

# Importance of Nutraceuticals in Various Diseases and Human Health: A Comprehensive Review.

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**Abstract:** Nutraceuticals is a broad umbrella term that is used to describe any product derived from food sources with extra health benefits in addition to the basic nutritional value found in foods. They can be considered non-specific biological therapies used to promote general well-being, suspend senescence, avert infections, ailments and control symptoms and prevent malignant processes. The term “nutraceutical” combines two words- “nutrient” (a nourishing food component) and “pharmaceutical” (a medical drug). The name was coined in 1989 by Stephen Defelice. Presently population is gradually suffering from many metabolic and degenerative diseases, which are primarily caused by nutritional deficiency. Nutraceuticals have made a special attention among health professionals and people for their nutritional supplementation. It can provide substantial health benefits especially in the prevention and treatment of acute and chronic diseases. The extensive research have revealed the involvement of nutraceuticals in treatment of many diseases viz., cancer, arthritis, metabolic abnormalities, diabetes, obesity, osteoporosis, allergies etc. The present review is an attempt to classify nutraceuticals followed by their applications in the treatment of various diseases. In the present review much effort has been devoted to present new concepts about nutraceuticals based on their disease modifying indications.

**Keywords:** Nutraceuticals, nutritional supplementation, various diseases.

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## I. Introduction:

Urbanization, industrialization, hectic life schedules and changing cultures have drastically changed the lifestyle of humans over last few decades. These factors have changed human eating habits and have forced them to depend on fast eating, taking instant and tasty food, fast food or junk food. These habits have directly affected our nutritional aspect of food and gradually decreased the quantity and quality of nutrients. Due to these altered dietary habits, population have increased the incidence of immune dysfunctions, metabolic disorders and degenerative disorders (Nema et. al, 2018). In recent years people are getting consciousness about their health and deeply concerned about the management of health. In last two decades, revolution in the field of medicine, phytomedicine, nutritional science, food industry and health care have promoted extensive attention in health professionals in particular and public in general. Major recent advancement has been done in nutraceuticals- a great concept designed by pharmaceutical companies for wellness, prevention and treatment of diseases. Nutraceuticals have received considerable interest because of their presumed safety and potential nutritional and therapeutic effects. (Ashwini et. al, 2013).

Nutraceutical is any non-toxic food component which have been used for the improvement and maintenance of health. The term was coined by Stephen De Felice in 1989. According to him, a nutraceutical is a food or part of food that provides remedy to medical or health diseases. Nutraceuticals may range from isolated nutrients, herbal products, dietary supplements, genetically improved foods, processed food products. Generally nutraceuticals contain vitamins, lipids, proteins, carbohydrates, minerals and other necessary nutrients. Hippocrates known as the father of medicine, correctly emphasized “let food be your medicine and medicine be your food”. So nutraceuticals are the medicinal foods that play an important role in maintaining well-being, enhancing health, modulating immunity, preventing as well as treating specific diseases and thereby stimulating optimal longevity and quality of life. Thus the field of nutraceuticals can be envisioned as one of the missing blocks in the health benefit of an individual. It has been scientifically proven and supported by various research articles that nutraceuticals are efficacious to treat and prevent various diseased condition (Rama et. al, 2006).

**Aims and Objectives:** The present study aims to validate the nutraceutical aspect in treatment of various diseases and maintenance of human health.

**Material and Methods:** Review of all literature regarding dietary supplements, various diseases and nutraceuticals starting from classical text to all available scientific publications.

## **II. Discussion:**

➤ **Classification of Nutraceuticals:** Nutraceuticals are products derived from food sources that are purported to provide extra health benefits in addition to the basic nutritional value found in foods. Nutraceuticals can be organized in several ways depending upon its easier understanding and application i.e. academic instruction, clinical trial designs, functional food development or dietary recommendations. Based on the availability of food in the market, nutraceuticals are categorized as (Chaudhuri et. al., 2017)

- I) Traditional nutraceuticals
- II) Non-traditional nutraceuticals
- III) Commercial nutraceuticals

**I) Traditional nutraceuticals:** These are natural food products with no changes to the actual food stuff. Many fruits, vegetables, grains, fish, dairy and meat products contain several natural components that deliver benefits beyond basic nutrition such as Lycoming in tomatoes, omega-3 fatty acids in Salmon or saponins in soy. Even tea and chocolate have been noted in some studies to contain health-8benefitting attributes (Ashwini et. al., 2013). Different types of traditional nutraceuticals are as follows (Chaudhuri et. al., 2017):

- a) Chemical constituents
- b) Probiotic
- c) Prebiotic
- d) Nutraceutical enzymes
- e) Dietary Fibers

**a) Chemical constituents:** These are further of following types

- Nutrients
- Herbal
- Phytochemicals

➤ **Nutrients:** These are the substances with established nutritional functions such as vitamins, minerals, amino acids and fatty acids. For example vitamin A is essential for treatment of many skin diseases, vitamin K is essential for blood clotting whereas fatty acids are involved in whole inflammatory responses and functioning of brain (Allen et al., 1997).

➤ **Herbals:** Nutraceuticals hold a great promise to improve health and prevent chronic diseases with the help of Herbals. For example Alovera gel dilates the capillaries and is having wound healing properties. Echinacea help in the treatment of symptoms of cold and flu. Gingko helps in the treatment of post thrombotic syndrome. (Tyler and Foster, 1996).

➤ **Phytochemicals:** These are secondary metabolites and also act as nutraceuticals. These are non-nutritive plant chemicals that have either defensive or disease protective properties. Chief Phytochemicals are polyphenol, isoflavonoids, anthocyanidins, phytoestrogens, terpenoids, carotenoid, limonoids, phytosterols, glucosinolates, polysaccharides etc. Carotenoid help in improving immune system. Non-carotenoids present in legumes, grains, palm oil etc. help in removing the cholesterol and are anticarcinogenic. Flavonoids present in the plants help in the prevention of different diseases like cancer, diabetes, heart diseases and kidney problems (Ehrlich, 2009).

**b) Probiotics:** These are live microbial feed supplement for improving its intestinal microbial balance. Specific Prebiotic are used to treat lactose intolerance, acute diarrhea and antibiotic associated gastrointestinal side effects. They help in the production of the specific enzyme (beta-galactose) that hydrolyzed the offending lactose into its component sugars. Lactobacillus bacteria and bifidobacteria are most important Prebiotic ( Nema et. al., 2018).

