



# CURRENT PROSPECTS OF NUTRACEUTICALS IN HARD CURATIVE DISEASES

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## ABSTRACT

Nutraceuticals are used to prevent chronic diseases thereby improves health, increases life expectancy and supports the structure or function of the body. Owing to potential nutritional, safety and therapeutic effects, they have received considerable interest in treating hard curative disorders related to oxidative stress including allergy, Alzheimer, cardiovascular, cancer, diabetes, inflammatory and Parkinson's diseases.

The term “nutraceutical” is emerging out of benefits from food that go beyond attributable to essential nutrients. Nutraceutical comprises of dietary supplements, has advantage over the medicine as they avoid side effects. Nutraceutical on the basis of their natural source are categorised into three terms – nutrients, herbals, dietary supplements. The most rapidly growing segments of the industry were dietary supplements (19.5 percent per year) and natural/herbal products (11.6 percent per year). Global nutraceutical market is estimated as USD 405.8 billion by 2025.

In the present review, emphasis has been made to present herbal nutraceuticals effective on hard curative disorders related to oxidative stress including allergy, Alzheimer, cardiovascular, cancer, diabetes, eye, immune, inflammatory and Parkinson's diseases as well as obesity and to present new concepts about nutraceuticals based on their diseases modifying indications.

**Keywords:** Nutraceutical, Alzheimer, Parkinson's diseases

## INTRODUCTION

“Pharmaceuticals” are considered as drugs used mainly to treat diseases whereas “nutraceuticals” are substances intended to prevent diseases. Pharmaceuticals have patent protection as a result of expensive testing to conform to the specifications of respective Governments. However, many nutrients may never receive government approval since no one could justify the expense of testing requirements for substances that cannot be protected by patent laws. Both pharmaceuticals and nutrients can cure and prevent disease(s) but only pharmaceuticals have governmental sanction.

Nutraceuticals are also termed as “functional foods”, as they fade away the traditional dividing line between food, and medicine. Functional food provides the body with adequate amount of vitamins, fats, proteins, carbohydrates necessary for healthy survival and aids in the prevention, treatment of disease(s)/disorder(s) other than deficiency conditions is termed as “nutraceutical” [1]. It is dietary supplement intended to fulfil nutrition in the diet that bears or contains one or more ingredients like, vitamin, mineral, a herb, an amino acid or a concentrate, metabolite, etc.

## INCREASING SIGNIFICANCE OF NUTRACEUTICALS

Nutraceuticals are widely used in the food and pharmaceutical industries. Most of the nutraceuticals are from mineral origin, animal origin or vegetable origin like gamma terpenes, beta carotene, curcumins, limonene, eugenol, pinene, geraniol, aloin, caryophyllene, lycopene. These constituents are incorporated into dosage forms as topical, oral, etc. viz. lotions, ointments, emulsions, aromatic oils, microemulsions, tablets, emulgels, herbal formulations employed as antidiabetic, antibiotic, antimicrobial, anti-inflammatory, anti-cancer, protective, etc. Nutraceuticals are quickly replacing pharmaceuticals in prevention and management of acute and chronic health problems.

- Nutraceuticals are represented as a conventional food or as a sole item of food or meal administered with a view to restore or correct normal physiological functions of our body.
- They have known to cover therapeutic areas, such as anti-arthritis, cold and cough, sleeping disorders, digestion and prevention of certain cancers, osteoporosis, blood pressure, cholesterol control, pain killers, depression and diabetes.
- They are pharmaceutical agents' aid in promoting health thereby preventing chronic diseases.
- Nutritionists have recognized that heavily processed food supply coming from crops grown with chemical fertilizers, pesticides, herbicides, and often genetically modified seeds, lacks sufficient nutrients necessary for optimum health.
- Nutraceuticals show an ample scope to flourish as therapeutic agents with curative properties.
- Nutraceuticals are quickly replacing pharmaceuticals in prevention and management of acute and chronic health problems.
- In case of economically challenged patients, masses believe more in prevention than a cure.
- Increasing numbers of consumers are concerned about healthcare costs. [2,3]

## NUTRACEUTICALS AND DISEASES

Nutraceuticals have been claimed to have a physiological benefits against the following diseases such as: Cardiovascular, Diabetes, Obesity, Allergy, Parkinson's, Alzheimer's, Cancer, Osteoarthritis, Immune system, Eye disorders and Inflammations.

