

Nutraceuticals: A Boon to Mankind

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ABSTRACT Nutraceuticals constitute a group of substances which are not recognized as nutrients, but provide enormous nutritional and health benefits without any side outcomes. They are easily accessible to everyone worldwide because of their low cost. They can be categorized into various groups on the basis of different parameters. Each nutraceutical has a specific role and beneficial health outcomes. Through its immense role in disease prevention, nutraceuticals are found to prove the quote of Hippocrates, i.e., "Let food be your medicine and medicine be your food". So, the objective of this review article is to gain an insight of this beneficial category which can be considered as a boon to mankind.

Keywords: Nutraceuticals, Foods, Nutrients, Disease prevention

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Submitted: 01-Jan-2022

Accepted: 04-Apr-2022

Published: 29-Aug-2022

INTRODUCTION

Industrialization and changed lifestyle of human beings have played an adverse role in polluting our atmosphere. This pollution has resulted in various harmful effects on human health causing various deadly diseases, which significantly has increased the need for better medical facilities. It has also burdened the economic status of people. Hence, people are trying to attain an improved and qualitative life with the consumption of more fresh foods of all colours like vegetables, fruits, and other plant foods, along with dietary supplements or nutraceuticals.

Generally, nutraceuticals are foods or parts of food that provide medical or health benefits, including the prevention and treatment of disease. It was coined by Stephen DeFelice in 1979 and derived from two words, viz. 'Nutrition' and 'Pharmaceuticals'. Nutraceuticals may constitute isolated nutrients, herbal products, dietary supplements, designer foods, and processed products like cereals, soups, and beverages. It is non-toxic food extract supplement with scientifically proven health merits for both treatment and prevention of diseases. It can be defined as natural functional/medical foods or bioactive phytochemicals with health-promoting, disease-preventing or medicinal qualities. It can be vitamins, lipids, proteins, carbohydrates, minerals, or other necessary nutrients. It has wide applications in nutritional

therapy depending on their chemical structures and biological functions.

Nutraceuticals are found in a range of products revealed from various industries like food industry, herbal and dietary supplement market, pharmaceutical industry, and the newly merged pharmaceutical/agri-business/nutrition conglomerates. And consumption of nutraceuticals in daily diet has become a big question for attaining the optimum nutritional and health status. It is due to the lack of evidences for dose, nutraceutical-drug interaction, and their impacts on persons suffering from various illnesses along with normal healthy conditions. For this, scientists are striving in finding out solutions to improve nutritional quality for better outcomes in nutraceuticals' consumption. Since overconsumption of food also causes harmful effects on human health.

However, currently available nutraceuticals are large in number and varieties and have therapeutic applications. These are available in various forms like concentrated forms as pills, capsules, powders and tinctures either as a single product or in combination. Evidences have proved the beneficial effects of chronic usage of nutraceuticals in altering or reversing the

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Access this article online
Website: www.ijfans.org
DOI: 10.4103/ijfans_214_22

How to cite this article: B. R. Abha Ayushree, Aparna Sahu and Dr. Anjali Tarai. Nutraceuticals: A Boon to Mankind. *Int J Food Nutr Sci* 2022; 11:168-177.

impacts of bad habits like lack of exercise, poor diet, negative emotions and environmental toxicity along with the progression of age etc. on mankind.

CATEGORIES

Nutraceuticals are non-specific biological therapies used to promote wellness, prevent malignant processes and control symptoms. They are classified into three categories on the basis of their chemical constituents, viz.

- a. Nutrients
- b. Herbals or botanical
- c. Dietary supplements

Nutrients

Chemical constituents of food supplying nourishment required for maintenance of life and growth are termed as nutrients. Vitamins, minerals, amino acids and fatty acids, etc., are the nutrients with nutraceutical benefits which are given below.

Herbals or Botanical

This constitutes different parts of plants viz. seeds, berries, leaves, roots, flowers and barks that possess nutraceutical properties and are helpful in prevention of different kinds of illnesses since time immemorial. This is now widely used in medicine nutrition therapies.