**c) Prebiotics:** Prebiotic are nutraceuticals which promote the flourishing of probiotics. These are the dietary ingredients that affect the host by selectively altering the composition or metabolism of gut flora. These are short chain fructo-oligosaccharides. Their consumption generally promotes the lactobacillus and bacterial

growth in the gut which helps in metabolism. It is beneficial in improving lactose intolerance, detoxification, dyslipidemia, relief from constipation and in certain tumors. Insulin is a Prebiotic obtained from the roots of plants such as chicory, Jerusalem artichoke and dandelions broadly used in processed foods (Montrose and Floch, 2005).

**d) Nutraceutical Enzymes:** Enzymes are an essential part of the body which is responsible for many biological functions. Plants, animals and microbes are the source of nutraceutical enzymes. (Chaudhuri et al., 2017). Enzyme supplements to diet eliminate many symptoms of hypoglycemia, hyperglycemia, digestive problems and obesity.

**e) Dietary Fibers:** These are edible plant material that is not hydrolyzed by Enzymes of digestive tract but digested by microflora in the gut. They mostly include non-starch polysaccharides (NPS) such as cellulose, hemicelluloses, gums, pectin, lignin, resistant dextrose and resistant starches and foods rich in soluble fiber including fruits, oats, barley and beans.

**II) Non-traditional nutraceuticals:** These are artificial products made with some changes to the actual food stuff with the aid of biotechnology in order to increase the nutrient content. Certain crops like rice and broccoli are biotechnologically designed crops rich in beta-carotene and vitamins respectively. They are categorized as:

- a) Fortified nutraceuticals
- b) Recombinant nutraceuticals

**a) Fortified nutraceuticals:** The addition of well compatible nutrients with respect to the main ingredients by using agricultural breeding are included in these type of nutraceuticals. Some of the examples are milk fortified with cholecalciferol used in the deficiency of vitamin D, cereals added with minerals, flour Fortified with calcium, iron and folic acid (Casey et. al, 2010).

**b) Recombinant nutraceuticals:** Extraction of bioactive components and the production of energy giving foods (cheese, yogurt, bread, fermented starch etc.) by enzymatic technology and by the application of biotechnology and genetic engineering comprises of recombinant nutraceuticals (Singh and Sinha, 2012).

**III) Commercial nutraceuticals:** Now a days consumers are much aware of the importance of healthy diet and lifestyle. This awareness increased the demand for nutraceutical supplements. Most of the pharmaceutical companies are trying to produce nutraceuticals as there is definitely a very massive and rising market. Anti-arthritis, cough and cold, sleeping disorders, digestion and prevention of certain cancers, osteoporosis, blood pressure, cholesterol, diabetes and depression are some of the therapeutic areas covered by nutraceuticals (Chaudhuri et al, 2017). Some of these are:

**a) Dietary supplements:** A dietary supplement is a product that contains dietary nutrients derived from food products are intended to add further nutritional value to the diet. In the United States, the Dietary Supplement Health and Education Act (DSHEA) of 1994 defined the term, "A dietary supplement is a product taken by mouth that contains a "dietary ingredient" intended to supplement the diet. The dietary ingredients in these products may include: vitamins, minerals, herbs or other botanicals, amino acids and substances such as enzymes, organ tissues, glandulars and metabolites. Dietary supplements can also be extracts or concentrates and may be found in many forms such as tablets, capsules, softness, gel caps, liquids or powders. (Nema et al, 2018).

**b) Functional food:** Any food component that possesses the ability to provide valuable health benefits beyond the basic fundamental nutrition is known as functional food (Spano, 2010). Some examples of functional food (legumes) like kidney beans, split beans, chickpeas, lentils and soya beans have profound antioxidant value and show a protective effect against cardiovascular diseases and diabetes (Thompson et. al, 2012).

**c) Medicinal food:** These are specific category of therapeutic agents that are proposed for managing distinctive nutritional requirements of a particular disease, administered under the supervision of a physician. In some medical conditions like impaired ingestion, digestion, absorption, they are prescribed by physician.

**d) Pharmaceuticals:** Nutraceuticals are pharmaceutical products having bioactive Phytochemical or Zoolochemical agents which are used in enhancing health in dosages

➤ **NUTRACEUTICALS AND DISEASES**

Worldwide, the burdens of chronic diseases like cardiovascular diseases, cancers, diabetes and obesity is rapidly increasing. In 2001, chronic diseases contributed approximately 59% of the 56.5 million total reported deaths in the world and 46% of the global burden of disease.

**1. Cardiovascular diseases :** Cardiovascular diseases (CVD) is the name for the group of disorders of the heart and blood vessels and include hypertension (high blood pressure), coronary heart disease (heart attack), cerebrovascular disease (stroke), heart failure, peripheral vascular disease, etc. In 1999 CVD alone contributed to a third of global deaths and by 2010 it would be the leading cause of death in developing countries. Majority of the CVD are preventable and controllable. It was reported that low intake of fruits and vegetables is associated with a high mortality in cardiovascular disease (Rissanen et al., 2003). Many research studies have identified a protective role for a diet rich in fruits and vegetables against CVD (Hu and Willet, 2002).

This apart, nutraceuticals in the form of antioxidants, dietary fibers, omega-3 polyunsaturated fatty acids (n-3 PUFAs), vitamins, and minerals are recommended together with physical exercise for prevention and treatment of CVD. It has been demonstrated that the molecules like polyphenols present in grapes and in wine alter cellular metabolism and signalling, which is consistent with reducing arterial disease (German and Walzem, 2000)

Optimal nutrition, nutraceuticals, vitamins, antioxidants, minerals, weight reduction, exercise, cessation of smoking, restriction of alcohol and caffeine plus other lifestyle modifications can prevent, delay the onset, reduce the severity, treat, and control hypertension. Nutrients and nutraceuticals with calcium channel blocking activity (thus antihypertensive activity) include  $\alpha$ -Lipoic acid, magnesium, Vitamin B6 (pyridoxine), Vitamin C, N-acetyl cysteine, Hawthorne, Celery,  $\omega$ -3 fatty acids etc. (Houston, 2005).