### Cardiovascular disease [4-11]

Cardiovascular diseases (CVD) is associated with dysfunctioning of the heart and blood vessels which include hypertension (high blood pressure), coronary heart disease (heart attack), cerebro-vascular disease (stroke), peripheral vascular disease, etc. In cardiac heart disease, atherosclerotic plaques form on the inner layer of arteries,

which narrows lumen and reduces the blood flow. Nutraceuticals used in cardiovascular diseases are **Anti-oxidants**, Dietary fibres, Omega-3 poly unsaturated fatty acids, Vitamins, minerals for prevention and treatment of CVD. **Milk and eggs** having gamma linolenic acid (GLA) which helps in prevention and management of cardiovascular diseases. Also, they are required for production and rebuilding of cells, to reduce blood pressure, lower cholesterol and triglycerides, reduce the risk of blood clots, help prevent many diseases including arthritis, arrhythmias. **Polyphenols** (present in grapes) prevent and control arterial diseases. **Flavonoids** (present in onions, vegetables, red wine, and cherries) block the ACE and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells, prevent platelet stickiness and hence platelet aggregation. Nutrients and nutraceuticals with calcium channel blocking activity (thus antihypertensive activity) include  $\alpha$ -Lipoic acid, magnesium, Vitamin B6 (pyridoxine), Vitamin C, N-acetylcysteine,  $\omega$ -3 fatty acids. Fagopyrum esculentum, dietary fiber preparation from defatted rice bran possess laxative and cholesterol-lowering ability benefits in prevention or alleviation of cardiovascular disease, diabetes, and colon cancer.

### Diabetes [12-18]

Diabetes mellitus is associated with abnormal high levels of blood glucose, due to insufficient insulin production, or due to its ineffectiveness. The most common forms of diabetes are type 1 diabetes (5%), an autoimmune disorder, and type 2 diabetes (95%), which is associated with obesity. Nutraceuticals used in diabetes are **Lipoic acid**, an antioxidant, for treatment of diabetic neuropathy. Ethyl esters of n-3 fatty acids **Docosahexaenoic acid** modulate insulin resistance. **Herbal stimulants**, such as ephedrine, caffeine, and green tea help in body weight loss. People with diabetes are at higher risk of blood vessel damage from free radicals. **Quercetin** class of flavanols works as an antioxidant by scavenging damaging particles in the body known as free radicals. Dietary fibers from psyllium have been used both as pharmacological supplements, food ingredients, in processed food to aid weight reduction, for glucose control in diabetic patients and to reduce lipid levels in hyperlipidemia. Good magnesium status reduces diabetes risk and improves insulin sensitivity; calcium and vitamin D appear to promote insulin sensitivity, improves glycemic control, also bitter melon and cinnamon have the potential to treat and possibly prevent diabetes.

### Obesity [19-21]

Obesity is the main reason for many disorders like hypertension, hyperlipidaemia, respiratory disorders, gall bladder disease, reduced fertility, heart failure etc. Due to increased accessibility of high-fat, energy dense foods such as energy-rich foods increases weight gain.

Nutraceutical based formulations are being used on a large-scale as potential and prime treatment for obesity and weight management. **Buckwheat** is a crop has special biological activities of cholesterol lowering effect, anti-hypertension effects and improving the constipation. **5-hydroxytryptophan** and green tea extract may promote weight loss. Nutraceuticals like conjugated linoleic acid (CLA), capsaicin, Momordica Charantia (MC) and Psyllium fiber possess potential antiobese properties. A combination of glucomannan, chitosan, fenugreek, G sylvestre, and vitamin C in the dietary supplement prominently reduces body weight in highly obese individuals.

### Allergy [22]

Allergy forms an intense or an exaggerated response to a drug or food. Histamines are mainly responsible for allergic and inflammatory reactions. Quercetin (QR) belongs to a group of polyphenolic substances termed as flavonoids. Antihistamines help in reducing the inflammation that results from hay fever, bursitis, gout, arthritis. The main sources of QR include onions, red wine and green tea. QR is a natural antihistamine inhibits inflammatory enzymes, such as lipid peroxidases, that decrease leukotriene formation. It has anti-inflammatory,

antiviral, immunomodulatory, anticancer and gastroprotective activities. It blocks an enzyme that leads to accumulation of sorbitol, which leads to nerve, eye, and kidney damage in those with diabetes. QR prevents damage to blood vessels by certain forms of cholesterol and other chemicals produced by the body. LDL cholesterol is an underlying cause of heart disease.