Table 1: Nutrients		
Nutrients	Sources	Nutraceutical Benefits
Vitamins		
Vitamin A/ Beta carotene	Egg, meat, cheese, fish, dark green and yellow-orange coloured fruits and vegetables	Immune boosting effect, antioxidant, cancer prevention action, bone health, integrity of epithelial tissue, RNA and protein metabolism etc.
Vitamin D	Sunlight, foods like fish, liver, fortified foods (milk, cheese, etc.)	Anti-infective, anti-rachitic effects, bone and teeth health, cancer prevention action etc.
Vitamin E	Vegetable oils and fats, nuts and oilseeds, oily fishes etc.	Anti-oxidant, anti-hemorrhagic, immune-boosting effects, liver, heart and muscle health etc.
Vitamin K	Green leafy vegetables, cereals, legumes, milk, eggs, meat, fish etc.	Blood coagulation.
Vitamin C	Citrus fruits like amla, lemon, guava, orange etc.	Anti-oxidant, anti-stress, immune-modulating effects, collagen formation, wound healing, bone formation, cholesterol metabolism, iron absorption etc.
Vitamin B1	Rice polishing, wheat germ and dried yeast whole cereals, pulses (legumes), oilseeds and nuts etc.	Normal growth and maintenance, carbohydrate metabolism, neurological activity etc.
Vitamin B2	Milk, liver, meat, fish, eggs, whole cereals, legumes and green leafy vegetables etc.	Hormone regulation, carbohydrate, protein and fat metabolism, healthy skin, healthy RBC production etc.
Vitamin B3	Dried yeast, rice polishings, liver, groundnut, cereals, pulses, meat, fish, milk, eggs, nuts and oilseeds etc.	Carbohydrate metabolism, healthy skin, nerves and digestive system etc.
Pantothenic acid	Royal jelly, dried yeast, liver, rice polishings and wheat germ etc.	Growth, fat metabolism, synthesis of cholesterol, steroids and fatty acids, etc.
Vitamin B6	Dried yeast, liver, rice polishing and wheat germ, Whole cereals, legumes (pulses), oilseeds and nuts, egg, milk, meat and fish and green leafy vegetables etc.	prevents and cures dermatitis, healthy immune system, healthy brain function, RBC formation, vitamin B12 absorption etc.
Vitamin B9	Liver, organ meats, citrus fruits, groundnuts and other legumes, beans, peas, spinach, and other dark greens, strawberries, whole grains, wheat germ, yeast breads etc.	RBC maturation, DNA synthesis, growth & cell function etc, heart health, etc.
Vitamin B12	meat, dairy products, poultry, shell fish and eggs, fortified cereals etc.	RBC formation, DNA synthesis, maintenance of central nervous system etc.

Table 1 (Cont.)		
Minerals		
Calcium	Ragi, milk and milk products, sesame seeds and green leafy vegetables etc.	Bone & teeth formation, blood coagulation, contraction and relaxation of heart muscle, excitability of nerve fibres and nerve centers etc.
Iron	wholegrain cereals, pulses and legumes, liver, egg yolk, fish, green leafy vegetables such as radish greens, lotus stems, cauliflower greens, and turnip greens, Fruits such as black currants, water melon, raisins, and dried dates etc.	Constituent of oxidative enzymes, oxygen carrying capacity, immune boosting action etc.
Magnesium	Cereals, pulses and leafy vegetables etc.	Constituent of certain enzymes, activator of various enzymes, cofactor for oxidative phosphorylation etc.
Phosphorous	Milk, eggs, meat and fish while vegetables	bone & teeth formation, phospholipid formation, carbohydrate metabolism etc.
Amino Acids		
Essential amino acids	Egg, fish, milk and its products, pulses, nuts etc.	Growth, maintenance and repair of body tissues, acid-base balance, immune enhancing effects etc.
Fatty Acids		
PUFA	Safflower oil, soybean oil, and other vegetable oils, Soybean, flaxseed, canola, pumpkin and walnut etc.	synthesis of prostaglandins, brain function, reduce cholesterol disposition etc.
MUFA	Olive and canola oils	Heart health and reduces metabolic syndrome.