Flavonoids are widely distributed in onion, endives, cruciferous vegetables, black grapes, red wine, grapefruits, apples, cherries and berries (Hollman et al, 1996). Flavonoids in plants available as flavones (containing the flavonoid apigenin found in chamomile); flavanones (hesperidin - citrus fruits; silybin- milk thistle flavonols (tea: quercetin, kaempferol and rutin grapefruit; rutin- buckwheat; ginkgo flavonglycosides - ginkgo), play a major role in curing the cardiovascular diseases (Hollman et al, 1996). Flavonoids block the angiotensin-converting enzyme (ACE) that raises blood pressure; by blocking the "suicide" enzyme cyclooxygenase that breaks down prostaglandins, they prevent platelet stickiness and hence platelet aggregation. Flavonoids also protect the vascular system and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells. Flavonoids block the enzymes that produce estrogen, thus reducing the risk of estrogen-induced cancers.

Polyphenols are simple phenolic molecules to highly polymerized compounds with molecular weights of greater than 30,000 Da. Stilbenes, anthocyanins, condensed tannins (proanthocyanidins), in grape and wine, tetrahydro- $\beta$ -carboline, dietary indoleamines, melatonin, and serotonin, in different plant foods are hypothesized to impart health benefits, associated with Mediterranean dietary style (Inti and Faoro, 2006) Hesperidin is a flavanone glycoside which is classified as a citrus bioflavonoid. Sweet oranges (*Citrus sinensis*) and tangelos are the richest dietary sources of hesperidin. The peel and membranous parts of lemons and oranges have the highest hesperidin concentrations. Therefore, orange juice containing pulp is richer in the flavonoid than that without pulp. Hesperidin, in combination with a flavone glycoside called diosmin, is used for the treatment of venous insufficiency and hemorrhoids. Hesperidin, rutin and other flavonoids are reported to possess analgesic and anti-inflammatory activity (Garg et al, 2001). 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 in elderly men (Hertog et al, 1993).

Ginger, the rhizome of *Zingiber officinalis*, one of the most widely used species of the ginger family, is a common condiment for various foods and beverages. Ginger has a long history of medicinal use dating back 2500 years. Some pungent constituents present in ginger and other zingiberaceous plants have potent antioxidant and anti-inflammatory activities, and some of them exhibit cancer preventive activity. The anticancer properties of ginger are attributed to the presence of certain pungent vallinoids, viz. [6]-gingerol and [6]-paradol (Shukla and Singh, 2007). Animal studies provide provides sound mechanistic basis for the use of ginger in hypertension and palpitations (Gayur et al, 2005). Ginger has some antiemetic properties but clinical evidence beyond doubt is only available for pregnancy-related nausea and vomiting. Preclinical safety data do not rule out potential toxicity, especially following ginger consumption over longer periods (Chrubasik et al, 2005).

Cholesterol has long been implicated as a significant risk factor in cardiovascular disease. Sterols occur in most plant species and are called as phytosterols. Although green and yellow vegetables contain significant amounts, their seeds concentrate the sterols. Phytosterols compete with dietary cholesterol by blocking the uptake as well as facilitating its excretion from the body. Phytosterols in diet have the potential to reduce the

morbidity and mortality from cardiovascular disease (Dutta,2003). *Fagopyrum esculentum Moench* (common buckwheat or sweet buckwheat), originated in Asia. Buckwheat seeds possess proteins, flavonoids, flavones, phytoosterols, thiamin-binding proteins etc. Buckwheat proteins are beneficial in constipation and obesity and more importantly lower cholesterol and high blood pressure (Si-quan and Zhang, 2001)

Dietary fiber preparation from defatted rice bran has laxative and cholesterol-lowering ability with attendant benefits towards prevention or alleviation of cardiovascular disease, diabetes, diverticulosis and colon cancer. It has been suggested that rice bran is a good fiber source (27%) that can be added to various food products (Hamid and Luan, 2000).

Milk and eggs are the important animal sources of nutraceuticals like proteins and polyunsaturated fats or essential fatty acids (EFAs). EFAs 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, and other cardiovascular diseases (Gita, 2004). Nutritional value of egg is increased because of added gamma linolenic acid (GLA) which has many benefits, including prevention and management of CVD like hypertension (Tucker, 2003).

Fatty acids of the omega-3 series (n-3 fatty acids) present in fish are well established dietary components affecting plasma lipids and the major cardiovascular disorders, such as arrhythmias (Sidhu, 2003). **Octacosanol is a 28-carbon chain alcohol. This nutraceutical is present in fruit, leaves and skin of many plants and whole grains (Kato et al, 1995). It has gastroprotective and lipid lowering effects. Since it has no side effects further studies may be undertaken to prove the claims (Rapport and Lockwood, 2000).**

### **Current status of nutraceuticals in CVD**

Because of the extremely long history of CVD, the causal relationship of nutrition/physical exercise on major CVD events is still difficult to assess prospectively (Ignarro et al, 2007). The relationship between calcium and risk of hypertension is inconsistent and inconclusive, and the relationship between calcium and risk of pregnancy-induced hypertension and preeclampsia is highly unlikely (Trumbo et al, 2007). Treatment with beta carotene, vitamin A, and vitamin E may increase mortality. The potential roles of vitamin C and selenium on mortality need further study (Bjelakovic et al,2007). There are possibilities to develop nutraceuticals to prevent and manage thrombosis risk in women with thrombophilic gene mutations (Subbiah, 2007).

**2. Obesity:** Obesity, defined as an unhealthy amount of body fat, is a well-established risk factor for many disorders like angina pectoris, congestive heart failure, hypertension, hyperlipidemia, respiratory disorders, renal vein thrombosis, osteoarthritis, cancer, reduced fertility etc. (Cateron and Gill, 2002). Obesity is now a global public health problem, with about 315 million people are estimated to fall into the WHO-defined obesity categories.

One of the primary causes of this rapid rise in obesity rates is the increased availability of high-fat, energy-dense foods (Mermel, 2004). Excessive consumption of energy-rich foods (snacks, processed foods and drinks) can encourage weight gain, which calls for a limit in the consumption of saturated and trans fats apart from sugars and salt in the diet. Caloric restriction and increased physical activity has been shown to be only moderately successful in managing obesity. Thus many health care practitioners and obese individuals are seeking the help of pharmaceuticals and nutraceuticals to treat obesity. A tolerable and effective nutraceutical that can increase energy expenditure and/or decrease caloric intake is desirable for body weight reduction. Herbal stimulants, such as ephedrine, caffeine, ma huang-guarana, chitosan and green tea have proved effective in facilitating body weight loss (Schiller et al, 2001). However, their use is controversial due to their ability to cause undesired effects. Buckwheat seed proteins have beneficial role in obesity and constipation acting similar to natural fibers present in food (Si-quan and Zhang, 2001) . 5-hydroxytryptophan and green tea extract may promote weight loss, while the former decreases appetite, the later increases the energy expenditure (Bell and Goodrick, 2002).