### **Parkinson's disease** [23, 24]

Parkinson's disease is defined as motor disorder that results from nerve damage in certain areas of the brain causing muscle rigidity, shaking, and difficult walking, mostly occurring in mid to late adult life. Nutraceuticals used in Parkinson's diseases are some of these supplements have shown some promising results in preliminary studies.

**Vitamin E, glutathione, and creatine** seem to be protective against Parkinson's disease.

### **Alzheimer's disease** [25-28]

Alzheimer's disease (AD) is characterized by progressive dementia with memory loss as the major clinical symptom. There is no cure for the disease and eventually leads to death. AD is diagnosed over 65 years of age in people. It is predicted to affect 1 in 85 people globally by 2050. Nutraceuticals used in treatment of Alzheimer's diseases are **β-Carotene, curcumin, lutein, lycopene, turmeric** etc may exert positive effects on specific diseases by neutralizing the negative effects of oxidative stress, mitochondrial dysfunction, and various forms of neural degeneration.

Researchers have focused on deleterious roles of metal ions in the development of Alzheimer's disease, by the augmentation of oxidative stress. The growing trend in nutraceutical intake put forth the belief of delaying the development of dementias such as Alzheimer's disease.

### **Cancer** [30-36]

A high risk of cancer is associated with chronic inflammation risk linked with immune suppression. At the molecular level, free radicals and aldehydes produced can induce deleterious gene mutation. According to the World Cancer Report the cancer rates there would be 25 million new cases in the year 2025.

Nutraceuticals used in cancer are **Lycopene** concentrates in the skin, testes, adrenal and prostate where it protects against cancer. Lycopene is one of the major carotenoids in western diets and is found in tomatoes, water melon, guava, pink grapefruit and papaya. **Phytochemicals** derived from herbs and spices also have potential anti-carcinogenic and anti-mutagenic activities are recommended for prevention of prostate/breast cancer. Soy foods source of isoflavones, curcumin from curry and soya isoflavones possess cancer chemo preventive properties. **Ellagic acid** is a anti-carcinogen present in strawberries, cranberries and walnuts. Beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes exhibits anti-tumour activity. Tannins present in blackberries, blueberries, cranberries, grapes, lentils, tea and wine with advantage to detoxify carcinogens. **Curcumin** (diferuloylmethane) is a polyphenol of turmeric possesses anticarcinogenic, and anti-inflammatory properties. Pectin (apples) prevents prostate cancer by inhibiting cancer cells from adhering to other body cells. Glucosinolates are found in cruciferous vegetables including the Brassica crops—Brussels sprouts, broccoli, cauliflower, cabbage, watercress, oilseed rape, and mustard and are powerful activators of liver detoxification enzymes. Glucosinolates and cruciferous vegetables are used in treatment of lower risk lung and colorectal cancer.

Increasing consumption of vegetables and fruits elevates the levels of antioxidative components, for example, selenium, vitamin E, vitamin C, lycopene, and various phytochemicals. Clinical trials studies suggest that some agents such as selenium, lycopene, soy, green tea, vitamins D and E, anti-inflammatory and inhibitors of 5α-reductase are effective in preventing prostate cancer.



## Osteoarthritis <sup>[37, 38]</sup>

Osteoarthritis (OA) is a debilitating joint disorder, leads to loss of the articular cartilage of the joint due to loss of protein substance between the bones of joints. Joint discomfort from OA and other joint disorders may reduce physical activity in individuals experiencing this condition, resulting in energy imbalance and weight gain.

Nutraceuticals used in osteoarthritis are **Glucosamine (GLN) and chondroitin sulphates (CS)** are widely used to improve symptoms of osteoarthritis. They have nutrient and pharmaceutical properties to regulate gene expression and synthesis of NO and PGE2, proving effective for their anti-inflammatory activities<sup>43</sup> Also, **Methyl sulfonyl Methane (MSM)** used in combination with glucosamine and chondroitin are helpful in treatment of osteoarthritis.

## Immune System <sup>[39, 40]</sup>

Nutraceuticals belonging to the category of immune boosters are useful to improve immune function. They include extracts from the coneflowers, or herbs of the genus Echinacea, such as Echinacea purpurea, Echinacea angustifolia, Echinacea pillida, and extracts from herbs of the genus Sambuca, such as elderberries.

