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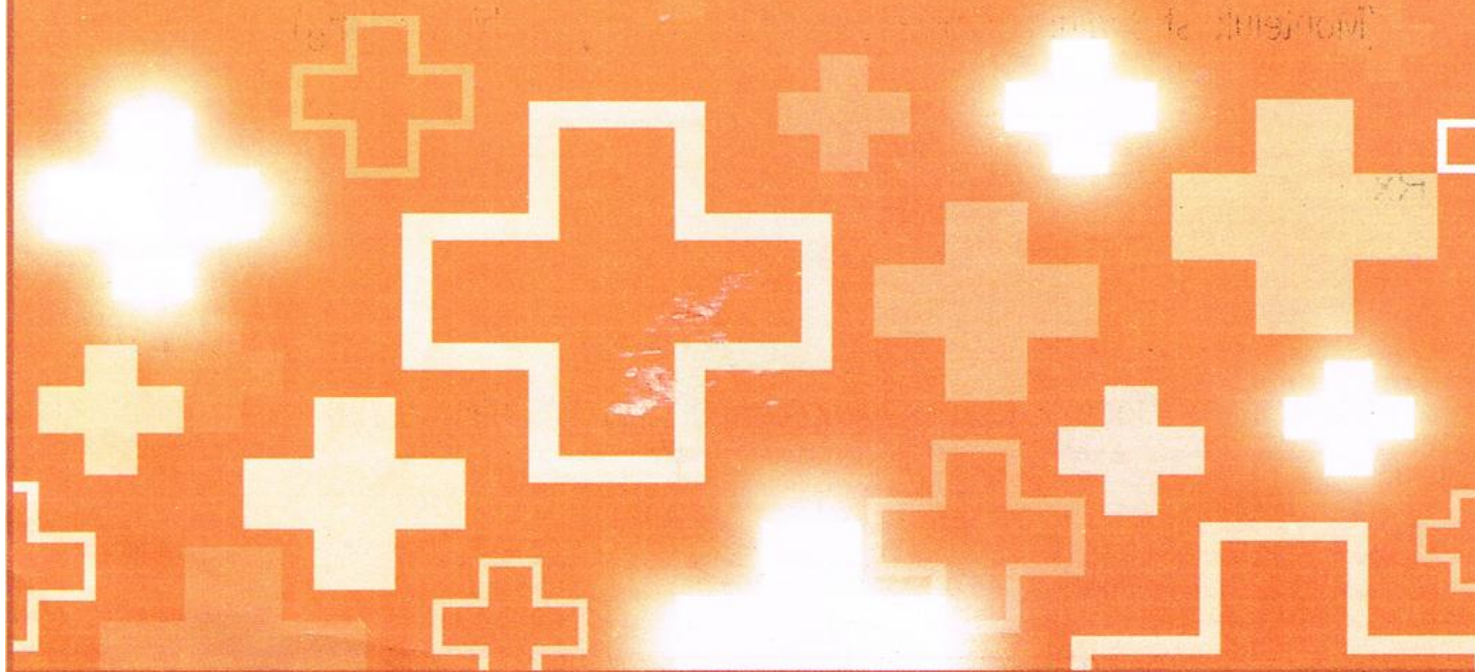
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# Nutraceuticals and chronic diseases

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## Background

Nutraceutical is a food or food product that provides health and medical benefits, including the prevention and treatment of disease. A nutraceutical have a physiological benefit or provide protection against chronic disease<sup>1</sup>. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered foods, herbal products, and processed foods such as cereals, soups, and beverages. It is a food stuff that provides health benefits<sup>2</sup>. The use of nutraceuticals, with reduced side effects, as compared with other therapeutic agents, analysis of food was limited to the flavor of food and its nutritional value (composition of carbohydrates, fats, proteins, water, vitamins and minerals). These chemical components are derived from plant, food, and microbial sources, and provide medicinal benefits valuable to long-term health. Some of these nutraceutical chemicals include probiotics, antioxidants, and phytochemicals. Products prevent chronic diseases, improve health, delay the aging process, and increase life expectancy<sup>3</sup>. There are multiple different types of products that may fall under the category of nutraceuticals like Dietary supplements, Functional foods, Medical foods and Pharmaceuticals. Medicinal plants containing phytochemicals, secondary metabolites or primary metabolites that have a medicinal action in humans and animals.