### **Current status of nutraceuticals in obesity**

A blend of glucomannan, chitosan, fenugreek, *G sylvestre*, and vitamin C in the dietary supplement significantly reduced body weight and promoted fat loss in obese individuals. Further studies are needed to establish a long term efficacy and adverse effect potential (Woodgate and Conquer, 2003). There is a very high prevalence of obesity globally and hence nutrition and exercise play a key role in its prevention and treatment. Nutraceutical interventions are currently being investigated on a large-scale basis as potential treatments for obesity and weight management. Nutraceuticals like conjugated linoleic acid (CLA), capsaicin, *Momordica Charantia* (MC) and Psyllium fiber possess potential antiobese properties (Kasbia, 2005).

**3. Diabetes:** Diabetes mellitus is characterized by abnormally high levels of blood glucose, either 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. Gestational diabetes occurs in pregnancy. Globally the total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030 (Wild et al, 2004). Diabetes, like most chronic health conditions, not only places substantial economic burdens on society as a whole but also imposes considerable economic burdens on individual patients and their families. In US alone an estimated the expenditures for health care for people with diabetes totalled \$85.7 (11.9% of total health care expenditures) in 1992 (Rubin et al, 1994).

Diet therapy is the cornerstone for the management of gestational diabetes mellitus. Although there is widespread use of herbal dietary supplements that are believed to benefit type 2 diabetes mellitus, few have been proven to do so in properly designed randomized trials. Isoflavones are phytoestrogens; they have a structural/functional similarity to human estrogen and have been consumed by humans world-wide. Of all phytoestrogens, soy isoflavones have been studied most. A high isoflavone intake (20–100 mg/day) is associated with lower incidence and mortality rate of type II diabetes, heart disease, osteoporosis and certain cancers (Brouns, 2002).

Omega-3 fatty acids have been suggested to reduce glucose tolerance in patients predisposed to diabetes. For the synthesis of the 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 (Sirtori and Galli, 2002). Docosahexaenoic acid modulates insulin resistance and is also vital for neurovisual development. This is especially important in women with gestational diabetes mellitus which foster the recommendation for essential fatty acids during pregnancy (Thomas et al, 2006).

Lipoic acid is a universal antioxidant, now used in Germany for the treatment of diabetic neuropathy. It is possible that lipoic acid may be more effective as a long-term dietary supplement aimed at the prophylactic protection of diabetics from complications (Coleman et al, 2001). 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 (Baljit, 2007).

Good magnesium status reduces diabetes risk and improves insulin sensitivity; chromium picolinate, calcium and vitamin D appear to promote insulin sensitivity and improve glycemic control in some diabetics; extracts of bitter melon and of cinnamon have the potential to treat and possibly prevent diabetes. However it has been suggested that nutraceuticals with meaningful doses of combinations may substantially prevent and presumably could be marketed legally (McCarty, 2005).

**4. Cancer:** In the year 2000, malignant tumors were responsible for 12 per cent of the nearly 56 million deaths worldwide from all causes. According to the World Cancer Report the cancer rates there would be 15 million new cases in the year 2020 i.e. a rise in 50%. Cancer has emerged as a major public health problem in developing countries, matching the industrialized nations. A healthy lifestyle and diet can help in preventing cancer (Willis and Wians, 2003). People who consume large amount of lutein-rich foods such as chicken eggs, spinach, tomatoes, oranges and leafy greens experienced the lowest incidence of colon cancer (Nkondjock and Ghadirian, 2004). Chronic inflammation is associated with a high cancer risk. At the molecular level, free radicals and aldehydes, produced during chronic inflammation, can induce deleterious gene mutation and posttranslational modifications of key cancer-related proteins. Chronic inflammation is also associated with immuno suppression, which is a risk factor for cancer. Ginseng as an example of an antiinflammatory molecule that targets many of the key players in the inflammation-to-cancer sequence (Hofseth and Wargovich, 2007).

Recently, attention has been on phytochemicals that possess cancer-preventive properties. Besides chemopreventive components in vegetables and fruits, some phytochemicals derived from herbs and spices also have potential anticarcinogenic and antimutagenic activities, among other beneficial health effect. A broad range of phyto-pharmaceuticals with a claimed hormonal activity, called "phyto-estrogens", is recommended for prevention of prostate/breast cancer (Limer and Speirs, 2004).

Flavonoids found in citrus fruit appear to protect against cancer by acting as antioxidants (Frydoonfar et al, 2003). Soyfoods are a unique dietary source of isoflavones, the polyphenolic phytochemicals exemplified by epigallocatechin gallate from tea (Mandel et al, 2005) curcumin from curry and soya isoflavones possess cancer chemopreventive properties (Thomasset et al.,2007).The main soybean isoflavones, genistein, daidzein, biochanin inhibits prostate cancer cell growth (Messina, 2003). Carotenoids are a group of phytochemicals that are responsible for different colors of the foods. Recent interest in carotenoids has focused on the role of lycopene in human health. Because of the unsaturated nature of lycopene it is considered to be a potent antioxidant and a singlet oxygen quencher (Rao and Rao,2007). Lycopene prevents cancer, cardiovascular disease, and gastrointestinal tract. It concentrates in the skin, testes, adrenal and prostate where it protects against cancer (Kucuk et al, 2002). The linkage between carotenoids and retinoids and the prevention of cancer coronary artery diseases, and advanced age-related macular degeneration heightened the importance of value-added fruits in human diet. Recently, it was reported that lycopene containing fruits and vegetables exert cancer-protective effect via a decrease in oxidative and other damage to DNA in humans (Stahl and Sies, 2005).

Lycopene is one of the major carotenoids in western diets and is found almost exclusively in tomatoes, water melon, guava, pink grapefruit and papaya (Miller et al, 2002).

