



## **Nutraceuticals: Supplements For Building A Healthy World**

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### **ABSTRACT**

*There is increasing recognition of the potential role of nutraceuticals and dietary supplements in reducing health risks and improving nano-level health quality. In 1989, Dr Stephen DeFelice first coined the term nutraceutical to offer health and medical benefits, including disease prevention and treatment. Attributable to their safety and potential nutritional values and therapeutic effects, nutraceuticals have established substantial interest. Companies of pharmaceutical and nutritional products are aware of the monetary success of consumers seeking more health and the changing trends leading to an exploration of natural nanomedicines that cover a large number of chronic and fatal diseases, including cancer. Some popular nutraceuticals include ginseng, echinacea, folic acid, aloe-vera gels, ephedra, garlic, ginger, glucosamine, omega-3 eggs, orange juice enriched with calcium, green tea, etc. Majority of them are appealed to have numerous therapeutic benefits. This review aims to understand nutraceuticals as nano better -supplements to alter disease conditions with specific indications and their crucial role in pathophysiological interventions.*

**Keywords:** nutraceutical; medicines; dietary supplements; herbal nutrients

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### **INTRODUCTION**

Economic development has improved the quality of life in connection with income, expenditure and lifestyle. It also posed a significant challenge in the form of 'lifestyle diseases', however. The first victim of this transformation in lifestyle was the habits of food. The consumption of junk foods has multiplied, leading to a number of nutritional deficiency-related diseases. Nutraceuticals can play an essential role in controlling them. In 1989, Stephen DeFelice, originator and chairman of the Foundation for Innovation in Medicine, an American organization that promotes medical health, devised the term nutraceutical from nutrition and pharmaceutical [1- 4]. According to him, "a nutraceutical substance is a food or part of the food and offers medical or health benefits, including disease prevention and treatment" (Figure 1). These products can assort from isolated nutrients, dietary supplements and specific diets to designer genetically engineered foods and herbal products [5]. The notion of nutraceutical was taken from the survey in the United Kingdom, Germany and France determined that the consumer rated diet more than exercise or genetic factors in order to achieve good health [6]. "Nutraceutical" was commonly used in the United States, but there was no regulatory definition. Its significance has been changed by the Canadian Ministry of Health, which defines nutraceutical as "a product isolated or purified from food, generally sold in a medicinal form that is not associated with food and has shown a physiological benefit. It also provides benefits against chronic disease" [7].

Due to the increasing attention of researchers and sophisticated techniques for determining qualitative and quantitative parameters, the nutraceutical market has been developed in recent years. It has changed to a global industry of millions of dollars. In 2008, global nutraceuticals marketing was USD 128.4 billion. Japan holds Asia's most significant marketing share of 70 percent [8,9]. The Indian nutraceutical market segment has experienced an annual growth rate of 20 % over the past three years, contributing to 2 % of the world market. India is currently in the category of promising nutraceutical drift known as Fast Moving Health Care Goods. The value of the nutraceutical market in 2009 was estimated at around 27 billion INR and is expected to reach 40.1 billion INR in 2011 [10]. The Indian nutraceutical market has reached a value of approximately US \$2 billion, retaining 1.5% of the global nutraceutical industry. This status

illustrates ongoing studies and attempts to integrate traditional herbal ingredients into the nutraceutical portfolio. In addition, it was found that the growth in the Indian nutraceutical market in 2016 was estimated at US\$ 2731 million. The scope and demand for nutraceuticals in the future depend on the awareness of Indian consumers. For further growth and establishment of new horizons for the growing nutraceutical industries, it requires particular focus and market interest [11].