Table 2: Herbs or Botanical		
Herbals or Botanical	Parts Used	Nutraceutical Benefits
Willow bark	Bark	Anti-inflammatory, analgesic, antipyretic, astringent and antiarthritic properties
Parsley	Leaf, root, seeds	Diuretic, carminative and anti-pyretic
Peppermint	Leaf	Cures cold and flu
Lavender	Buds and greens	Helpful in curing depression, hypertension, stress, cold, cough and asthma
Cranberry	Fruit	Useful in cancer, ulcers and urinary tract infections
Garlic	Dried bulb	Anti-inflammatory, antibacterial, antigout, nervine tonic
Ginger	Rhizome	Stimulant, chronic bronchitis, hyperglycemia and throat ache
Turmeric	Rhizome	Anti-inflammatory, antiarthritic, anticancer and antiseptic
Onion	Dried bulb	Hypoglycemic activity, Antibiotic and antiatherosclerosis
Aloes	Dried juice of leaves	Dilates capillaries, anti-inflammatory, emollient, wound healing properties
Asafoetida	Oleo gum resin	Stimulant, carminative, expectorant
Bael	Unripe fruits	Digestive, appetizer, treatment of diarrhea and dysentery
Brahmi	Herbs	Nervine tonic, spasmolytic, anti-anxiety

Dietary Supplements

Its main purpose is to supply nutrients that are found to be

deficient in the diet of an individual. In other words, the major goal of dietary supplements is to combat deficiency of certain nutrients. It can be vitamins, minerals, fiber, fatty acids,

Table 3: Dietary Supplements	
Names	Dietary Supplements and its Uses
Proteinex®	Protein supplement
GRD	Nutritional supplement that provides Proteins, vitamins, minerals and carbohydrates
Chyawanprash	Immune booster
Omega woman	Immune supplement
Celestial Healthtone	Immune booster
Amiriprash (Gold)	Good immunomodulator
Calcirol D-3	Calcium supplement
Coral calcium	Calcium supplement

or amino acids, among other substances. These also find applications in sports nutrition, weight loss plan and meal replacement programme. Over 50,000 dietary supplements are now on the market and multivitamins are the most widely used dietary supplement.

Besides, on the basis of prevalence in market nutraceuticals can be bifurcated into two categories such as traditional and non-traditional nutraceuticals.

Traditional Nutraceuticals

No alterations are made on this kind of nutraceuticals. Here, the natural active component of food provides health benefits to mankind. Nutrients, herbals and phytochemicals etc. fall under this category.

Non-Traditional Nutraceuticals

Here, alterations are made in food stuffs to derive health benefits for mankind with the help of certain scientific technology. This can again be grouped into categories, namely

- i. Fortified nutraceuticals, and
- ii. Recombinant nutraceuticals.

Fortified Nutraceuticals: Fortified foods supplying health and nutritional benefits come under this group of nutraceuticals. To name a few, calcium fortified orange juice, folic acid fortified flour, fortified milk with *Bifidobacterium lactis HN019*, fortified banana with soybean ferritin gene, etc.

Recombinant Nutraceuticals: For this category of nutraceuticals, biotechnology plays a vital role. For instance, production of energy-yielding foods like bread, alcohol, fermented starch, yogurt, cheese, vinegar, and others etc. has been possible with biotechnology. In addition, enzyme or fermentation technology is also used for production of recombinant nutraceuticals like probiotics.

Furthermore, various food sources are also shown to have nutraceuticals effects and are classified as follows:

- Dietary Fiber
- Probiotics
- Prebiotics
- Polyunsaturated fatty acids
- Antioxidant vitamin
- Polyphenols
- Spices

Dietary Fiber: Whole grains, fruit, vegetables etc. are major source of dietary fibre in our diet. These cannot be digested completely in our gut and thus form bulk or roughage and thus are essential for healthy functioning of our gut. Based on solubility in water, dietary fibre can be soluble and insoluble type. Soluble dietary fibre is miscible in water that can be obtained from food sources like beans, fruits and oat products. They play a vital role in decreasing level of fats in blood and controls blood sugar level. In contrary, insoluble dietary fiber are immiscible in water, hence passes directly via the gastrointestinal tract. Whole grain products and vegetables are good sources of insoluble dietary fibre. These needs more time for digestion, hence provide the feeling of fullness to individuals consuming it and thus have a great role in maintaining weight. It also regulates bowel movement and reduces the occurrence of diverticular disease and constipation. It also diminishes the chances of incidence of diabetes and colorectal cancer. Soluble fibres also mix with digestive enzymes, cholesterol, starch, glucose and toxins, forming a viscous solution and then get excreted via feces and thus become helpful for both obese and diabetic patients.