Nutraceutical plants produce healthy phytochemical those are formulated and intake is in the form of capsules, tinctures or tablets. Functional foods are a component of nutraceuticals and are consumed as foods. Medicinal and nutraceutical plants offers a wide range of products utilized in the pharmaceutical and functional food industries. Nowadays, nutraceuticals have received considerable interest due to potential nutritional, safety and therapeutic effects. A market research recently proposed that the worldwide nutraceuticals market is expanding and would reach US \$250 billion by 2018<sup>4</sup>.

## Chronic Disease Dilemma

According to the World Health Organization (WHO), chronic diseases are the leading cause of mortality in the world, accounting for 63% of all deaths. Chronic conditions are non-infectious, of long duration and slow progression, like cardiovascular disease, dementia, osteoporosis and diabetes. Many of these diseases set in or start to cause symptoms from middle age onward. The close link between diet and chronic disease is widely recognized, and with the world's population rapidly aging, it is no surprise that fortified and functional products aimed at mature consumers attempting to stave off and/or manage chronic conditions are an increasingly important focus for food and beverage manufacturers. Recent studies have shown promising results for these compounds in various pathological complications such as diabetes, atherosclerosis, cardiovascular diseases, cancer and neurological disorders. These conditions involve many changes, including alterations redox state.

Most of nutraceuticals have antioxidant activity with the ability to counteract this situation. Hence, they are considered as healthy sources of health promotion, especially for prevention of life threatening diseases such as diabetes, infection, renal and gastrointestinal disorders<sup>5-8</sup>.

## Methods

The recently published papers about different aspects of nutraceuticals as alternative for pharmaceuticals were searched using scientific sites such as Medline, PubMed and Google Scholar. The used terms included nutraceutical and alzheimer, cardiovascular, cancer, diabetes, immune and inflammatory.

## Alzheimer's disease and nutraceuticals

Alzheimer's disease (AD) is the most common form of dementia. There is no cure for the disease and eventually leads to death. Most often, AD is diagnosed in people over 65 years of age, although the less prevalent early onset Alzheimer's can occur much earlier. There were 26.6 million sufferers worldwide in 2006 and is predicted to affect 1 in 85 people globally by 2050. Women are more affected in comparison to men, at a ratio of almost 2:1. Several lines of evidence suggest that oxidative stress might be related to a number of neurodegenerative disorders including AD. Nutraceutical antioxidants such as curcumin, lutein, lycopene, turmerin and  $\beta$ carotene may exert positive effects on specific diseases by combating oxidative stress. The growing trends in nutraceutical usage are due to the belief that these compounds are able to postpone the development of dementias such as AD<sup>9,10</sup>.

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## **Cardiovascular diseases and nutraceuticals**

Worldwide, the prevalence of CVD and the researches in this area is increasing. CVD is a term which is used for disorders of the heart and blood vessels and includes coronary heart disease (heart attack), peripheral vascular diseases, cerebrovascular disease (stroke), hypertension, heart failure, and so on. It is believed that low intake of vegetables and fruits is associated with a high mortality in CVD<sup>11, 12</sup>.

Majority of the CVD are preventable. Many studies have reported a protective role for a diet rich in vegetables and fruits against CVD. Nutraceuticals in the form of vitamins, minerals, antioxidants, dietary fibers and omega-3 polyunsaturated fatty acids together with physical exercise are recommended for prevention and treatment of CVD. The molecules such as polyphenols alter cellular metabolism and signaling, which is believed to reduce arterial disease.

Flavonoids are widely distributed in vegetables, onion, grapefruits, apples, cherries and red wine, playing a major role in prevention and curing the CVD. Flavonoids block the angiotensin converting enzyme, block the cyclooxygenase enzymes that break down prostaglandins, and prevent platelet aggregation. They also protect the vascular system that carries oxygen and nutrients to cells<sup>13, 14</sup>.

Flavonoid intake was significantly inversely associated with mortality from coronary heart disease and the incidence of myocardial infarction. Flavonoids in regularly consumed foods may reduce the risk of death from coronary heart disease, especially in elderly people.

