desk job increased by 80%.

### 3.3. Role of nutraceutical agents in cardiovascular diseases:

- Various nutraceuticals used in cardiovascular diseases like carnitine,
- N-acetyl cysteine, creatine, glutathione, selenium, resveratrol, beta-sitosterol and flavonoids.
- Carnitine is an amino acid derivative that is found
- in all cells of the body, especially in striated muscles.
- It is synthesized in the liver, kidneys and brain from the amino acids lysine and methionine.

Two analogues of carnitine, acetyl-L-carnitine and propionyl-L-carnitine, have been used clinically<sup>6</sup>. It plays an important role in the transport of free fatty acids across the inner mitochondrial membranes for energy production. It is a cofactor in carbohydrate metabolism and has noted to reduce the build-up of toxic metabolites in an ischemic condition. Although

L-carnitine has reported to have beneficial effect on cardiac function and it has postulated to be cardio protective due to its antioxidant effects<sup>6</sup>. Studies have suggested that it will lower, to a variable extent, plasma triglycerides and elevate high-density lipoprotein cholesterol levels.

### 3.4. Probiotics in kidney health

When the waste products accumulate in high concentrations in the blood, they become highly toxic and can cause severe damage to many organ systems if they are not properly excreted [6]. Due to the overloaded and impaired kidneys, a build-up of poisonous wastes occurs in the bloodstream. Certain probiotic microorganisms can utilize urea, uric acid, creatinine, and other toxins as nutrients for their growth[6]. They then multiply thereby creating a greater diffusion of these uremic toxins from the circulating blood across the lining of the intestinal walls into the bowel. This increased microbial growth is excreted along with the faeces (which is normally 50% microbes by weight). Enteric toxin reduction technology uses probiotic organisms to transform the colon into a blood-cleansing agent, which, with the aid of microbes, indirectly removes toxic wastes and helps eliminate them as faecal matter. Consequently, it is possible to maintain a healthy kidney function with the oral use of Kibow® Biotics. The patented, proprietary probiotics in Kibow® Biotics have been clinically tested and shown to be safe, effective and free of serious side effects when taken for as long as six months. Pharmaceuticals and nutritional supplements having close relationship that gives efficacy and safety to the nutraceuticals which is scientifically proved.

#### 4. Current status

Nutraceutical food or food components that help in treatment and prevention of diseases are made from herbal/botanical raw material. This is rapidly growing industry (7-12 % per year) with more than millions of people in the world using these natural products. The global nutraceutical market to reach \$ 450 billion by 2015. According to recent analysis from Euro monitor,

The Indian consumer's awareness about conventional nutraceutical ingredients is severely limited and nutraceutical manufacture's need to take up the cause and spread awareness about their products to the Indian masses. The global nutraceutical market has seen maximum growth in last decade. In India, beverages and functional food are expected to witness much higher growth rates when compared to dietary supplement over the next five years [2]. Non-herbals represented the fastest growing segment, while proteins and peptides was the most lucrative market segment in 2011. In Eastern Europe, nutraceutical products market growth is being fuelled by expansion in dietary supplements and functional food market segments. Russia represents the region's largest nutraceuticals consumer [6]. Hungary and Russia forecast to hold just over 20% and just under 24.5% of the nutraceutical market respectively in 2017[6]. Nutraceuticals came into medicinal format such as capsule, tablet or powder in a prescribed dose while modern nutraceuticals are available as forms of food or included in foods or as whole food itself such as probiotic drink and yogurt. There is lack of investment and focus on research and development, imbalance of food provided to the undernourished through government schemes are current challenges[5]

**Table 3** Nutraceuticals with their therapeutic benefits

Name of Nutraceutical	Therapeutic Benefits
Natural Lycopene	Reducing risk of prostate and cervical cancers.
Natural Purified Lutein Esters	Supporting Cardiovascular health Dietary supplement Functional foods Antioxidants
Garlic	Cholesterol lowering, Cardiac diseases, Diabetic support
Green Tea	Cancer prevention, Weight management, Lowering cholesterol
Gymnema, Momordica	Diabetic control
Glucosamine	Arthritis treatment
Ginkgo Biloba	Allergy relief
Digestive Enzymes	Digestive support
Ginseng	Immunomodulatory
Phycocyanin Powder	Antioxidant