Probiotics: It consists of both live bacteria and yeasts having good impact on health, especially on gut health. Actually body is a store house of both good and bad bacteria. And “good” or “helpful” bacteria constitute this category that has importance for healthy digestive system of body. It is found

to be suitable for the treatment of diarrhoea (both infectious and antibiotic-related), irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), allergies, cold and skin conditions like eczema etc. and helpful for urinary, vaginal and oral health and for people with lactose intolerance. It is found in dairy products like yogurt, fermented products, chocolate

Prebiotics: These cause the growth or activity of microorganisms like bacteria and fungi that promote well-being of their host. For instance, prebiotics change the constitution of gut microbiota. Besides, certain prebiotics boost the function or make-up of skin microbiota. Scientific studies revealed that all prebiotics act as fiber, but not all fiber shows the function of prebiotic. Scientifically a prebiotic can be defined as a substance that withstands gastric acidity, hydrolysed by mammalian enzymes, and absorbed in the upper gastrointestinal tract, fermented by the intestinal microflora and selectively stimulates the growth and/or activity of intestinal bacteria potentially associated with health and well-being. Functions of prebiotics are very limited compared to that of dietary fiber. Anyhow, prebiotic consumption may be helpful in the treatment of both infectious and antibiotic-associated diarrhoea, inflammatory bowel disease (IBD), colon cancer, cardiovascular disease and increase minerals (*viz.* Ca, Fe, Mg, etc.) uptake and bioavailability and induce satiety and weight loss and thus fend off obesity.

Polyunsaturated Fatty Acids: These are found to exhibit health promoting effect and are helpful in curing various disorders that resulted due to modern lifestyle chronic diseases like coronary heart disease, hypertension, diabetes, arthritis and other inflammatory conditions, autoimmune disorders, depression, schizophrenia, and various kinds of cancers etc. these are mainly obtained from safflower oil, soybean oil, olive oil, canola oils and other vegetable oils, fish oils, oily fishes like salmon, soybean, flaxseed, canola, pumpkin, walnut, etc. It is also observed that regular consumption of fish oils reduce both morbidity and mortality risks from cardiovascular disease including ischemic heart disease, nonischemic myocardial heart disease, and hypertension. They significantly act against thrombosis, cholesterol build-up and allergies and are crucial for normal growth of brain and retina. These may be incorporated in foods like bakery products, pastas, dairy products, spread and juices, and may also be used as dietary supplements in liquid or capsule forms.

Antioxidant Vitamin: Evidences have shown that free radicals mutilate cells and results in aging process and development of diseases. Antioxidants form the first line of defense against this mutilation, and are crucial in the optimum health maintenance. Antioxidants actually stabilize, or deactivate free radicals before they damage cells. A highly

developed antioxidant system is prevalent in human body, consisting of both endogeneous and exogeneous compounds that act as analogues in preventing the action of free radicals. These compounds are nutrient-derived antioxidants (like vitamin C, vitamin E, carotenoids, glutathione and lipoic acid), antioxidant enzymes (like superoxide dismutase, glutathione peroxidase, and glutathione reductase, etc.), metal binding protein (e.g., ferritin, lactoferrin, albumin, and ceruloplasmin etc.), endogenous antioxidants (such as bilirubin, thiols, e.g., glutathione, lipoic acid, N-acetyl cysteine, NADPH and NADH, ubiquinone (coenzyme Q10), uric acid, enzymes like copper/zinc and manganese-dependent superoxide, iron-dependent catalase, selenium-dependent glutathione peroxidase), exogeneous or dietary antioxidants (like vitamin C, vitamin E, beta carotene and other carotenoids and oxycarotenoids such as lycopene and lutein, polyphenols, e.g., flavonoids, flavones and flavonols and proanthocyanidins, etc.) and metal binding proteins (e.g., albumin ceruloplasmin, metallothionein, ferritin, myoglobin, transferrin, etc.).