Beta-carotene, the important precursor of vitamin A has anti-oxidant properties and help in preventing cancer and other diseases. Among the carotenes, beta carotene is the most active as antioxidants. Alpha carotene possesses 50% to 54% of the antioxidant activity of beta carotene, whereas epsilon carotene has 42% to 50% of the antioxidant activity. Alpha and beta carotenes, along with gamma carotene and the carotenes lycopene and lutein (McMillan et al, 2002 ) which do not convert to vitamin A, seem to offer protection against lung, colorectal, breast, uterine and prostate cancers.  $\beta$ -Carotene is the more common form and can be found in yellow, orange, and green leafy fruits and vegetables. These can be carrots, spinach, lettuce, tomatoes, sweet potatoes, broccoli, cantaloupe, oranges, and winter squash.

Saponins are reported to possess antitumor and anti-mutagenic activities and can lower the risk of human cancers, by preventing cancer cells from growing. Saponins are phytochemicals which can be found in peas, soybeans, and some herbs with names indicating foaming properties such as soapwort, soapbark and soapberry. They are also present in spinach, tomatoes, potatoes, alfalfa and clover. Commercial saponins are extracted mainly from *Yucca schidigera* and *Quillaja saponaria*. The non-sugar part of saponins has also a direct antioxidant activity, which may result in other benefits such as reduced risk of cancer and heart diseases (Gulping et al, 2006). Tannins also called proanthocyanidins, detoxify carcinogens and scavenge harmful free radicals (Li et al, 2003). Tannins in cranberries also protect against urinary tract infections. It is present in blackberries, blueberries, cranberries, grapes, lentils, tea and wine.

Ellagic acid is a proven anti-carcinogen (Sudheer et al, 2007) is used in alternative medicine and to prevent cancer (Rommel and wrolstad, 1993) . It is present in strawberries, cranberries, walnuts, pecans, pomegranates and the best source, red raspberry seeds. Pectin is a soluble fiber found in apples. A new form of citrus pectin called modified citrus pectin (MCP) has been shown to prevent prostate cancer metastasis by inhibiting the cancer cells from adhering to other cells in the body. Several studies have also shown pectin to have positive influences in decreasing serum cholesterol levels, without effecting serum triglyceride levels. Pectin also has the ability to reduce the rise of blood sugar when combined with meal (Middleton and Kandaswami, 1994) . Naturally occurring phenolic acid derivatives are reported to possess potential anticancer properties (Gomes et al, 2003). Phenolics such as ferulic, caffeic, gallic acids and curcumin are reported to possess anticancer activity (Indap et al, 2006).

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 (Fenwick and Heaney, 1983) . Glucosinolates and their hydrolysis products, including indoles and isothiocyanates, and high intake of cruciferous vegetables has been associated with lower risk of lung and colorectal cancer They also regulate white blood cells and cytokines. White blood cells are the scavengers of the immune system and cytokines act as "messengers," coordinating the activities of all immune cells. Bio-transformation products of glucosinolates include isothiocyanates, dithiolthiones and sulforaphane. They block the enzymes that promote tumor growth, particularly in the breast, liver, colon, lung, stomach and esophagus (Higdon et al, 2007).

The sulphur compounds, in garlic were found to kill bacteria and parasites, boost the immune system and reduce atherogenesis and platelet stickiness. All members of the cruciferous family” broccoli, cauliflower, cabbage, bok choy, Brussels sprouts, collards, cress, kale, kohlrabi, mustard” contains a group of closely related sulphur compounds known as glucosinolates. Sulforaphane rich in broccoli is a potent phase 2 enzyme inducer. It produces D-glucarolactone, a significant inhibitor of breast cancer. Sulforaphane is an antioxidant and stimulator of natural detoxifying enzymes. Sulforaphane has been reported to reduce the risk of breast cancer and prostate cancer.

Thiosulfonates an organosulfur phytochemical is present in garlic and onions (*Allium cepa*). Onions are rich in two chemical groups that have perceived benefits to human health, which include anticarcinogenic properties, antiplatelet activity, antithrombotic activity, antiasthmatic and antibiotic effects (Griffiths et al, 2002).

Curcumin (diferuloylmethane) is a polyphenol derived from the plant *Curcuma longa*, commonly called turmeric. Curcumin, an active yellow pigment of turmeric reported to possesses anticarcinogenic, antioxidative and anti-inflammatory properties (Sanjay, 2006). The anticancer potential of curcumin stems from its ability to suppress proliferation of a wide variety of tumor cells. Top of Form Beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes, were reported to possess anti tumor activity (Thanapolou et al, 2006). **Non-prescription antioxidants and other nutrients (patients using beta-carotene; vitamins A, C, and E; selenium; cysteine; B vitamins; vitamin D3; vitamin K3; and glutathione as single agents or in combination.) do not interfere with therapeutic modalities for cancer (Auerbach,2006).**

### **Current status of nutraceuticals in cancer**

Approximately 20-30% of Americans consume multivitamin supplements daily, indicating high public interest in the prevention of cancer and other chronic diseases through a nutrition-based approach. Because epidemiologic studies generally evaluate foods rather than specific bioactive food components, a systematic approach to determining how combinations of vitamins and minerals may interact to ameliorate cancer risk is necessary to further our understanding of the potential benefits and risks of supplement use (Penner et al, 2005).

Increasing consumption of vegetables and fruits elevates the levels of antioxidative components, for example, selenium, vitamin E, vitamin C, lycopene, cysteine-glutathione and various phytochemicals. These detrimental processes of heme catalysis of oxidative damage hypothesized here are not well recognized. More investigative studies in this field to be done (Salvatore et al, 2007).

Large scale clinical trials suggest that some agents such as selenium, lycopene, soy, green tea, vitamins D and E, anti-inflammatory and inhibitors of 5 $\alpha$ -reductase are effective in preventing prostate cancer. In order to demonstrate clinical benefit with the minimum adverse effects. Appropriate selection of agent(s), trial design and end points is critical in selecting the most promising regimens to accomplish these goals (Weese and Arroyo, 2003).

Cancer was not prevented by beta-carotene, alpha-tocopherol, retinol, retinyl palmitate, N-acetylcysteine, or isotretinoin in smokers (Isolauri et al, 1991). Ongoing trials may help define new avenues for chemoprevention. The concept of chemoprevention in lung cancer is still in its infancy, but in the future it may have a significant impact on the incidence and mortality of lung cancer. Several studies have demonstrated the improvement in quality of life and the value of complimentary medicine as an adjuvant to chemotherapy or radiotherapy. Complimentary therapy might serve as a valuable and useful supportive measure for prostate cancer patients (Oksanen et al, 1990). Majority of the studies indicate a preventive role of nutraceuticals in cancer, however more elaborate randomized double blind studies are needed.