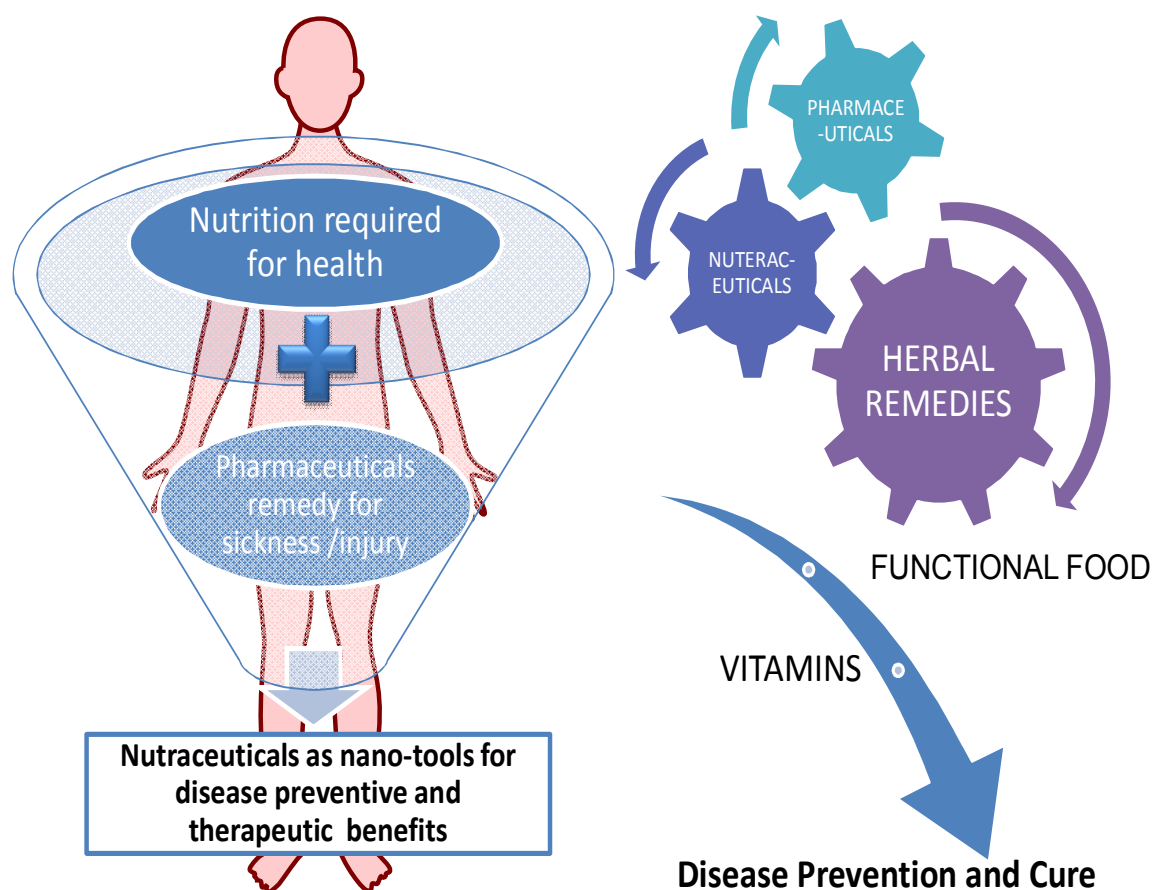


Figure 1: Role of Nutraceuticals

## METHODS

Appropriate studies were identified through electronic searches of Pubmed, Medline, Scopus, and Google scholar. The search used the terms “nutraceuticals,” “dietary supplements,” or “herbal products.”. In addition, we searched the bibliographies of relevant studies and reviews for articles.

## NEUTRACEUTICALS CONNECTING THE GAP BETWEEN FOOD AND MEDICINE

Hippocrates highlighted around 2000 year ago “Let food be your medicine and medicine be your food”. Nutraceuticals are food or food ingredients that benefit health or health. This emerging product class blurs the food - drug line. They are not easily included in the legal categories of food or medicine and often live in a grey area between them [12].

The legal categorization of a nutraceutical in the European Union (EU) law is generally based on its accepted effects on the body. It can therefore be considered a food ingredient if the substance contributes only to the maintenance of healthy tissues and organs. However, if it can be shown to affect one or more physiological processes in one or more of the bodies, it is likely to be considered a medicinal substance [13]. For two reasons, the European Medicines Act can define a nutraceutical as a medicine:

- It can be used to prevent, treat or cure a disease.
- It can be administered in order to restore, correct or modify human physiological functions [13].