Polyphenols: These are phytochemical components found in plant-based foods, like fruits, vegetables, whole grains, cereal, legumes, tea, coffee, wine and cocoa etc. naturally. Today, already over 8000 polyphenols *viz.* phenolic acids, flavonoids, stilbenes, lignans and polymeric lignans have been pinpointed in whole plant foods. Polyphenols are secondary metabolites of plants having protective role against ultraviolet radiation, oxidants and pathogens. Phenolic acids are mainly found in berry fruits, kiwi, cherry, apple, pear, chicory and coffee, etc. These may be grouped into various classes on the basis of number of phenol rings and structural elements that bind these rings to one another. Phenolic acids constitute one-third of polyphenols in diet and include two main classes-

- a) Hydroxybenzoic acid derivatives (protocatechuic acid, gallic acid, *p*-hydroxybenzoic acid).
- b) Hydroxycinnamic acid derivatives (caffeic acid, chlorogenic acid, coumaric acid, Ferulic acid, sinapic acid).

Spices: These are key ingredient in the culinary art since ancient times. Spices are aromatic vegetable components, in the form of whole, broken or ground, that play major role in seasoning food rather providing nutrition. These provide significant flavor, aroma and pungency to foods. Besides, spices are also important in indigenous medicines, pharmaceuticals, Nutraceuticals, aroma therapy, preservatives, beverages, natural colors, perfumes, dental preparations, cosmetics and botanicals as pesticide and thus, have a vital part in country's economy. Some spices having nutraceutical effects are cinnamon, clove, *curcuma spp.*, saffron and long pepper etc. that are good source of vitamin C and rich in antioxidants, thus, boosts immunity, promotes digestion and prevents cough, asthma, fever, heart disease, impotency and coarseness speech.

Spices like turmeric, red pepper, black pepper, clove, ginger, garlic, coriander, rosemary, saffron and cinnamon has been shown to exert its activity against neurodegenerative diseases like Alzheimer's disease, Parkinson's disease, multiple sclerosis, brain tumor and meningitis, etc.

Herbs and spices are found to have significant role in maintaining and enhancing human beauty since antiquity. For instance, use of turmeric in skin care. Spices like turmeric, cardamom, clove, aniseed, coriander, basil, saffron, garlic and sage are found importance in beauty and cosmetic industry.

Functions

Nutraceuticals have a wide range of functions and applications, especially in health sectors, which are summarized below:

Cardiovascular Agents

Cardiovascular diseases (CVD) consists of a group of diseases of heart and blood vessels including hypertension, coronary heart disease, cerebrovascular disease, heart failure, peripheral vascular disease, etc. A diet rich in fruits and vegetables is found to be helpful in preventing CVD. Nutraceuticals like antioxidants, dietary fibers, omega-3 fatty acids, vitamins, and minerals are prescribed as a cure of CVD. Stilbenes, anthocyanins, condensed tannins (proanthocyanins) found in grapes and wine modify cellular metabolism and signalling that is related with declining arterial disease. α -Lipoic acid, magnesium, Vitamin B6 (pyridoxine), Vitamin C, N Acetylcysteine, Hawthorne, Celery, ω -3 fatty acids etc. possess antihypertensive property. Flavonoids in the form of flavones, flavanones, flavanols have been found to be helpful in treating cardiovascular diseases. Flavonoids found in onion, endives, cruciferous vegetables, black grapes, red wine, grapefruits, apples, cherries and berries. Consumption of flavonoids decreases the death rate caused by coronary heart disease. Phytosterols can also decline the risk of both incidence and death from cardiovascular disease. Dietary fibre is also found to treat cardiovascular disease, diabetes and colon cancer. EFAs help to regulate blood pressure, reduce cholesterol and triglycerides, and decrease the risk of blood clots.