Ginger has potent antioxidant and anti-inflammatory activities

and recently it has been recommended for various diseases including hypertension and palpitation. This plant has a good protective effect on toxicity of synthetic drugs, too. Phytosterols compete with dietary cholesterol by blocking the uptake as well as facilitating its excretion from the body. Hence, they have the potential to reduce the morbidity and mortality of CVD. Phytosterols occur in most plant species and although green and yellow vegetables contain significant amounts of sterols, their seeds concentrate them<sup>15, 16</sup>.

Fatty acids of the omega 3 series (n-3 fatty acids) present in fish are dietary components affecting plasma lipids and the CVD, like arrhythmias. Octacosanol, present in whole grains, fruits and leaves of many plants, has lipid lowering property, with no side effects.

## **Cancer and nutraceuticals**

Cancer has emerged as a major public health problem in developing countries. According to the World Cancer Report the cancer rates are increasing and it would be 15 million new cases in the year 2020 that is, a rise in 50%. A healthy lifestyle and diet can help in prevention of cancer.

Carotenoids are a group of phytochemicals responsible for different colors of the foods. They have antioxidant activities and effective on cancer prevention. Recent interest in carotenoids has focused on the role of lycopene in human health, especially in cancer disease. Unsaturated nature of lycopene it is considered to be a potent antioxidant and a singlet oxygen quencher. Lycopene concentrates in the prostate, testes, skin and adrenal where it protects against cancer. The linkage between carotenoids and prevention of cancer and CAD heightened the importance of vegetable and fruits in human diet. Lycopene contained

vegetables and fruits exert cancer protective effect via a decrease in oxidative stress and damage to DNA. Lycopene is one of the major carotenoids and is found exclusively in tomatoes, guava, pink grapefruit, water melon and papaya.

B-carotene has antioxidant activity and prevents cancer and other diseases. Among the carotenes,  $\beta$ -carotene has the most antioxidant activity. Alpha-carotene possesses 50–54% of the antioxidant activity of  $\beta$ -carotene, whereas epsilon carotene has 42–50% of the antioxidant activity. Chronic inflammation is associated with a high cancer risk. Chronic inflammation is also associated with immunosuppression, which is a risk factor for cancer. Ginseng is an example of an anti-inflammatory molecule that targets many of the key players in the inflammation to cancer sequence.

Nowadays, phytochemicals with cancer preventive properties have been on high attention. Chemopreventive components in fruits and vegetables, among other beneficial health effect, have potential anticarcinogenic and antimutagenic activities. A broad range of phytopharmaceuticals with a claimed hormonal activity, called "phytoestrogens," is recommended for prevention of prostate and breast cancers. Citrus fruit flavonoids are able to protect against cancer by acting as antioxidants.

Consumption of fruits and vegetables having cysteine, glutathione, selenium, Vitamin E, Vitamin C, lycopene, and various phytochemicals elevates the levels of antioxidative capacity. However, more investigations are needed to determine their beneficial effects in cancer prevention or treatment. Large scale clinical trials suggest that some agents such as green tea, Vitamins D and E, selenium,



lycopene, soy, anti-inflammatory and inhibitors of 5 $\alpha$  reductase are effective in preventing prostate cancer.

Several studies have shown the values of alternative and complementary medicine as adjuvant to chemotherapy or radiotherapy. Complimentary therapy may be reliable and useful supportive measure for prostate cancer patients. Majority of the studies have shown a preventive role for nutraceuticals in cancer, however more elaborate studies are needed<sup>17-19</sup>.

### **Diabetes and nutraceuticals**

The most common form of diabetes is type 2 diabetes with 95% prevalence and is associated with obesity. Although various drugs for prevention and treatment of diabetes have been introduced, however, globally the total number of people with diabetes with various causes is increasing. Diabetes, not only imposes considerable economic burdens on individual patients and their families but also places substantial economic burdens on society.

In recent years a wide range of herbal dietary supplements and herbal medicines have scientifically proven to benefit type 2 diabetes mellitus in preclinical studies, however, few have been proven to do so in properly designed randomized clinical trials.

Isoflavones, are phytoestrogens which have structural/functional similarities to human estrogen. Soy isoflavones have been studied most and their consumption have been associated with lower incidence and mortality rate of type II diabetes, heart disease, osteoporosis and certain cancers. Omega-3 fatty acids have been suggested to reduce glucose tolerance in patients predisposed to diabetes. For the synthesis of a long chain n-3 fatty acids, insulin

is required; the heart may thus be particularly susceptible to their depletion in diabetes. Ethyl esters of n-3 fatty acids may be potential beneficial in diabetic patients.

