

ROLE OF NUTRACEUTICALS IN HEALTH AND DISEASE PREVENTION

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ABSTRACT

Nutraceuticals, in broad, are food or part of food playing a significant role in modifying and maintaining normal physiological function that supports healthy human beings. These are used as alternatives to modern medicines that promote quality of health, increases the nutritional value of the diet, and prolong life expectancy. With its role in combating major health problems with zero side effects, nutraceuticals have gained a huge market worldwide. They possess numerous therapeutic benefits like anti-obesity, immune enhancement, natural antioxidants, cardiovascular effects, anti-diabetic, anti-inflammatory effects, etc. The aim of this article is to provide current knowledge about the application of various nutraceuticals in different diseases.

Keyword Nutraceuticals, Anti Diabetic, Immune Enhancement, Health Promotion, Diseases, and Anti Inflammatory.

1. INTRODUCTION

The words "nutrition" and "pharmaceutics" are the roots of the term "nutraceutical." The concepts "pharmaceutical" and "nutrition" were combined to form the term "nutraceutical" in 1989 by Dr. Stephen L. DeFelice, chairman and creator of the base for innovation in medicines. Dietary fibre, prebiotics, probiotics, polyunsaturated fatty acids, antioxidants, and other diverse kinds of herbal/natural foods are some of the food products used as nutraceuticals. Nutraceuticals, including arthritis, cold and flu, sleeping issues, digestion, and the prevention of certain malignancies, osteoporosis, high blood pressure, high cholesterol, painkillers, depression, and diabetes cover the majority of therapeutic areas. [1].

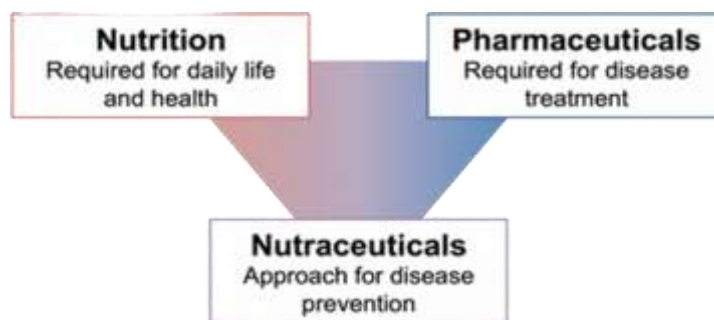


Fig- 1 Meaning of Word Nutraceuticals

A naturally generated, refined nutrient may be a nutraceutical if it is offer in a medicinal form or as a food supplement in the form of a tablet or powder. Nutraceuticals can be used as a food supplement and offer extra nutrients to food. It has been proven that nutraceuticals nourish the body without causing any negative side effects and go beyond what the body needs in terms of nutrition. They satisfy the body's need for nutrients and keep the balance of adequate nutrients in a typical diet. [2, 3]

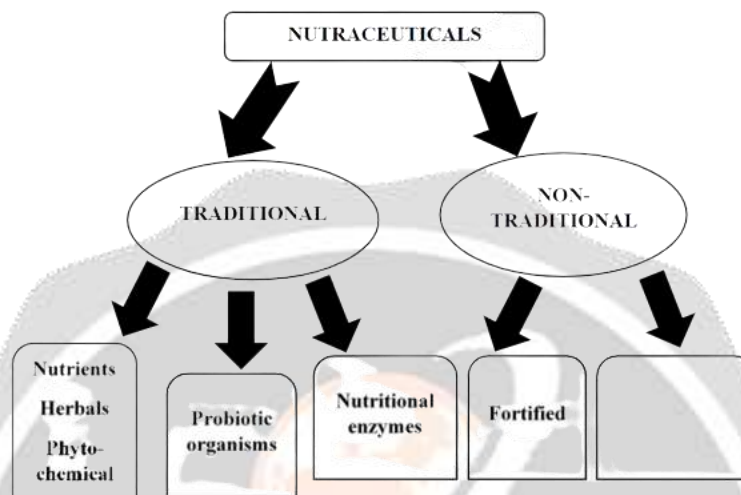


Fig- 2 Classification of Nutraceuticals

1.1 Traditional nutraceuticals

A traditional nutraceutical is a food that has been created but has not been altered in any way. Its ingredients are all-natural and may have health benefits. Many natural compounds can be found in a range of fruits, vegetables, grains, fish, dairy, and meat diets, such as lycopene in tomatoes, omega-3 fatty acids in salmon, and saponins in soy. Researchers have found that salmon and tomatoes both have health benefits that go beyond simple dietary needs.[3]