### **Immune boosters and anti-inflammatory agents**

#### **Immune boosters**

Various nutrients in the diet play a crucial role in maintaining an “optimal” immune response, on the organism’s immune status and susceptibility to a variety of disease conditions. A broad range of phyto-pharmaceuticals with a claimed hormonal activity, called “phyto-estrogens”, is recommended for prevention of various diseases related to a disturbed hormonal balance. In this respect, there is a renewed interest in soy isoflavones (genistein, daidzein, biochanin) as potential superior alternatives to the synthetic selective estrogen receptor modulators (SERMs), which are currently applied in hormone replacement therapy. Phytochemicals integrate hormonal ligand activities and interfere with signaling cascades; their therapeutic use may not be restricted to hormonal ailments only, but may have applications in cancer chemoprevention and/or certain inflammatory disorders as well (Dijsselbloem et al, 2004). Nutraceuticals that belong to the category of immune boosters and/or anti-viral agents are useful to improve immune function and accelerate wound-healing. They include extracts from the coneflowers, or herbs of the genus *Echinacea*, such as *Echinacea purpurea*, *Echinacea angustifolia*, *Echinacea pillida*, and mixtures thereof; extracts from herbs of the genus *Sambuca*, such as elderberries; and Goldenseal extracts. The coneflowers in particular are a popular herbal remedy used in the central United States, an area to which they are indigenous. The extract derived from the roots contains varying amounts of unsaturated alkyl ketones or isobutylamides. Goldenseal is an immune booster with antibiotic activity, and includes compounds like berberine and hydrastine, which stimulate bile secretion and constrict peripheral blood vessels respectively. *Astragalus membranaceus*, *Astragalus mongolicus*, and other herbs of the genus *Astragalus* are also effective immune boosters in either their natural or processed forms. *Astragalus* stimulates development and transformation of stem cells in the marrow and lymph tissue to active immune cells.

**The effect of plant and bacteria on systemic immune and intestinal epithelial cell function has led to new credence for the use of probiotics and nutraceuticals in the clinical setting. The probiotics have been found to effective in conditions like in infectious diarrhea in children and recurrent *Clostridium difficile* induced infections. Evidence is being acquired for the use of probiotics in other gastrointestinal infections, irritable bowel syndrome and inflammatory bowel disease (Gupta et al, 2000). The dietary approach to allergy has evolved to include active stimulation of the immature immune system in order to support the establishment of tolerance. Supplementation with probiotics may provide maturational signals for the lymphoid tissue and improve the balance of pro- and anti-inflammatory cytokines. Enteral polymeric feeding is effective in Crohn's disease. Dietary nucleotides may improve growth and immunity, optimize maturation, recovery and function of rapidly dividing tissue (Vanderhoof et al, 1999).**

Usage of probiotics (live viable microbial organisms) in the treatment of specific diseases has evolved into an extremely valuable option. the ability to reduce antibiotic use, the apparently very high index of safety,



and the public's positive perception about "natural" or "alternative" therapies. These products manipulated the intestinal microflora to maintain the normal balance between pathogenic and non-pathogenic bacteria. Therapeutic effects of most commercial preparations are unsubstantiated. Certain probiotics will be effective in the treatment or prevention of certain conditions (Fuller, 1991). Lactobacillus GG has been shown to be effective in the treatment or prevention of a number of problems including acute diarrhea in children (Gibbson and Fuller 2000), travellers' diarrhoea in adults (Divisi et al, 2006), Crohn's disease (MacAlindon,2006) and reduction of the incidence of antibiotic-associated diarrhoea in infants (Heitzman et al, 2005). Most probiotic preparations are comprised of one or more lactic acid bacteria (LAB). Within this group, strains of Lactobacillus, Bifidobacterium sp. and occasionally Streptococcus are most commonly used (Hardin,2007). A supplementary use of oral digestive enzymes and probiotics is also an anticancer dietary measure towards decreasing the incidence of breast, colon-rectal, prostate and bronchogenic cancer (Lyons et al, 2003).

**5. Inflammatory disorders:** Inflammation is the response of body tissues to injury or irritation, characterized by pain and swelling and redness and heat. Arthritis is a general term that describes inflammation in joints. Some types of arthritis associated with inflammation include: rheumatoid arthritis shoulder tendinitis or bursitis gouty arthritis and polymyalgia rheumatica.

Micronutrients for which preliminary evidence of benefit exists include vitamin C and vitamin D. In addition, numerous nutraceuticals that may influence osteoarthritis pathophysiology, including glucosamine, chondroitin, S-adenosylmethionine, ginger and avocado/soybean unsaponifiables, have been tested in clinical trials. These products are safe and well tolerated, but interpretation of the collective results is hampered by heterogeneity of the studies and inconsistent results (Jang et al, 1997).

Cat's claw is a potent anti-inflammatory agent. The two known species of cat's claw are *Uncaria guianensis*, used traditionally for wound healing, and *Uncaria tomentosa*, which has numerous medicinal uses and is most commonly found in supplements. Cat's claw is a rich source of phytochemicals: 17 alkaloids, along with glycosides, tannins, flavonoids, sterol fractions, and other compounds (Balch et al, 2003). Scientists previously attributed the efficacy of cat's claw to compounds called oxindole alkaloids; more recently, however, water-soluble cat's claw extracts that do not contain significant amounts of alkaloids were found to possess strong antioxidant and anti-inflammatory effects are independent of their alkaloid content (Clark,2007).

Resveratrol is present in the fruits of bilberry (*Vaccinium myrtillus*), the lowbush "wild" blueberry (*Vaccinium angustifolium*), the rabbiteye blueberry (*Vaccinium ashei* Reade), and the highbush blueberry (*Vaccinium corymbosum*). Although blueberries and bilberries were found to contain resveratrol, the level of this chemoprotective compound in these fruits was <10% that reported for grapes (Chan et al, 2005). Resveratrol shows the strongest sirtuin-like deacetylase action of any known phytochemical. Sirtuins have been shown to extend the lifespan of yeast and fruit flies. It acts as an anti-inflammatory agent, antifungal and inhibits cyclooxygenase-1 enzyme. Other beneficial health effects include anti-cancer, antiviral, neuroprotective, anti-aging and life-prolonging effects (Alarcon et al, 1994).

