

# Role and effect of Nutraceutical in Human Health

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**Abstract:** - The term "nutraceutical" is a combination of "nutrition" and "pharmaceutical." Nutraceuticals, broadly speaking, are food or food components that have a significant role in modifying and maintaining the regular physiological processes that support healthy human beings. Dietary fibre, prebiotics, probiotics, polyunsaturated fatty acids, cancer prevention agents, and other many types of naturally occurring homegrown foods can all be characterised as food substances used as nutraceuticals. The existing population and the patterns of wellbeing are the main drivers of the global development of the nutraceutical market. Overall, "nutraceutical" has brought about the underutilised time of medicine and health, during which the food business has evolved into a research-oriented division. These nutraceuticals aid in the fight against some of the biggest health problems of the century, including obesity, cardiovascular disease, cancer, osteoporosis, joint pain, diabetes, and cholesterol. In other words, "Nutraceuticals" are foods that provide nutrition or are composed of foods that do, but they also serve a medicinal purpose.

**Keywords:** - *Dietary fiber, Probiotics, Prebiotics, Polyphenols, Spices, Human diet.*

## INTRODUCTION:

Hippocrates correctly emphasized, "Let food be your medicine, and medicine be your medicine," around 2000 years ago. Due to the recognition that "nutraceuticals" play a significant role in health improvement, there is currently an increased worldwide interest. Dr. Stephen DeFelice, Chairman of the Establishment for Advancement in Medicine, coined the term "Nutraceutical" in 1989 by combining the terms "Sustenance" and "Pharmaceutical." [4] "Nutraceutical" is a marketing term for dietary supplements that are sold with the intention of treating or preventing disease, and it has no administrative definition. [5] In more recent times, a unused eat less wellness world view is developing, which places more emphasis The fundamental eating habits of the previous have changed as a result of the modern lifestyle that people today live. The consumption of garbage food has made it more difficult to treat some diseases that are caused by garbage food. Weight is now recognized as a global problem. In most developing nations around the world, heart disease continues to be a major cause of death, followed by cancer, osteoporosis, and joint pain. Nutraceuticals are especially appealing because of the red tape associated with overseen care, which makes them appealing to consumers who are perplexed by the pricey, high-tech approach to disease treatment offered by current solutions. The maxim that Hippocrates cited approximately 2,500 years ago, "Let food be thy pharmaceutical and pharmaceutical be thy food," remains applicable today. A "nutraceutical" is any substance that is considered a food or a portion of a food and provides restorative or wellness benefits, enveloping, prevention, and treatment of diseases. Nutraceuticals are the rising trend of common items that blur the line between food and health care [6]. Hereditarily crafted "architect" foods, homegrown items, and handled foods like cereals, soups, and beverages are all examples of such items. These items can also include isolated nutrients, diets, and supplements. Over 470 useful food and nutraceutical products with reported health benefits are currently available. [7] "Nutraceuticals and functional foods have received impressive interest due to their assumed safety and potential dietary and remedial effects," according to the study. The global showcase value is between 30 and 60 billion US dollars, with Japan, the United States, and Europe accounting for the largest portion. The pharmaceutical market is expected to reach \$197 billion in 2010 [ 8]

## *Nutraceutical:*

The survey conducted in the United Kingdom, Germany, and France was the first to introduce the term "nutraceutical." The respondents rated diet as the most important factor in maintaining good health, followed by exercise and genetics. [9] In 1989, Stephen De Felice, founder and chairman of the Foundation for Innovation in Medicine (FIM), Cranford, NJ, coined the term "nutraceutical" from the terms "nutrition" and "pharmaceutical." [10] De Felice defines a nutraceutical as "a food (or a part of food) that provides medical or health benefits, including the prevention and or treatment of a disease." Nutraceuticals, on the other hand, are defined as "a product prepared from foods, but sold in the form of pills, powder (potions), or in other medicinal forms, not usually associated with foods" by Health Canada [11]. Nutraceuticals can be found in a variety of products that originate from (a) the food industry, (b) the market for herbal and dietary supplements, (c) the pharmaceutical industry, and (d) the newly merged pharmaceutical/agribusiness/nutrition conglomerates. It could include diets, supplements, herbal products, isolated nutrients, genetically engineered "designer" foods, and processed foods like cereals, soups, and beverages. [12]