Anti-Obese Agents

Obesity is undesirable excessive deposition of fat in body which is responsible for many diseases viz. angina pectoris, congestive heart failure, hypertension, hyperlipidaemia, respiratory disorders, renal vein thrombosis, osteoarthritis, cancer, reduced fertility etc. Excessive consumption of high-fat, energy dense foods is one of the reasons for obesity. Hence, a low calorie diet along with proper exercise is helpful in controlling obesity. And this calls for the increased use of nutraceuticals. Herbals like ephedrine, caffeine, ma huang-guarana, chitosan and green tea play a major role in reducing

weight of individuals. However, these may cause some undesirable outcomes. Buckwheat seed proteins are found to be helpful in treating obesity and constipation.

Anti-Diabetic Agents

Diabetes mellitus is the condition of abnormally high blood glucose levels. It can be of three types viz. type I diabetes (5%), type II diabetes (95%) and gestational diabetes. Diet is helpful for preventing gestational diabetes mellitus and type 2 diabetes mellitus. A high isoflavone consumption (20-100 mg/day) is shown to decrease morbidity and death risk of type II diabetes. Omega-3 fatty acids lower glucose tolerance in diabetic patients. It's because insulin is essential for the production of n-3 fatty acids and thus diabetic patients are susceptible to heart diseases. Lipoic acid being a potent antioxidant is having a pivotal role in curing diabetic neuropathy. Dietary fibers are helpful in maintaining blood glucose level. Magnesium lowers the outbreak of diabetes and promotes insulin sensitivity. Chromium picolinate, calcium and vitamin D also improve insulin sensitivity. Extracts of bitter melon and cinnamon is essential against diabetes. Polyphenols also possess hypoglycaemic effects and lower absorption of carbohydrate in intestine, modulate enzymes partaking in glucose metabolism, promote β -cell function and insulin action and secretion.

Anti-Cancer Agents

Cancer has proven to be a deadly disease worldwide and as a preventive measure a healthy diet is crucial. Lutein found in chicken eggs, spinach, tomatoes, oranges and leafy greens has an inverse relationship with colon cancer. Chronic inflammation being related to immune suppression causes cancer in human being. Ginseng with anti-inflammatory properties helps in preventing immune suppression and thus cancer. Phytochemicals present in herbs and spices possess anticarcinogenic, antimutagenic properties and hormonal role that are helpful in inhibiting the progression of prostate/breast cancer. Flavonoids from citrus fruits with antioxidant effect are suitable for cancer prevention. Isoflavones from soy food, epigallocatechin gallate found in tea, curcumin present in curry and soya isoflavones are proved to have chemo preventive role. Lycopene, a carotenoid, being unsaturated possess strong antioxidant properties and thus prevents cancer. Tomatoes, water melon, guava, pink grapefruit and papaya are rich sources of lycopene. Besides, Alpha, beta and gamma carotenes also possess anti-carcinogenic properties and acts strongly against lung, colorectal, breast, uterine and prostate cancers. Saponins having antitumor and antimutagenic activities reduce the occurrence of cancer and present in peas, soybeans, and some herbs like soapwort, soapbark and soapberry. Tannins found in blackberries, blueberries, cranberries, grapes, lentils, tea and wine possess

detoxification properties against carcinogens and prevents the action of free radicals. Ellagic acid being an anti-carcinogen found in strawberries, cranberries, walnuts, pecans, pomegranates and red raspberry seeds are helpful in preventing cancer. Evidences has proved the role of modified citrus pectin (MCP), a type of pectin against prostate cancer. Colorectal and lung cancer are prevented with consumption of glycosylates and their hydrolysed products, i.e., indoles, isothiocyanates etc. Onions, beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes are proven to have anti-tumour activity and are efficient for cancer prevention.

Immune Boosters

Nutraceuticals with immune boosting properties include extracts from the coneflowers, or herbs of the genus Echinacea, such as Echinacea purpurea, Echinacea angustifolia, Echinacea pallida, and their mixtures; extracts from herbs of the genus Sambuca, such as elderberries; and Goldenseal extracts. Astragalus membranaceus, Astragalus mongholicus, and other herbs of the genus Astragalus are also potent immune boosters. Astragalus plays a vital role in activating immune cells. Probiotics also have proven their efficiency against infections. Probiotics are also helpful in maintaining the normal balance between pathogenic and non-pathogenic bacteria in gut. Oral supplementation of digestive enzymes and probiotics is effective in lowering the risk of breast, colorectal, prostate and bronchogenic cancer.