## CATEGORIES OF NUTRACEUTICALS

Nutraceuticals can be regarded as biological treatments used to promote wellness, prevent malignant processes and control symptoms. The following are categorized:

### Traditional and Non- traditional nutraceuticals

On the market, the wide variety of nutraceutical foods falling into the category of conventional and non - traditional foods are available.

### Traditional Nutraceuticals

These are natural substances that do not affect food. They are grouped according to chemical constituents, probiotic microorganisms and nutraceutical enzymes. They can be categorized in Table 1, 2, 3 and 4 [14-17].

### Chemical Constituents

a) *Nutrients*: With traditional nutritional functions, it includes vitamins, minerals, amino acids and fatty acids. They help heal heart disease, strokes, cataracts, osteoporosis, diabetes and cancer. In osteoporosis and anaemia, fossils originate in plant, animal and dairy products are beneficial. Flaxseed and salmon are powerful inflammatory process controls, brain function maintenance and cholesterol deposition reduction [6,48].

b) *Herbals*: Examples include; *Lavendulaan gustifolia* contains tannin to cure depression, high blood pressure, stress, cold, cough and asthma. *Salix nigra*, which has an active salicin component, which is anti-inflammatory, analgesic, astringent and anti-arthritis. *Mentha piperita* contains active menthol and cures cold and gripe. *Petroselinum crispum* is diuretic, carminative and antipyretic and contains flavonoids. *Vaccinium erythrocarpum* contain proanthocyanidins and are useful for cancers, ulcers and infections of the urinary tract [6].

c) *Phytochemicals* Flavonoid polyphenolics are found in fruits, vegetables and vegetables that are effective antioxidants, phytoestrogens, breast cancer prevention, prostate cancer and diabetes control. In dark grapes, raisins, berries, peanuts, turmeric roots, non - flavonoid polyphenolics are present; they are strongly anti-inflammatory, antioxidants, anticoagulants and reduce cholesterol. Also used as food supplements are spirulina and chlorella.

**Table 1** List of vitamins, minerals and their benefits

Nutrients	Health benefits
Vitamin A	Antioxidant, vital for growth and development in the treatment of specific skin disorder.
Vitamin E	Antioxidant, helps to form blood cells, muscles, lung and nerve tissue boosts the immune system.
Vitamin K	Important for blood clotting.
Vitamin C	Antioxidant, for healthy bones, gums, teeth and skin, in wound healing, prevents the common cold and attenuate its symptoms.
Vitamin B1	Helps in conversion of food into energy, which is essential for neurological function.
Vitamin B2	Helps maintain healthy eyes, skin and skin and nerve function in energy production as well as other chemical processes in the body.
Vitamin B3	Helps convert food into energy and keep the brain function properly.
Vitamin B6	Produce cell genetic material, RBC formation, central nervous system maintenance and amino acid synthesis and fat, protein and carbohydrate metabolism.
Folic acid	Produce cell genetic material to protect against heart disease during pregnancy to prevent birth defects, the formation of RBCs.
Calcium	Bone and teeth and bone strength in nerve, muscle and glandular functions are important.
Iron	Production of energy, transport and transfer of oxygen to tissues.
Magnesium	Healthy function of the nerve and muscle and bone formation can help prevent premenstrual syndrome (PMS).
Phosphorous	Strong bones and teeth help to form genetic material, produce and store energy.
Chromium	With insulin, carbohydrates and fats can be converted into energy.
Cobalt	Vitamin B12 is an essential component, but ingested cobalt is metabolized in vivo to form coenzymes of B12.
Copper	Essential for the production of hemoglobin and collagen, the heart, energy production and iron absorption from the digestive tract are healthy.
Iodine	For proper thyroid function.