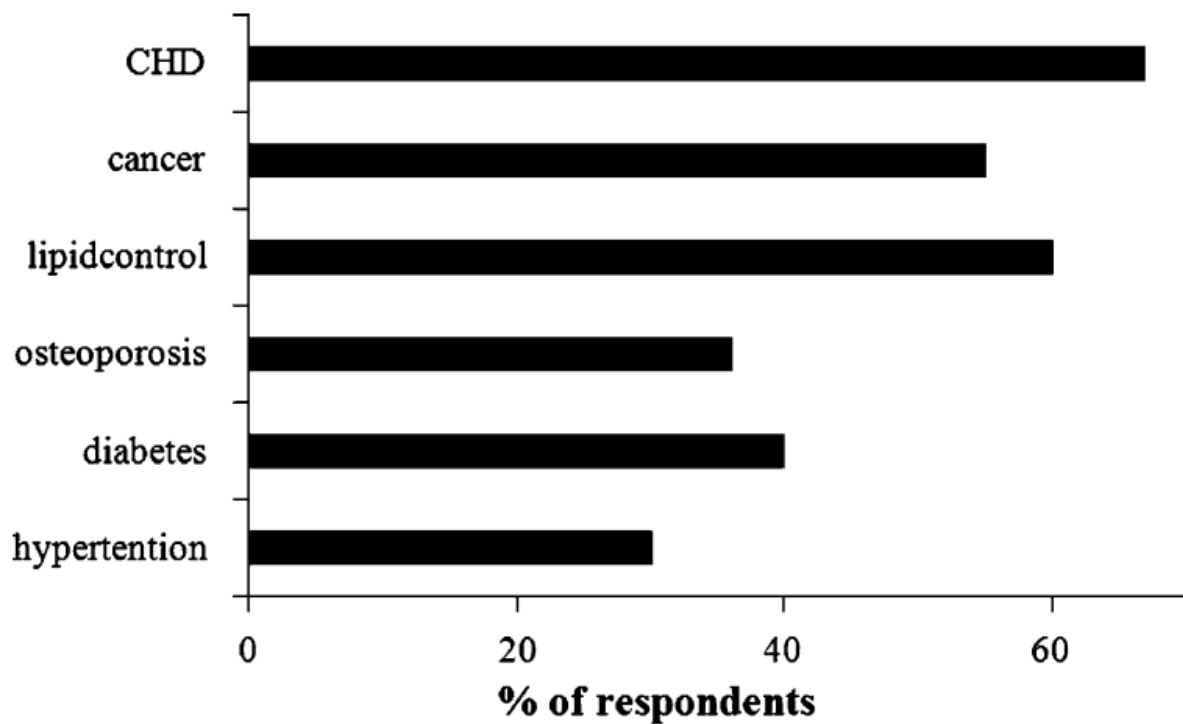


Fig. 1 Therapeutic areas covered by nutraceutical products

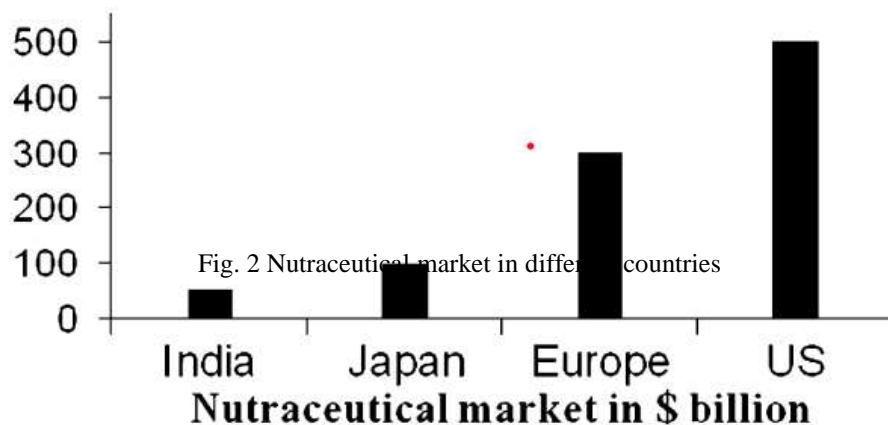


Fig. 2 Nutraceutical market in different countries

#### ***Nutraceuticals are categorized as:***

Nutraceuticals can be organized in a variety of ways to make them easier to understand and use, such as for academic instruction, the design of clinical trials, the development of functional foods, or dietary recommendations. Food sources, the mechanism of action, the chemical nature, and other factors can all be used to classify nutraceuticals. The food sources utilized in nutraceuticals fall into the following categories:

- ✓ Dietary Fibre
- ✓ Probiotics
- ✓ Prebiotics
- ✓ Polyunsaturated fatty acids
- ✓ Antioxidant vitamins
- ✓ Polyphenols
- ✓ Spices

In the next part of the review, a brief description of the health and medical benefits of some such nutraceuticals are done. More broadly, nutraceuticals can be classified in two groups [14]

- ✓ Potential nutraceuticals
- ✓ Established nutraceuticals

After thorough clinical evidence of its health and medical benefits has been gathered, a potential nutraceutical cannot be considered established. It should be noted that the majority of nutraceutical products are still classified as "potential."

**Dietary Fibre:**

Food, or more specifically plant material, that is digested by gut microflora rather than hydrolyzed by enzymes secreted by the digestive tract is called dietary fiber. Non-starch polysaccharides (NSP) like celluloses, hemicelluloses, gums and pectins, lignin, resistant dextrins, and resistant starches make up most dietary fibres. Fruits, oats, barley, and beans are all sources of soluble fiber. Table 1 shows the amount of dietary fiber found in certain foods. Chemically, "dietary fiber" refers to polymers of carbohydrates with a polymerization level of at least 3 that are neither digested nor absorbed by the small intestine. Dietary fibers can be broken down into two categories based on how well they dissolve in water: -

- ✓ Insoluble dietary fibre (IDF), which includes celluloses, some hemicelluloses and lignins which is fermented to a limited extent in the colon.
- ✓ Soluble dietary fibre (SDF), which includes  $\beta$ -glucans, pectins, gums, mucilages and hemicelluloses that are fermented in the colon.