The omega-3 and omega-6 series play a significant role in health and disease by generating potent modulatory molecules for inflammatory responses, including eicosanoids (prostaglandins, and leukotrienes), and cytokines (interleukins) and affecting the gene expression of various bioactive molecules. Gamma linolenic acid (GLA, all cis 6, 9, 12-Octadecatrienoic acid, C18:3, n-6), is produced in the body from linoleic acid (all cis 6,9-octadecadienoic acid), an essential fatty acid of omega-6 series by the enzyme delta-6-desaturase. Preformed GLA is present in trace amounts in green leafy vegetables, nuts, vegetable oils, such as evening primrose (*Oenothera biennis*) oil, blackcurrant seed oil, borage oil and hemp seed oil, and from spirulina, cyanobacteria. It is a nutraceutical used for treating problems with inflammation and auto-immune diseases (Formica and Regelson, 1995).

The most significant source of GLA for infants is breast milk. GLA is further metabolized to dihomogamma linolenic acid (DGLA) which undergoes oxidative metabolism by cyclooxygenases and lipoxygenases to produce anti-inflammatory eicosanoid. Phytoconstituent gentianine present in Gentian root is an effective anti-inflammatory agent. Anti-inflammatory herbal nutraceuticals and anti-inflammatory nutraceutical compounds derived from plants or herbs may also be used as anti-inflammatory agents. These include 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.

## **6. Osteoarthritis**

Osteoarthritis (OA), a debilitating joint disorder, is the most common form of arthritis in the United States, where it affects an estimated 21 million people. In 2004, the direct and indirect health care costs associated with all forms of arthritis were approximately 86 billion dollars. Joint discomfort from OA and other joint disorders may reduce physical activity in individuals experiencing this condition, resulting in energy imbalance and weight gain. Increased weight can exacerbate existing problems, through additional stress on joints (Rice-Evans, 2001).

Glucosamine (GLN) and chondroitin sulfate (CS) are widely used to alleviate symptoms of OA. These nutraceuticals have both nutrient and pharmaceutical properties and seem to regulate gene expression and synthesis of NO and PGE2, providing a plausible explanation for their antiinflammatory activities (Kalioraa et al, 2006).

## **7. Allergy**

Allergy is a condition in which the body has an exaggerated response to either a drug or food. Quercetin (QR) belongs to a group of polyphenolic substances known as flavonoids. QR is a member of the class of flavonoids called flavonols. It is widely distributed in the plant kingdom in rinds and barks. Especially rich sources of QR include onions, red wine and green tea. QR is a natural antihistamine and opposes the actions of the histamine in the body. Histamines are responsible for allergic and inflammatory reactions. It can help reduce the inflammation that results from hay fever, bursitis, gout, arthritis, and asthma (Chidambara et al, 2005). QR inhibits some inflammatory enzymes, such as lipid peroxidases, and decreases leukotriene formation. QR has anti-inflammatory, antiviral, immunomodulatory, anticancer and gastroprotective activities. QR blocks an enzyme that leads to accumulation of sorbitol, which has been linked to nerve, eye, and kidney damage in those with diabetes.

QR also possesses potent antioxidant properties. It protects LDL cholesterol from becoming damaged. 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. QR also works as an antioxidant by scavenging damaging particles in the body known as free radicals. People with diabetes are at higher risk of blood vessel damage from free radicals (Kruger et al, 2002).

## **8. Degenerative diseases**

### **Macular degeneration**

**The prevalence and effects of age-related macular degeneration (AMD) are increasing dramatically as the proportion of elderly in our population continues to rise. A combination of vitamin C, vitamin E, beta-carotene, and zinc (with cupric oxide) is recommended for AMD (Alzheimer, 1907). Healthy lifestyle with a diet containing foods rich in antioxidants, like lutein and zeaxanthin, n-3 fatty acids, appears beneficial for AMD. Herbs or herbal extracts, such as garlic, (which contain allicin), green tea (containing catechins and bioflavonoids such as QR, hesperidin, rutin) are effective antioxidants.**

Bioactive components of food, which are of special interest, include the Vitamins E and C, polyphenols, carotenoids—mainly lycopene and  $\beta$ -carotene, and coenzyme Q10 possess antioxidant properties. High content of polyphenolic flavonoids in nutraceuticals and functional foods had been ascribed to possess antioxidant/radical scavenging activity (Geldmacher and Whitehouse, 1997). Antioxidant therapy is supposed to be effective in the early stages of atherosclerosis by preventing LDL oxidation and the oxidative lesion of endothelium.

Astaxanthin is an important naturally occurring molecule and the most abundant carotenoid in the marine world. It can be found in many of our favorite seafood such as salmon, trout, seabream and shrimps. Natural astaxanthin is produced from *Haematococcus pluvialis* microalgae. Unlike  $\beta$ -carotene, astaxanthin has no pro-vitamin A activity. It has a number of essential biological functions in aquatic animals such as protecting against oxidation process, protecting against UV light effects, immune response and pigmentation. It is also a very potent anti-oxidant and it has ten times more powerful antioxidant activity than any other carotenoids. For more than ten years, astaxanthin's role in enhancing the immune system and preventing oxidative stress has been the subject of international research. It offers powerful protection for the eyes and prevents macular degeneration. Prevents heart disease due to oxidative damage, boosts immune system function, protects the nervous system from degenerative diseases like Alzheimer's disease. It is used in drug delivery for medicines that are insoluble in water. *In vivo* antioxidant activity of carotenoids from green microalgae (*Dunaliella salina*) was reported (Cui et al, 2004).

## **9. Vision improving agents**

Lutein is one of the carotenoids, found in many fruits and vegetables including mangoes, corn, sweet potatoes, carrots, squash, tomatoes and dark, leafy greens such as kale, collards and bok choy. Lutein dipalmitate is found in the plant *Helenium autumnale*. Lutein also known as helenien is used for the treatment of visual disorders. Zeaxanthin is used in traditional Chinese medicine mainly 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, kale, collard greens, spinach, lettuce, kiwi and honeydew. Lutein and zeaxanthin are also found in nettles, algae and the petals of many yellow flowers. In green vegetables, fruits and egg yolk, lutein and zeaxanthin exist in non-esterified forms. They also occur in plants in the form of mono- or diesters of fatty acids. A new source of these carotenoids, a crystalline lutein product, is an extract from the

marigold flower (*Tagetes erecta*) that contains approximately 86% by weight of the carotenoids lutein and zeaxanthin (Fisher and Naughton, 2005).