**Table 4** Examples of functional food components

Components	Source	Potential benefits
Polyphenols Anthocyanidine Catechin Flavanones Flavones	Fruits Tea, Babul pods, Mustard cake, Rapeseed, Shorea robusta seeds. Citrus Fruit, Vegetables, Soybean	Neutralizes free radicals, reduce risk of cancer
Saponins	Soybean, GNC, Lucerne	Lower cholesterol level Anti-cancer
Probiotics/Prebiotics/Symbiotic Lactobacillus, Fructo-oligosaccharides	Yoghurt White grain, Onions	Improve GI health

Phytoestrogens	Soybean, Flax, Maize Berseem clover, Lucerne Flax, Rye, Vegetables	Reduce menopause symptoms, improve bone Health
Diadzein Genistein Lignans	Wheat bran Oats Cereal grains	Reduce cancer and heart disease
Dietary Fibres Insoluble fibres $\beta$ Glucan Whole grains	Clover, Lucerne, Oats, Corn, Carrots,	Reduce breast, colon cancer Reduce CVD
Carotenoids $\beta$ Carotene, Zeaxanthin, Lutein	Vegetables, Fruits	Neutralize free radicals Healthy vision

To overcome that challenges we should encourage research in the field of nutraceuticals by funding, provide R & D infrastructure support to nutraceutical players for conducting research also there should be collaboration between industry and academia and increase public- private partnership [5]

## 5. Regulatory aspects

The primary set of rules governing the nutraceutical market is the Dietary Supplement Health and Education Act (DSHEA) passed in 1994 [1,7]. The Food Safety and Standard Rule, 2011 have been issued. Food Safety and Standard Authority has also issued regulations with respect to Licensing and registration of food business, manufacturing, packing and labelling, food product standard etc. The Food Safety and Standard Rule and Regulations are effective from August 2011. This act will encourage manufacturers for product Research and Development; develop reliable protocols and carryout clinical studies. Foreign Direct Investment Act passed recently in 2012 that also provide new opportunities for international firms to manufacture and sale nutraceutical products in India. Thus, there is only single authority to regulate production, distribution and marketing of nutraceuticals in India [6].

### 5.1. The Future of Nutraceuticals

The expanding nutraceutical market indicates that end users are seeking minimally processed food with extra nutritional benefits and organoleptic value. This development, in turn, is propelling expansion in the nutraceutical markets globally. The emerging nutraceuticals industry seems destined to occupy the landscape in the new millennium. Its tremendous growth has implications for the food, pharmaceutical, healthcare, and agricultural industries. Many scientists believe that enzymes represent another exciting frontier in nutraceuticals. "Enzymes have been underemployed. They are going to be a hot area in the future." Fermentation technology using microbes to create new food products also represents potential. Global trends to healthy products cannot be reversed. Companies taking the lead by investing strategically in science, product development, marketing and consumer education will not go unrewarded. Nutraceuticals supplied through oral or transdermal delivery system would provide well targeted health benefits with optimal bioavailability. With the evolution of "Smart Nutraceuticals", a Futuristic "Physician's Desk Reference" would contain information on individual genetic profiles to be matched with specific nutritional interventions as well. This would be a vast improvement over current nutritional recommendations which being too generalized are reported to benefit only 60% of population

## 6. Discussion

The emerging health benefits of anthocyanin's combined with the popularity of strawberries justifies research into the absorption and metabolism of strawberry anthocyanin. The strawberries used in this study contained primarily pelargonidin 3-glucoside, as has been observed by researchers in other laboratories. The strawberries used in this study were slightly lower in anthocyanin content the lower pigment content was apparent visually before processing. These strawberries contained 15.2 mmol/100 g (6.7 mg/100 g). In comparison, reported 21–41 mg/100 g total anthocyanin in strawberries.

## 7. Conclusion

The global market is currently experiencing period of growth post-recession even after effect of recession fades, the market for nutraceutical is likely to remain in the growth phase which is driven by emerging market of countries like India, China, Brazil etc. In case of plant extracts and phytochemicals, various Indian companies have entered their place as supplier both locally as well as globally, which will help in flourishing nutraceuticals sector in near future.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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