**Table 2:** Herbals used and their therapeutic relevance

Herbals (Botanical source)	Therapeutic relevance
Aloe vera gel( <i>Aloe vera</i> Linn.)	Anti-inflammatory, emollient healing belongings.
Chamomile( <i>Matricariarecutita</i> L.)	Anti-inflammatory, smooth muscle relaxant, antimicrobial, wound healing.
Echinacea ( <i>Echinacea purpurea</i> L.)	Immunostimulant, treatment of cold and flu indications.
Ephedra ( <i>Ephedrasinica</i> )	Bronchodilator, vasoconstrictor, reduce bronchial edema.
Evening( <i>Oenothera lamarckiana</i> Ser.)	A nutritional supplement of linoleic acid, handling of atrophic eczema.
Feverfew( <i>Tanacetum parthenium</i> L.)	Handling of headache, fever and menstrual problem, severity and duration of migraine headaches.
Garlic( <i>Allium sativum</i> L.)	Antibacterial, antifungal, antithrombotic, hypotensive anti-inflammatory.
Ginger( <i>Zingiber officinale</i> Roscoe)	Carminative, antiemetic, cholagogue, positive inotropic.
Ginseng ( <i>Panax ginseng</i> )	Adaptogen.
Ginkgo( <i>Ginkgo biloba</i> L.)	Vasodilation, increased peripheral blood flow, treatment of the post-thrombotic syndrome.
Goldenseal( <i>Hydrastiscanadensis</i> L.)	Antimicrobial, astringent, antihemorrhagic treatment of mucosal inflammation dyspepsia, gastritis.
Horehound ( <i>Marrubium vulgare</i> L.)	Expectorant, antitussive choleric.
Liquorice( <i>Glycyrrhiza glabra</i> L.)	Expectorant, secretolytic treatment of peptic ulcer.
Melissa ( <i>Melissa officinalis</i> )	Topical antibacterial and antiviral.
Plantago seed( <i>Plantagolanceolata</i> )	Cathartic.
St. John's wort( <i>Hypericum perforatum</i> L.)	Anxiolytic, anti-inflammatory, antidepressant, monoamine oxidase inhibitor.
Valerin( <i>Valeriana officinalis</i> L.)	Spasmolytic, mild sedative, sleep aid.
Willow Bark( <i>Salix alba</i> L.)	Anti-inflammatory, analgesic, antipyretic, astringent, treatment of rheumatic and arthritic.

**Table3** Various categories of dietary supplements

Dietary supplements	Significance	Ref.
Ketogenic diets	In order to improve seizure control, foods with high fat and low protein and carbohydrates have been reported. These diets, however, are widely recognized as unpleasant.	[18]
Minimally refined grains	Cereals and calcium - enriched grains can reduce diabetes incidence and prevent gastrointestinal cancers.	[19,20]
Phytoestrogens	It was found on soy flour and linseeds and was documented to improve levels of estrogen when the hormonal level is low. This can prevent hot flushes and breast cancer.	[21]
Several species of edible mushrooms	Tonnage, Lentinus, Pleurotus, Auricularia, Flammulina, Tremella, Hericium and Grifola have different degrees of reduction and antitumor without significant toxicity.	[21]
Glucosamine sulfate and chondroitin sulfate	They are useful and safer to relieve osteoarthritis symptoms.	[22]
Peptides/Hydrolysates	Found in casein and whey protein and having activity like ACE inhibitors. Buckwheat proteins used as flour reduce cholesterol, high blood pressure, improve constipation and obesity by acting similar to dietary fibers and interrupt in vivo metabolism.	[23,24]
Dairy foods	Containing friendly or probiotic bacteria that promote intestinal health.	[25]

**TABLE 4** Various categories of dietary supplements based on their uses

Type of disease	Exploited nutraceuticals	Ref.
Cardiovascular	Antioxidants, dietary fibers, polyunsaturated fatty acids Omega-3, vitamins, minerals, to prevent and treat CVD. Polyphenol (in grape) prevents arterial diseases. Flavonoids (in onions, vegetables, grapes, red wine, apples and cherries) block ACE and strengthen the small capillaries that carry oxygen and essential nutrients to all cells.	[26, 27]
Diabetes	In diabetic patients, ethyl esters of n-3 fatty acids may be beneficial. Docosahexaenoic acid modulates insulin resistance and is also essential for the development of neurovisual properties. An antioxidant lipoic acid to treat diabetic neuropathy. In diabetic patients, dietary fibers from psyllium were used to control glucose and reduce lipid levels in hyperlipidemia.	[28-31]