Lipoic acid is an antioxidant which is used for the treatment of diabetic neuropathy and seems to be effective as a long term dietary supplement for protection of diabetics from complications. Dietary fibers from psyllium have been used extensively 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<sup>20-22</sup>.

### **Inflammation and nutraceuticals**

Inflammation is characterized by swelling, pain, redness and heat, and is the response of body tissues to irritation or injury. Nutraceuticals that their influence on osteoarthritis has been tested are ginger, soybean, glucosamine, chondroitin, S adenosyl methionine. Although they are safe and well tolerated, however, the results are hampered by heterogeneity of the studies and inconsistent results. Vitamins C and D are micronutrients for which evidence of benefit exists. Resveratrol shows the strongest known anti-inflammatory phytochemical.

The omega-3 and omega-6 series have a significant role on diseases by generating potent modulatory molecules for inflammatory responses, including prostaglandins, leukotrienes, and interleukins.

Osteoarthritis is a debilitating joint disorder which affects the number of population. In 2004, the costs associated with all forms of arthritis were approximately 86 billion dollars. Joint discomfort from any joint disorders may reduce physical activity in subjects, resulting in energy imbalance and

weight gain. Increased weight can exacerbate existing problems, through additional stress on joints. Glucosamine and chondroitin sulfate are widely used to alleviate symptoms of osteoarthritis. These nutraceuticals seem to regulate gene expression and synthesis of NO and PGE<sub>2</sub>, providing a plausible explanation for their anti-inflammatory activities<sup>23</sup>.

### **Discussion**

Now a days, nutraceuticals have received high interests due to their potential nutritional and safety profile, other than therapeutic capability. Pharmaceutical and nutritional companies are aware of the changing trends which are due to the advantages of these compounds. Most of the nutraceuticals possess multiple therapeutic benefits. The present study devoted towards a better understanding of the nutraceuticals based on their pharmaceutical and therapeutic indications.

Pharmaceuticals are mostly considered as medications which are used mainly to treat diseases, however nutraceuticals are the substances which are mostly considered to prevent diseases. This distinction between pharmaceuticals and nutraceuticals is very erroneous and superficial. Pharmaceuticals and nutraceuticals both can cure and prevent disease(s) however, only pharmaceuticals have governmental sanction.

Pharmaceuticals are compounds which usually possess patent protection due to expensive testing. However, nutraceuticals do not need these testing documents. Medical foods or medicinal foods are a specific category of therapeutic agents that are considered for the nutritional management of a specific disease. For example, medicinal foods are designed to manage inflammatory conditions, cancer,



homocysteinemia, pancreatic exocrine insufficiency and other diseases. They also play a substantial protection against numerous age related or chronic diseases.

Herbal medicines that are used as a nutrient are considered in this category. Nutraceuticals found in many fruits and vegetables are responsible for health benefits. Due to these health benefits of nutraceuticals, they might regularly be taken to cure or reduce the risk factors such as high cholesterol, high blood pressure and diabetes. Some of the most popular nutraceuticals products marketed today are botanicals such as ginseng, ginkgo biloba and St. John's wort. The list of nutraceuticals being studied is changing continually and reflects ongoing market developments, research, and consumer interest. With rapidly increasing interest in the nutraceuticals consumption, substantial researches are absolutely necessary to warrant the nutraceuticals usage safe and effective.

## Conclusion

Nutraceuticals might be defined as substances that have physiological benefits or provide protection against chronic diseases. Nutraceuticals may be used to improve health, delay the aging process, prevent chronic diseases, increase life expectancy, or support the structure or function of the body. Nowadays, nutraceuticals have received considerable interest due to potential nutritional, safety and therapeutic effects. Recent studies have shown promising results for these compounds in various complications. In the present review much effort has been devoted to provide their diseases modifying indications related to oxidative stress including allergy, Alzheimer, cardiovascular, cancer, diabetes, eye, immune,

inflammatory and Parkinson's diseases as well as obesity.

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Obese patients on warfarin may be at greater risk of bleeding than those of normal weight.

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