Thyroid Function

Nutraceuticals like selenium, l-carnitine, myo-inositol, melatonin, and resveratrol etc. have positive impact on thyroid health and functioning. Inositol's are useful in hormones signalling including thyroid stimulating hormone (TSH). Also, imbalanced metabolism of inositol results in impaired biosynthesis, storage and secretion of thyroidal hormone. Melatonin with antioxidant role is useful in various illnesses. Myo-inositol can ameliorate thyroid function, and in combination with melatonin raises serum TSH level. Resveratrol maintains TSH concentration trapping iodine and proved to be a potent anti-thyroid drug. Besides, thyroid gland contains the largest portion of selenium, stored in its cells. Selenium acts as a cofactor for the action of thyroid hormones.

Substances that Manage Chronic Inflammatory Disorders

Injury or irritation to body tissues causes Inflammation that accompanies with pain and swelling and redness and heat. Arthritis is a disorder characterized by inflammation in joints. Some examples of arthritis are rheumatoid arthritis, shoulder tendinitis or bursitis, gouty arthritis and polymyalgia rheumatica. Vitamin C and vitamin D are found to be helpful

against these inflammations. Furthermore, nutraceuticals like glucosamine, chondroitin, S-Adenosylmethionine, ginger and avocado/soybean unsaponifiable, are found to be useful in osteoarthritis. Cat's claw possessing a strong anti-inflammatory effect is high in phytochemicals viz. alkaloids, glycosides, tannins, flavonoids, sterol fractions, and other compounds. Resveratrol found in the fruits of bilberry, "wild" blueberry, rabbit eye blueberry and the highbush blueberry has potent anti-inflammatory effect. The omega-3 and omega-6 fatty acids are also proven to be essential against inflammatory illnesses. Gamma linolenic acid is effective in fighting problems of inflammation and auto-immune diseases. Bromelain from pineapple; teas and extracts of stinging nettle; turmeric, extracts of turmeric, or curcumin etc. also possess strong anti-inflammatory properties. Osteoarthritis symptoms are lowered with the use of glucosamine (GLN) and chondroitin sulfate (CS). Quercetin (QR) maily found in onions, red wine and green tea possess antihistaminic properties and thus prevents allergic and inflammatory conditions. It is effective in treating inflammation in diseases like hay fever, bursitis, gout, arthritis, and asthma by hindering the action of some inflammatory enzymes like lipid peroxidises.

Formulations to Cure Degenerative Diseases

Degenerative diseases like macular degeneration, Alzheimer's disease and Parkinson's disease etc. can also be cured with the use of nutraceuticals. A diet rich in vitamin C, vitamin E, beta-carotene, and zinc (with cupric oxide) is helpful in treating age-related macular degeneration (AMD). AMD can also be prevented with a healthy lifestyle and a diet high in antioxidants, like lutein and zeaxanthin, n-3 fatty acids. Herbs or herbal extracts viz. garlic, green tea, polyphenols, carotenoids like lycopene and β -carotene, and coenzyme Q10 possess antioxidant properties. Astaxanthin is too useful in boosting immune system and fending oxidative stress off and thus alleviates macular degeneration and Alzheimer's disease. Nutraceutical antioxidants viz. β -Carotene, curcumin, lutein, lycopene, turmeric, etc., are helpful in particular degenerative diseases like Alzheimer's disease caused due to oxidative stress, mitochondrial dysfunction, etc. Nutraceutical consumption has been shown to delay the incidence of dementias in Alzheimer's disease. Parkinson's disease can be well treated with diet rich in vitamin E and creatine.

CONCLUSION

To conclude, it can be mentioned that nutraceuticals can be available in various forms and are easily accessible. They provide all the essential nutrients necessary for the optimum functioning of human body. In addition, nutraceuticals with

their protective, healthy and novel approach can conquer various illnesses without harming individuals. These can be a suitable alternative to modern medicines and hence can be considered as a boon to mankind.

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