Obesity	Stimulants of herbs, such as ephedrine. Caffeine, ma huang - guarana, chitosan and green tea help in the loss of body weight Buckwheat seed proteins similar to food fibers. 5-hydroxytryptophan and green tea extract can contribute to weight loss, while the former reduces appetite and increases energy expenditure later. In the dietary supplement, a mixture of glucomannan, chitosan, fenugreek, G Sylvestre and vitamin C significantly reduced body weight. Momordica Charanrtia (MC), conjugated linoleic acid (CLA), capsaicin, has potential anti - obese properties.	[32-36]
Cancer	Flavonoids that block estrogen - producing enzymes reduce cancers caused by estrogen. A wide range of phyto-pharmaceutical products with a claimed hormonal activity called "phytoestrogens" is recommended to prevent prostate / breast cancer. The source of iso - flavones in soy foods, curcumin from curry and soy iso - flavones have chemo preventive properties for cancer. Lycopene is concentrated in the skin, testicles, adrenal and prostate to protect against cancer. Saponins (found in peas, soybeans, herbs, spinach, tomatoes, potatoes, alfalfa and clover) have antitumor and anti - mutagenic activity. Curcumin (diferuloylmethane), a turmeric polyphenol, is carcinogenic, oxidative and anti - inflammatory. Beetroots, cucumber fruits, leaves of spinach and turmeric rhizomes have been reported to have anti - tumor activity.	[37-43]
Anti-inflammatory	In the treatment of inflammation and autoimmune diseases, linoleic acid (found in green leafy vegetables, nuts, vegetable oils, i.e. evening primrose oil, black cassava seed oil, hemp seed oil, and spirulina, cyanobacteria) is used. Glucosamine and chondroitin sulfate are used to control osteoarthritis and regulate NO and PGE2 gene expression and synthesis. The cat's claw contains 17 alkaloids, glycosides, tannins, flavonoids, sterol fractions and other compounds and acts as a powerful anti - inflammatory agent.	[44,45]
Alzheimer's disease	By neutralizing the harmful effects of mitochondrial dysfunction of oxidative stress and various forms of neural degeneration, $\beta$ -carotene, curcumin, lutein, lycopene, turmeric etc. can have positive effects on specific diseases.	[45]
Parkinson's disease	In food, vitamin E can protect against Parkinson's disease. Creatine changes the characteristics of Parkinson's disease by measuring a decrease in clinical signs.	[46]
Vision improving agent	The treatment of visual disorders uses lutein (found in mangoes, corn, sweet potatoes, carrots, squash, tomatoes and dark, leafy greens such as kale, collards and bokchoy). Zeaxanthin (found in corn, egg yolks and green vegetables and fruits, such as broccoli, green beans, green peas, cabbage, kale, collard greens, spinach, lettuce, kiwi and honeydew) is used mainly for the treatment of visual disorders in traditional Chinese medicine.	[6,45]
Osteoarthritis	Glucosamine (GLN) and sulfate chondroitin (CS) alleviate osteoarthritis symptoms.	[45,47]

### Probiotic Microorganisms

It is defined as live microorganisms that have a health effect on the host when consumed in adequate quantities. Probiotics can treat lactose intolerance by producing a specific enzyme B-galactosidase, which can hydrolyze lactose into its sugar components. Prebiotics adds to our vocabulary more recently and are substances that we do not digest when consumed. They act instead as a source of nutrients for good probiotic bacteria [6,49].

### Nutraceutical Enzymes

These enzymes come from microbial, animal or plant sources [6].