1.1.1 Nutrients

Nutrients can be used to treat a variety of conditions, including cancer, diabetes, osteoporosis, cataracts, and heart disease. Osteoporosis and anaemia can be treated using minerals that come from plant, animal, and dairy diets. Salmon and flaxseed include omega 3-PUFAs, which are powerful regulators of inflammation, the maintenance of brain function, and the decrease of cholesterol buildup.[4]

1.1.2 Herbs

Herbs, also referred to as botanical foods, have been used to treat both acute and chronic ailments for thousands of years. Important components of several nutraceuticals can be discovered in medicinal plants, offering a vast supply of medication to treat severe and protracted illnesses. Examples include: The herb parsley (*Petroselinum crispum*), which contains the flavonoids apiol and psoralen, is diuretic, carminative, and antipyretic. Salicin, an active ingredient in willow bark (*Salix nigra*), has anti-inflammatory, analgesic, antipyretic, astringent, and antiarthritic properties. Tannins found in lavender (*Lavendula angustifolia*) can cure sadness and anxiety.[5]

1.1.3 Phytochemicals

Phytochemicals are non-nutritive plant substances with anti-viral or anti-disease properties. They are optional nutrients that plants produce largely for defence. By scavenging reactive or harmful molecules, phytochemicals derived from plants are used in food and provide health benefits such as substrate for biochemical reactions, cofactors for enzymatic reactions, enzyme inhibitors, and enzyme intestinal absorbents that bind to and remove unwanted constituents and improve absorption and/or stability of critical nutrients. A variety of foods, including whole grains, legumes, fruits, vegetables, and herbs, include phytonutrients or phytochemicals. These phytochemicals hold great therapeutic promise for the treatment of a wide range of ailments, whether used alone or in combination.

There is a hopeful reexamination of conventional wisdom, as glucose and insulin regulation are significant properties of phytochemicals.[6]

1.1.4 Probiotic bacteria

Probiotics are live microorganisms that are administered to a host in sufficient amounts to have a positive effect on health. They are frequently used to treat gastrointestinal (GI) diseases such as lactose intolerance, acute diarrhoea, and gastrointestinal side effects caused by antibiotics. They are available in powder, liquid, gel, paste, or granule form, as well as capsule form.

The most widely used probiotics are those of the *Lactobacillus* and *Bifidobacterium* species, however *S. cerevisiae*, as well as a number of *E. coli* and *Bacillus* species, are also employed.[7]

1.2 Enzymes in nutraceuticals

Enzymes are vital to life; without them, our bodies wouldn't work properly. Anyone experiencing digestive problems, such as hypoglycemia, abnormal blood sugar levels, or obesity, may find relief from their symptoms by supplementing their diet with enzymes derived from microbial, plant, and animal sources.[4]

1.2.1 Non-Traditional Nutraceuticals

These are biotechnology-advanced artificial foods. This group of foods includes those whose nutritional value has been enhanced by the addition of specific dietary elements or nutrients. Recombinant and fortified nutraceuticals are two further divisions.[5]

1.2.2 Recombinant nutraceuticals

These products are made through genetic engineering, fermentation/enzyme technologies, or other methods and include probiotics and bioactive substances. Furthermore, new biotechnology used to create meals that provide energy, such as alcohol, cheese, yoghurt, fermented starches, vinegar, bread, and more.[6]

1.2.3 Fortified Nutraceuticals [8]

Fortification is the process of enhancing a food's nutritional value and effectiveness by adding certain micronutrients, such as vitamins and trace minerals.

The probiotics can restore the normal composition of microbiota (abundance and diversity) by producing SCFAs.