**Goldenseal** is an immune booster with antibiotic activity, and in which compounds like berberine and hydrastine, are known to stimulate bile secretion and constrict peripheral blood vessels respectively. **Astragalus membranaceous, Astragalus mongolicus** are effective immune boosters in either their natural forms. Astragalus stimulates development and transformation of stem cells in the marrow and lymph tissue to active immune cells. Most probiotic preparations are comprised of one or more lactic acid bacteria (LAB). Within this group, strains of Lactobacillus, Bifidobacterium sp. are mostly used. Oral digestive enzymes and probiotics are dietary measures towards decreasing colon-rectal, prostate and bronchogenic cancer

**Phytoestrogens** are recommended for prevention of several diseases associated with hormonal imbalance. **Soy isoflavones** play prime role as potential superior alternatives to the synthetic selective oestrogen receptor modulators, employed in hormone replacement therapy. Garlic and morphine also are good illustration of the nutraceuticals, which stimulate and suppress immune system respectively.

## Eye Disorders <sup>[41, 42]</sup>

High content of polyphenolic flavonoids in nutraceuticals have been shown to possess antioxidant activity. They are, thus proven as vision improving agents. **Lutein** and **Zeaxanthin** are carotenoids, found in sweetpotatoes, carrots, squash, tomatoes and dark, leafy greens such as kale and bok choy, used for the treatment of visual disorders. Food sources of zeaxanthin, include corn, egg yolks and green vegetables and fruits, such as broccoli, green beans, green peas, brussel sprouts, cabbage, spinach, lettuce, kiwi and honeydew. They are also found in nettles, algae and the petals of many yellow flowers. A new source of these carotenoids, marigold flower extract (*Tagetes erecta*) that contains approximately 80-86% by weight of the carotenoids lutein and zeaxanthin. **Astaxanthin** offers powerful protection for the eyes and prevents macular degeneration.

## Inflammatory disorders <sup>[43-45]</sup>

Inflammation can be stated as the response of body tissues to injury or discomfort, characterized by pain and swelling and redness and heat. Some inflammation disorders include: rheumatoid arthritis shoulder tendinitis and polymyalgia rheumatica. Several nutraceuticals that influence osteoarthritis pathophysiology, includes glucosamine, chondroitin, ginger and avocado/soybean.

**Resveratrol** is present in the fruits of bilberry (*Vaccinium myrtillus*), the lowbush "wild" blueberry (*Vaccinium angustifolium* and the highbush blueberry (*Vaccinium corymbosum*). Resveratrol shows the strongest sirtuin-like deacetylase action of any known phytochemical. Sirtuins have shown to extend the lifespan of yeast and fruit flies,

acts as an anti-inflammatory agent, antifungal agent. Other beneficial health effects include anti-cancer, antiviral, neuroprotective, anti-aging effects.

**Gamma Linoleic Acid (GLA)** is present in trace amounts in green leafy vegetables, nuts, vegetable oils blackcurrant seed oil, borage oil and hemp seed oil, and from spirulina, cyanobacteria. It is a nutraceutical used against inflammation and auto-immune diseases. bromelain, a proteolytic enzyme found in pineapple; teas and extracts of stinging nettle; turmeric, extracts of turmeric, or curcumin, a yellow pigment isolated from turmeric can be used as anti-inflammatory agents.

**Moringa oleifera Lam** (Moringaceae) has an impressive range of medicinal uses with high nutritional value is a good source of protein, vitamins, beta-carotene, amino acids and various phenolics. It provides a rich and rare, combination of zeatin, QR, beta-sitosterol and kaempferol. the leaves, roots, seed, bark, fruit, flowers and immature pods act as cardiac and circulatory stimulants, possess antitumor, antipyretic, antiepileptic, anti-inflammatory, antiulcer, antibacterial and antifungal activities.

## CONCLUSION

Nutraceuticals are replacing pharmaceuticals in prevention and management of acute and chronic health problems at a faster rate. Although nutraceuticals show a promising approach for the promotion of health and prevention of various diseases, yet nutritionists, toxicologists should strategically work in collaboration to explore them for their full potential. Use of nutraceuticals to explore their therapeutic potential with minimum side effects as compared to conventional pharmaceuticals has observed a great success. Nutraceuticals still need extensive scientific research to prove their preference over pharmaceuticals. It can be achieved by enactment of Functional Independence measure scale (FIM) putforth Nutraceutical Research and Education Act (NREA) which includes Nutraceutical Commission (NUCOM) for the development, review and approval of nutraceuticals as well as clinical research. Inclination from Pharmaceuticals to nutraceuticals indicates the shifting trend in health care sector. Tremendous growth in nutraceutical industry has implications for food, pharmaceutical and agriculture sector. According to a latest research report by Grand View Research, nutraceutical market is projected to reach worth USD 578.23 Billion with CAGR of 8.8% by 2025.

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