### Non-traditional Nutraceuticals

These are artificial foods that biotechnology helps prepare. Food samples contain bioactive components designed to produce human well-being products. They are divided into a) Fortified nutraceuticals b) Recombinant nutraceuticals

a) *Fortified nutraceuticals*: Fortified food or added nutrients or ingredients from agricultural breeding, for example. Calcium-fortified orange juice, added vitamins or minerals to cereals and added folic acid to flour. Milk also used in vitamin D deficiency fortified with cholecalciferol. Bifidobacterium lactis HN019 fortified prebiotic and probiotic milk used in children with diarrhoea, respiratory infections and severe diseases.

b) *Recombinant nutraceuticals*: As the word itself indicates, with the help of biotechnology, they are energy supplying food formed by "recombination." For example Yogurt, cheese, vinegar, bread, alcohol, starch, etc [6].

### **MARKET INTEREST OF NUTRACEUTICALS**

In comparison with other therapeutic agents, the use of nutraceuticals as an attempt to achieve desirable therapeutic results with reduced side effects has achieved great monetary success. Approximately two-thirds of the American population use as a minimum one type of nutraceutical health product. In pharmaceutical and biotech companies, there is a clear predilection for the discovery and production of nutraceuticals over pharmaceuticals. In the United States, the nutraceutical industry is about \$ 86. This figure is somewhat higher in Europe and Japan; it accounts for about a quarter of its total annual food sales of \$ 6 billion - 47 percent of the Japanese population consume nutraceuticals. Professional intelligences continuously propose that the market is continuously lysing, even without specific financial figures. The ageing baby-boomer population is one possible amplification for the growth of nutraceuticals in the United States. As citizens' average age continues to rise, the population is increasingly focused on health and wellness. By the middle of the 21st century, nearly 142 million Americans over the age of 50 could be based on a projected population of nearly 400 million citizens. As generic products enter the market the price of some nutraceuticals may fall, the dependence of people on these products suggests that market progress remains stable [7,50].

Together with India's rising healthcare industry, there is also a developing trend in Fast Moving Healthcare Goods (FMHG) in India; ingredients with human health benefits beyond basic nutrition are by definition known worldwide as nutraceuticals. Nutraceutical and functional food ingredients are ingredients that do not have essential nutritional benefits for human health. The market for nutraceuticals in 2007 was INR 18.75 billion, according to Cygnus estimates. The total nutraceuticals market in India is estimated at INR 44 billion in 2009; it is expected that it will reach INR 95 billion in 2013. Two segments of the market are food supplements and vitamins and minerals [7,51].

### **CHALLENGES**

Although nutraceuticals have significant promises to promote human health and disease prevention, health professionals and regulatory toxicologists could also work together strategically to plan appropriate regulations to provide humanity with the ultimate therapeutic benefits. Quality controls such as the composition and content of active ingredients in natural plants and maintenance are crucial for the production processes of nutraceuticals. In order to determine the safety and efficacy of the product, extensive safety studies are required, including acute, sub-acute, sub-chronic, chronic and long-term toxicity studies, as well as studies in animals and clinical trials in humans. The safety and efficacy of drugs, chemicals, food supplements and nutraceuticals can be examined using DNA microarray technology. In summary, agricultural, food and biomedical biotechnology continue to grow as a constant change in our lives, the potential for our food to one day also serve as medicines is high [52,53].

### **CONCLUSION**

In many ways, the studies have confirmed the crucial role of nutraceuticals in the prevention and treatment of different diseases. Most people prefer to treat any condition in a natural way that can be achieved through the regular use of nutraceuticals. Nutraceuticals consumption is the best way to remain natural and improve the quality of life. Nutraceuticals can also be an alternative for patients who are unwilling to undergo chemical treatment. It is too cost-effective over other therapies. The studies show that nutraceuticals mechanically carry out different types of biological activity. Ultimately, these properties reduce age and chronic diseases. Many of these potential nutraceuticals are currently in the research and development phases. The nutraceuticals marketing graph is also growing around the world. The reported market values show the public behaviour to focus more on the use of nutraceuticals, which is ultimately linked to the brighter scope of the nutraceutical industry. However, there is enormous scope for further progress in the field by introducing supply carriers and raising awareness of the potential of such systems. Therefore, the field undoubtedly has the greatest hidden value associated with it, which is only necessary to explore in order to make life easier and better.

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