There are many studies which demonstrated that *Lactobacillus* species (*L. casei*, *rhamnosus* and *acidophilus*) can prevent or can reduce the severity of antibiotic associated diarrhea while species belonging to *Lactobacillus*, *Bifidobacterium* or *Escherichia coli* Nissle 1917 can prevent or treat gastro-intestinal diseases or metabolic disorders

Prebiotics are nutraceuticals which were approved for bolstering the growth of microbiota's beneficial species. Carbohydrates are the main source of SCFAs— acetate, propionate and butyrate. Due to the action of SCFAs, the composition and diversity of microbiota can be changed in a positive way

2. HEALTHCARE IMPACT OF NUTRACEUTICALS

2.1 Nutraceuticals in gut health

2.1.1 Antioxidant Property of Nutraceuticals

There are many chemical classes of nutraceuticals found in all sorts of foods. Some nutraceuticals are well known, like epigallocatechin 3-gallate (EGCG) from green tea and resveratrol from grapes. A common method of determining intrinsic free radical scavenging activity is to use a cell free assay system with the radical 2,2-diphenyl-1-picrylhydrazyl (DPPH). Resveratrol, carnosic acid, and rosmarinic acid have each been shown to be effective scavengers of DPPH radicals. In contrast, allicin has been found to be a poor scavenger of peroxy radicals while another garlic compound, 2-propenesulphenic acid, is a good scavenger of these radicals.

Additionally, EGCG has been shown to scavenge a wide variety of free radicals including superoxide, hydroxyl radical, hydrogen peroxide, and nitric oxide. The intrinsic free radical scavenging activities of these nutraceutical antioxidants suggest that they may have potential utility in mitigating neuronal oxidative stress and neurodegeneration.

Rosmarinic acid has been shown to scavenge the reactive nitrogen species, peroxynitrite, and various ROS. As a free radical scavenger, rosmarinic acid is effective at protecting SH-SY5Y human neuroblastoma cells from hydrogen peroxide-induced oxidative stress and cell death.[10, 11]

2.2 Nutraceuticals in renal health

The importance of nutrition in nephrology, with a special focus on protein and salt restriction, has long been recognized as crucial for the management of CKD patients, along with pharmacological therapy to slow down

disease progression and correct the signs and symptoms of uremia . On the contrary, notions about the role of nutrition as a measure to prevent renal disease are less discussed.[9]

2.2.1 Fibre

The crucial role of microbial dysbiosis in CKD progression and comorbidities, our group and other investigators have recently highlighted the importance of adequate fiber intake in the dietary management of CKD. Indeed, fiber intake reduces proteolytic putrefaction and increases saccharolytic fermentation. potentially counteracting the putrefactive dysbiosis that accompanies the decline in renal function.

Moreover, there are some hints suggesting that dysbiotic microbiota could represent a risk factor for CKD occurrence in genetically or epigenetically predisposed subjects. The resulting reduction of uremic toxin production, induction of SCFA colonic release, decreased intestinal inflammation, and restored intestinal barrier are all factors potentially contributing to renal health by reducing the risk of renal function decline.[12]

2.2.2 Proteins

In the context of CKD, the positive clinical effects of a low-protein diet (LPD) are not only related to the control of uremic symptoms, reduction in proteinuria, and hyperfiltration, but also to the related reduction of sodium, inorganic acids, and phosphorus content. Favourable renal outcomes have been reported with LPD. In the early stages of CKD, a normalization of the protein intake based on the current recommendations for the general population (0.8 g/Kg/day) is advised. With the worsening of renal function (CKD stages 3 and 4), more restrictive diets are necessary (0.6–0.7 g/Kg/day).

Healthy people are advised to ingest a recommended daily allowance (RDA) of 0.8 g of proteins/kg body weight. This amount, which has been obtained by theoretical studies based on measurements of nitrogen urinary waste, assumed proportional to the body nitrogen turnover, indicates the minimum quantity necessary to cover the basal daily protein need of 97.5% of healthy people. Protein exerts different beneficial functions for human health. First, they guarantee an optimal structural turnover, both at an extra- and an intracellular level. Second, they are crucial for the functioning of the immune system. Third, protein is particularly required in some special life phases and conditions: pregnancy and infancy, the elderly and intensive physical activity. They also become critical in the context of low-calorie diets aimed at weight loss, as they prevent lean mass waste. [13]

2.3 Nutraceuticals in reproductive health of women [14]

Adolescence is a transition period between childhood and adulthood during which puberty sets in girls of 10-13 years of age. Good nutrition is needed to support physical growth and reproductive maturation during adolescence. Sometimes failure to consume an adequate diet at this time can result in delayed sexual maturation and delayed or retarded physical growth. Nutritional status and physical growth are dependent on one another such that optimal nutrition is a requisite for achieving full growth potential. Adolescent girls may benefit from multivitamins (A, B, C, D, E) minerals (zinc, calcium, phosphorous), healthy fats and proteins.