**Table 1** Level of dietary fibre in foods

Product	AOAC (g/100 g) <sup>a</sup>
Apples (with skin)	2.0
Bananas	1.9
Carrots (boiled)	3.1
Baked beans	4.2
Cabbage	2.0
White Bread	2.0
Brown Bread	4.5
Wholemeal Bread	7.4

**(PUFA) polyunsaturated fatty acids:**

Because they are consumed externally and are essential to the body's function, PUFAs are also referred to as "essential fatty acids." [15] There are two subgroups of PUFAs: omega-3 and omega-6 fatty acids, respectively. Docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA), and alpha-linolenic acid (ALA) are the most important omega-3 fatty acids. EPA and DHA are both precursors of ALA. Fish oils and fatty fish like mackerel, salmon, herring, trout, and blue fin tuna are rich sources of EPA and DHA. Flaxseed, soybeans, canola, some nuts (like walnuts), and red/black currant seeds are the primary sources of ALA. [16] Linoleic acid (LA), -linolenic acid (GLA), and arachidonic acid (ARA) are the primary components of omega-6 PUFAs. LA is mostly found in vegetable oils like corn, safflower, sunflower, and soyabean. Omega-3 fatty acids have been shown to have three primary effects on cardiovascular disease anti-arrhythmic (preventing or alleviating irregularities in the force or rhythm of the heart). ARA can be found in animal products like meat, poultry, and eggs. [17]

**Probiotics:**

Over 2,000 years ago, the first probiotics were consumed in the form of fermented milk. Metchnikoff's work in 1907, which transformed the harmful bacteria in the large intestine into a host-friendly colony of *Bacillus bulgaricus*, sparked increased scientific interest in this field. [18] A probiotic is a live microbial feed supplement that improves the intestinal microbial balance of the host animal when given to it in sufficient amounts. [19]

Probiotics generally include the following categories of bacteria: -

- ✓ *Lactobacilli* such as *L. acidophilus*, *L. casei*, *L. delbrueckii subsp. bulgaricus*, *L. brevis*, *L. cellobiosus*.
- ✓ *Gram-positive cocci* such as *Lactococcus lactis*, *Streptococcus salivarius subsp. thermophilus*, *Enterococcus faecium*
- ✓ *Bifidobacteria* such as *B. bifidum*, *B. adolescentis*, *B. infantis*, *B. longum*, *B. thermophilum*.