#### **10. Alzheimer's disease**

Alzheimer's disease (AD) is characterized by progressive dementia with memory loss as the major clinical manifestation (Devising, 1978). In 1996, approximately 4 million people in the United States were clinically diagnosed with AD; which is expected to triple in the next 50 years (Etminon et al,2005). Women are more affected than men at a ratio of almost 2:1 due in part to the larger population of women who are over 70. Several lines of evidence strongly suggest that oxidative stress is etiologically related to a number of neurodegenerative disorders including Alzheimer's disease. Nutraceutical antioxidants like  $\beta$ -Carotene, curcumin, lutein, lycopene, turmeric etc may exert positive effects on specific diseases by neutralizing the negative effects oxidative stress, mitochondrial dysfunction, and various forms of neural degeneration (Glenville,2006).

A great deal of research has pointed to deleterious roles of metal ions in the development of Alzheimer's disease, by the augmentation of oxidative stress by metal ion. The growing trend in nutraceutical intake is in part a result of the belief that they postpone the development of dementias such as Alzheimer's disease. However, pathogenic events centered on metal ions are expected to be aggravated by frequent nutraceutical intake (Haider and Bhutta, 2006).

#### **11. Parkinson's disease**

Parkinson's disease is a brain disorder that results from nerve damage in certain regions of the brain causing muscle rigidity, shaking, and difficult walking (Losso,2003), usually occurring in mid to late adult life. Canadian researchers indicated that vitamin E in food may be protective against Parkinson's disease (Latif et al,2007) . Creatine appeared to modify Parkinson's disease features as measured by a decline in the clinical signs (Brower, 2005).

Researchers have also studied glutathione to determine its effect on nerve and its power as an antioxidant. The appropriate long-term dosing, side-effects and the most effective method of administration are not yet clear. Nutritional supplements have shown some promising results in preliminary studies, it is important to remember that there is not sufficient scientific data to recommend them for Parkinson's disease at present. The patients should be cautioned that over-the-counter medications do have side-effects and interactions with other drugs and are also expensive .

#### **12. Miscellaneous**

In our modern society women can be over-fed, but under-nourished which can lead to nutrient deficiencies with adverse impact on the pregnancy outcome. Good quality nutritional supplements (combinations rather than isolated single nutrients) can play a valuable role in the health of the pregnant mother and the baby though emphasis must always be on eating a good diet. There is also insufficient evidence to identify adverse effects and to say that excess multiple-micronutrient supplementation during pregnancy is harmful to the mother or the fetus.

Angiogenesis is an enzymatic process involved in almost all classes of enzymes. It is a process that is generally down regulated in healthy individuals. Anti-angiogenic compounds are selective against newly formed blood vessels while sparing existing ones may not lead to side effects even after prolonged exposure. Available indirect evidences suggest that antiangiogenic compounds may prevent diseases involving degenerative process like, arthritis, multiple sclerosis, Alzheimer's, Parkinson's, osteoporosis, diabetes and cancer. Many inhibitors of angiogenesis are being isolated from functional foods. Naturally occurring bioactive compounds are speculated to be potentially effective and safe anti-angiogenic compounds. Such compounds include catechins, flavins, Curcumin, Isoflavones, Resveratrol, proanthocyanidins, flavonoids, Saponins, terpenes, Chitin, chitosan, Vitamins B3, Vitamin D3, Fatty acids, peptides and amino acids (alpha 2-macroglobulin, arginine, phenylalanine etc.

Psyllium, a dietary fiber is valuable in the management of irritable bowel syndrome, inflammatory bowel disease-ulcerative colitis, colon cancer, constipation (Baljit, 2007).

*Moringa oleifera* Lam (Moringaceae) has an impressive range of medicinal uses with high nutritional value. Different parts of this plant contain a profile of important minerals, and are 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, caffeoylquinic acid and kaempferol. With water purifying powers and high nutritional value. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods act as cardiac and circulatory stimulants, possess antitumor, antipyretic, antiepileptic, antiinflammatory, antiulcer, antispasmodic, diuretic, antihypertensive, cholesterol lowering, antioxidant, antidiabetic, hepatoprotective, antibacterial and antifungal activities, and are being employed for the treatment of different ailments in the indigenous system of medicine, particularly in Asia.

### III. Conclusion:

Nutraceuticals are currently receiving recognition as being beneficial in coronary heart disease, obesity, diabetes, cancer, osteoporosis and other chronic and degenerative diseases such as Parkinson's and Alzheimer's diseases. Evidences indicate that the mechanistic actions of natural compounds involve a wide array of biological processes, including activation of antioxidant defenses, signal transduction pathways, cell survival-associated gene expression, cell proliferation and differentiation and preservation of mitochondrial integrity. It appears that these properties play a crucial role in the protection against the pathologies of numerous age-related or chronic diseases ( Mandel et al, 2005).

It is very imperative that the nutrients found in many foods, fruits and vegetables are responsible for the well-documented health benefits. For example, lutein and zeaxanthin prevent cataracts and macular degeneration; beta-carotene and lycopene protect the skin from ultraviolet radiation damage; lutein and lycopene may benefit cardiovascular health, and lycopene may help prevent prostate cancer. Because of these and other marked health benefits of these, it must be taken regularly and to reduce the risk factors like high cholesterol, high blood pressure and diabetes. Some of the most popular nutraceutical products marketed today are botanicals such as St. John's wort, echinacea, ginkgo biloba, saw palmetto, and ginseng.

Many industries manufacture and market the nutraceuticals, where the side effects (especially consumed in large quantities) of these nutraceuticals not reported or often unproven. In order to have scientific knowledge about the nutraceuticals, publics should be educated, where recommended daily doses of these nutraceuticals should be known by each consumer with the rapidly increasing interest in the nutraceutical revolution, we need to establish a vibrant nutraceutical research community which is absolutely necessary to convert the majority of potential nutraceuticals to established ones thereby truly delivering their enormous benefits to all of us.

The list of nutraceuticals being studied is changing continually and reflects ongoing research, market developments and consumer interest.

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