2.3.1 Premenstrual syndrome

Menstrual cramps are a very common ailment in premenopausal women experienced by approximately 50 per cent of women starting with first menses. Cramps can worsen in women with age due to hormone imbalance and other conditions associated, including uterine fibroids. Nutraceuticals have anti-inflammatory and smooth muscle relaxing properties. Owing to the presence of ginger, evening primrose, valerian, Dong Quai, Chasteberry and Black Haw, they could be used to treat menstrual disorders.

2.3.2 Pregnancy

The requirement for micronutrients, which include vitamins, minerals, and trace elements, increases even more during pregnancy. Prenatal vitamins have more of some nutrients that you need during pregnancy. Nutrients most important during pregnancy are folic acid, iron, calcium, magnesium, docosahexaenoic acid (DHA), iodine and vitamin A, B6, B12, C and D. While prenatal vitamins aren't meant to replace the healthy eating plan, they may help prevent nutritional gaps by providing extra micronutrients that are in high demand during pregnancy.

Nausea and vomiting during pregnancy can severely impact quality of life as well as pose significant health risks for some women. Ginger has been used to relieve nausea associated with morning sickness. Inadequate milk production is the most common reported reason for stopping breastfeeding. A number of women have turned to nutraceuticals such as fenugreek and milk thistle to stimulate milk production.

2.3.3 Menopause

Symptoms of menopause, such as hot flashes, can range from slightly annoying to life-altering. There is increasing evidence that adequate calcium intake reduces bone loss and the risk of fracture in postmenopausal women. Top essential nutraceutical supplements for women are calcium, fish oil, folic acid, vitamin B, vitamin D, co-enzyme

Q10 and lutein. Menopausal symptoms can be managed with nutraceuticals such as pycogenol, melatonin, vitamin E, Black cohosh, valerian, red clover, soy, licorice, rhubarb, chasteberry and flaxseed. Osteoporosis occurs after menopause due to low estrogen levels and bone density is lost at a much faster rate. Nutraceuticals that may protect against osteoporosis are vitamin D, calcium, red clover, soy, genistein and licorice. [10]

2.4 Nutraceuticals in stem cell growth

Certain nutraceuticals produces significant effects on stem cell growth and proliferation and showed significant role in healing and tissue regeneration by stimulating and recruiting endogenous stem cell at the site of injury. Blueberries, green tea, catechins, carnosine, vitamin D3, PUFA and essential amino acids strengthen our immune system. [15]

2.5 Nutraceuticals in mitochondrial bioenergetics

Mitochondria have been involved in the energy utilization during exercise and nutraceuticals implicated in the prevention and treatment of heavy exercise related to mitochondrial dysfunction. Mitochondria targeted nutraceuticals (MTNs) have antioxidant effects at the molecular level and boost mitochondrial bioenergetics. It has great impact on sports medicine.[16]

2.6 Prolonging life Span

Nutraceuticals present in citrus fruits and soybean has effects on epigenetic modifications, autophagy and necrosis. Researches have shown that spermidine and its derivatives confer lifespan extension in humans by enhancing autophagy. Caffeic acid and Rosmarinic acid present in fruits, vegetables and herbs are also anti carcinogenic, antioxidant, anti-rheumatic and anti-microbial. They can prolong the healthy life span extension. [11]

2.7 Nutraceuticals in memory enhancement: [11,12,14,15]

2.7.1 Probiotics

In addition to polyphenols, probiotics can also improve cognitive function and spatial memory. Probiotics refer to bacteria that support health by changing the composition of the gut microbiome. This, in turn, influences brain health via the gut-brain axis. Probiotics and gut microbes can affect brain physiology through their influence on cytokine levels. Changes in the gut microbiota are communicated to the brain through the vagus nerve and through levels of dietary tryptophan, a serotonin precursor. Dietary changes are one established method of altering gut microbiota populations. Probiotics are capable of regulating the hypothalamic-pituitary-adrenal (HPA) axis, which is involved in the stress response, and changing levels of brain-derived neurotrophic factor (BDNF), which plays an important role in learning and memory.

2.7.2 Multivitamins

Similarly, multivitamins, especially vitamins A, C, and E, have been shown to benefit cognition and spatial memory as well. Vitamins have been linked to better cognitive health, particularly in free recall memory. Vitamins A, C, B group, and E can act as antioxidants by scavenging free radicals and preventing oxidative stress. Vitamin C, in particular, is highly concentrated in the brain, where it promotes neuronal, vascular, and neurotransmitter function. Decreased vitamin B12, B6, and folate have also been linked to cognitive decline associated with aging. Moreover, maternal B12 levels have been linked to the cognitive function of their offspring. Taking B vitamins was shown to be beneficial for the cognitive function of people without dementia as well. Vitamin D is a steroid hormone with many functions that take effect after binding a receptor in the nucleus. Vitamin D levels have also been linked to brain functioning. This may be due to its role in neuroinflammation, which is involved in cognitive decline and neurodegeneration accompanying aging.

2.7.3 Zinc

Another nutrient, zinc, is crucial for memory formation and learning. Zinc is critical for cognitive development, since it is involved in neuronal migration and it regulates neurogenesis and differentiation. In addition to its functions within glia and neurons, zinc also affects neurotransmission. Zinc deficiencies can affect attention, behaviour, and motor development. Long-term administration of zinc sulfate in rats enhanced learning, spatial memory, and exploratory activity. In addition to improving spatial working memory, zinc supplements in rats were also found to improve recognition memory. Zinc might also affect memory formation through its ability to regulate glutamate signalling. Additionally, zinc ions are highly concentrated in the hippocampus and, thus, play a key role in modulating spatial learning and memory.

3. ROLE OF NUTRACEUTICALS IN PREVENTION OF DIFFERENT DISEASES: [2, 4, 5, 14, 16]

3.1 Cardiovascular diseases

Several classes of nutraceuticals have potential benefits in the treatment of CVD and the ones with the strongest evidence are briefly summarized below.

3.1.1 Sterols/stanols

Plant sterols/stanols are phytosterols, and have been identified in a range of plant products including various fruits and vegetables, cereals, seeds and nuts. Their biological activity results from their molecular structural similarity to cholesterol.

3.1.2 Polyphenols

Polyphenols are phytochemicals with widespread distribution in foods of plant origin. They are found in fruits, vegetables, cereal and legumes. Additionally, they are found in beverages produced from plant products such as tea, coffee, wine and cocoa. These include flavonoids, phenolic acids, stilbenes and lignans. Polyphenols found in grapes and grape derivatives, cocoa and tea are of interest in the prevention of CVD

A variety of polyphenols have been identified in cocoa and its derivative. These include catechins, flavonol glycosides, anthocyanins and procyanidins. Cocoa-containing foods provide a higher content of flavonoids per serving than other beverages such as red wine and tea

Green tea, which is minimally fermented, contains more catechins such as epigallocatechin gallate, epicatechin-3-gallate, epigallocatechin and epicatechin whereas the more extensively fermented black tea is rich in flavins and thearubigins.

3.2 Diabetes

Isoflavones are Phytoestrogens; they have a structural as well as functional resemblance to human estrogen as well as have been expended by human's world-wide of all phytoestrogens, soy isoflavones have been studied most. A high isoflavones intake (20–100 mg/day) is connected with lower incidence besides mortality rate of type II diabetes, heart disease, osteoporosis as well as certain cancers, Omega-3 fatty acids have been proposed to reduce glucose tolerance in patients predisposed to diabetes. Ethyl esters of n-3 fatty acids may be potential beneficial in diabetic patients. Docosahexaenoic acid modulates insulin resistance and is also vital for neurovascular development. This is particularly significant in women with gestational diabetes mellitus which foster the recommendation for essential fatty acids during pregnancy. Lipoid acid is a universal antioxidant, now used in Germany for the treatment of diabetic neuropathy⁵.

Calcium/vitamin D:

One of the first large prospective studies to examine the role of habitual diet on diabetes risk identified high calcium intake as protective; women in the top quintile of calcium intake, as contrasted to those in the bottom quintile, were 30% less likely to develop diabetes over a 6-year follow up, after correction for various potential confounders. Surprisingly, it appears that no subsequent studies have followed this lead. No prospective studies have examined the implications of habitual vitamin D intake (or sunlight exposure) for diabetes risk. Yet there are theoretical grounds for suspecting that, by suppressing secretion of parathyroid hormone (PTH), good calcium/vitamin D status may help to preserve insulin sensitivity and thus help prevent diabetes mellitus.

3.3 Anti-inflammatory activities

Cucurmin which is a polyphenol of turmeric have anticarcinogenic, anti-oxidative and anti-inflammatory properties. Linoleic acid (found in green leafy vegetables, nuts, vegetable oils i.e., evening primrose oil, blackcurrant seed oil, hemp seed oil, cyanobacteria and from spirulina) are used for treating problems with inflammation and autoimmune diseases. Glucosamine and chondroitin sulfate are used against osteoarthritis and regulate gene expression and synthesis of NO and PGE2.

3.4 Cancer

Flavonoids which block the enzymes that produce estrogen reduce of estrogen induced cancers. Phytoestrogens is recommended to prevent prostate/breast cancer. Soy foods are source of Iso-flavones, curcumin from curry and soya isoflavones possess cancer chemo preventive properties. Lycopene concentrates in the skin, testes, adrenal and prostate protects against cancer Saponins contains antitumor and antimutagenic activities. Curcumin (diferuloylmethane) which is a polyphenol of turmeric possesses anti-carcinogenic, antioxidative and anti-inflammatory properties. Beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes were reported to possess anti-tumor activity.[6]

A dysregulation of proliferation alone is not sufficient for cancer formation; a suppression of apoptotic signalling is needed. Cancer cells acquire resistance to apoptosis by overexpression of antiapoptotic proteins (Bcl-2, IAPs, and

FLIP) and/or by the downregulation or mutation of proapoptotic proteins (Bax, Apaf-1, caspase-8, and death receptors).

Overexpression of antiapoptotic Bcl-2 and Bcl-xL probably occurs in more than 50% of all cancers. Flavonoids are a group of more than 4000 polyphenolic compounds that occur naturally in foods of plant origin.

Recent epidemiologic studies have shown good correlation between dietary intake of carotenoids and reduced risk of cancer and cardiovascular diseases. Tomato is rich in various carotenoids. Lycopene is the precursor of β -carotene in tomato, which accumulates after the lycopene cyclase gene is downregulated during ripening. Lycopene and β -carotene can induce apoptosis in prostate cancer cells and malignant lymphoblast cells. Caffeic acid phenethyl ester, an active phenolic component extracted from honey bee propolis, blocks tumorigenesis in a two-stage model of mouse skin cancer. Caffeic acid phenethyl ester has been reported induce apoptosis in HL-60 leukemic cells and mouse epidermal JB6 Cl 41 cells. Curcumin induces apoptosis in colon carcinoma cells, leukemic cells, prostate cancer cells, melanoma cells, and breast cancer cells. The use of garlic as anticancer agent has long been established. The allylsulfur compounds derived from garlic have significant anti-proliferate activity against human cancers. Diallylsulfide and diallyldisulfide induce apoptosis in non-small cell lung cancer cells and in prostate cancer and breast cancer cells. With our increased understanding of the chemistry and biology of nutraceuticals, the nutraceutical research will shift more into the area of chemoprevention.[15,16]

3.5 Oral diseases

Odontonutraceuticals, a new term has been discovered. It represents pleiotropic phytotherapeutic agents in dentistry as they regulate different molecular and biochemical targets.

3.6 Parkinson's disease

In Parkinson disease, the dopamine-releasing cells in the brain damaged due to neurodegeneration. It is the second most common age-related disorder in the world. Plant Polyphenols, stilbenes, soybean and other phytoestrogens, vit-C, vit-D, vit-E, coenzyme Q 10 and unsaturated fatty acid revealed protective roles against progression of Parkinson's disease.

3.7 Eye disorders

Nutraceuticals rich diet appears beneficial for age related macular degeneration. Lutein, DHA, green tea, carotenoids, flavonoids, vitamin E, coenzyme Q10 possess antioxidant activity and are affective for presbyopia, cataracts. Zeaxanthin is used for the treatment of glaucoma, visual disorders. Melatonin, spirulina, coenzyme Q10 and soy isoflavones are also used for the control of macular degeneration.

3.8 Osteoarthritis:

Osteoarthritis is a disease with a multifactorial etiology affecting all joint tissues and involving both biochemical and mechanical factors that act in synergy to degrade cartilage. Joint discomfort reduces physical activities resulting energy imbalance and weight gain. Nutraceuticals like chondroitin sulfate, glucosamine, diacerin, banana, ginger, green tea, pomegranate, boswellia, oxaceprol, tipi, willow bark, curcumin, avocado, soybean, collagen hydrolysate are used to alleviate the complications.

3.9 Stress Management

Stress is a vital part of our psychological makeup and is a threat to our existence. The natural bioactive compounds called adaptogens helps to cope up against stress related cellular damages. They cause a non-specific increase in the resistance of an organism to noxious influences. They exert to normalize and provide balancing action for both stress and mental health.

4. Benefits of Nutraceuticals [2]

Nutraceuticals may offer many benefits:

- a) May increase the health value of our diet.
- b) May help us livelonger.
- c) May help us to avoid particular medical conditions.
- d) May have a psychological benefit from doing something for one self.
- e) May be perceived to be more "natural" than traditional medicine and less likely to produce unpleasant side effects.
- f) May present food for populations with special needs (e.g. nutrient-dense foods for the elderly).
- g) May easily be available and economically affordable

Table 1: Use of Chemical Constituents of Nutraceuticals [1, 4, 7, 9, 14, 15, 16]

Sr. NO.	Chemical constituents	source	uses
Carotenoids			
1	Lycopene	Guava, papaya, watermelon, Tomatoes, Pink coloured grape fruit.	They reduces cholesterol levels, anti-oxidants, protects against cancer.
2	β -Carotene	Vegetables, fruits, oats, Carrots.	Antioxidants, protection of cornea against uv light
3	Lutein	Spinach, corn, avocado, egg yolk	Protect eyes against age related muscular degenerations, cataracts, anticancer activity (colon)
4	Tocotrienol	Palm oil, different grains.	Improves cardio vascular health, fight against cancer (breast cancer).
5	Saponins	Beans like soya beans, chickpeas.	Very effective against colon cancer, reduces cholesterol level.
Phenolic Compounds			
6	Flavonones	All Citrus fruits	Different types of Anti-oxidant & anticancer activity
7	Flavones	Different types of fruits, soya beans, vegetables.	Different types of Anti-oxidant & anticancer activity
8	Flavonols	Broccoli, tea, Onions, fruits like Apples Etc	Different types of Anti-oxidant & anticancer activity
9	Curcumin	Turmeric root	Strongly anti-inflammatory and strongly antioxidant, effective anti-anti-clotting agent.
10	Glucosinolates	Cauliflower, Cruciferous vegetables	Anticancer activity, protect against bladder
11		Phytoestrogens	
12	Isoflavones	Legumes, beans like soy beans	It Lowers LDL cholesterol, antioxidants, Protects against prostate, breast, bowel, and other cancer.
13	Lignans	Vegetables, rye & Flaxseed	Protect against development of cancer like colon and breast cancer.
Dietary fibre			
14	Soluble fibre	Beans like Legumes, cereals like oats, barley, some fibrous fruits	They help in maintenance of a healthy digestive tract & have anticancer activity.
15	Insoluble fibre	whole grain foods wheat and corn bran, Nuts, etc.	They help in maintenance of a healthy digestive tract, and have Anticancer (colon) activity.
16	Sulphide/Thiols	Present in Cruciferous vegetables	Help in maintenance of healthy immune function.

Fatty Acids			
17	Omega 3 Fatty Acids	Present in Salmon & Flax seed	They are the Potent controllers of the inflammatory processes, help in Maintenance of brain function & Reduce cholesterol dis osition.
18	Monosaturated fatty acids	Present in Tree nuts	They Reduce the risk of coronary heart disease.
19	Prebiotics/Probiotics Lactobacilli, bifidobacteria	Present in Yogurt, other dairy and nondairy applications.	They help to improve gastrointestinal health and systematic immunity.
20	Minerals like zinc, Calcium, Selenium, copper, potassium	Food	They are the Important constituents of balanced diet
21	Polyols Sugar alcohols (xylitol, sorbitol)	Present in Fruits	They may reduce the risk of dental caries (cavities)

5. CONCLUSION

Nutraceuticals have proven health benefits and their consumption will keep diseases away and allow humans to maintain an overall good health. They are widely accepted by all age groups due to their safety, higher quality, purity, efficacy, health promoting and disease curing properties. In the current scenario of self-medication, nutraceuticals play major role in development of health. It is also necessary to review this topic because the nutraceutical industry is growing at a rate far exceeding expansion in the food and pharmaceutical industries.

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