**Prebiotics:**

By selectively altering the composition or metabolism of the gut microbiota, prebiotics have a positive effect on the host. [20] These are polysaccharides with short chains and distinct chemical structures that humans cannot digest; in oligosaccharides based on fructose that are either added to food or found naturally in food. Consuming prebiotics generally aids metabolism by encouraging the growth of lactobacillus and bifidobacteria in the gut. [21] Fructo-oligosaccharides are abundant in tomatoes, chicory roots, chicory roots, and alliums. The oligosaccharides raffinose and stachyose, which are found in beans and peas, are two additional examples. Prebiotics have been shown to improve lactose tolerance, have antitumor properties, neutralize toxins, stimulate the immune system in the intestines, and reduce constipation, blood lipids, and cholesterol levels. [22] Bifidobacteria grow when 5–20 grams of insulin and oligosaccharides are consumed daily. [23] . Again, these oligosaccharides can cause flatulence, abdominal distension, and diarrhea when consumed in large quantities. [24]

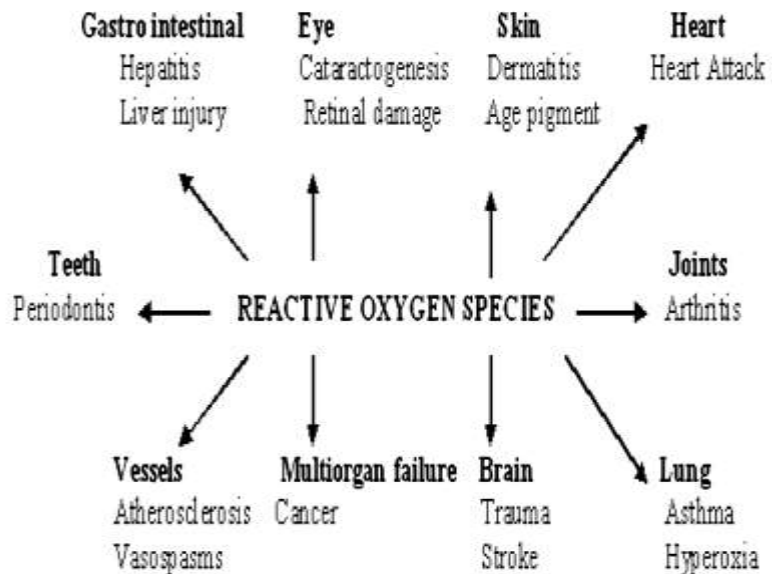
**Selenium:**

Selenium is a trace mineral that can be found in soil, water, and some foods. It is also known as an essential mineral. Selenomethionine is the most common form, but it can be found in a variety of forms. It is necessary for DNA synthesis and repair, apoptosis, and protecting cells from oxidative damage. [ 25] Selenium works through glutathione peroxidases and thioredoxin reductases to remove oxidative stress-induced harmful lipid hydroperoxides, hydrogen peroxide, and peroxynitrite, stabilizing the cell membrane and protecting DNA. [26] Selenium, in many forms, is most abundant in animal proteins like meat and seafood, most of which are highly bioavailable.[27,28] Selenium, in many forms, is most abundant in animal proteins like meat and seafood, most of which are highly bioavailable. [29]

**Antioxidant vitamins:**

The group of vitamins known as antioxidant vitamins includes carotenoids, vitamin C, and vitamin E. These vitamins prevent oxidative reactions that cause a variety of degenerative diseases, including cancer, cardiovascular disease, and cataracts, by acting independently and in concert. [30] (Fig. 3).

Fig. 3 Clinical conditions involving reactive oxygen species

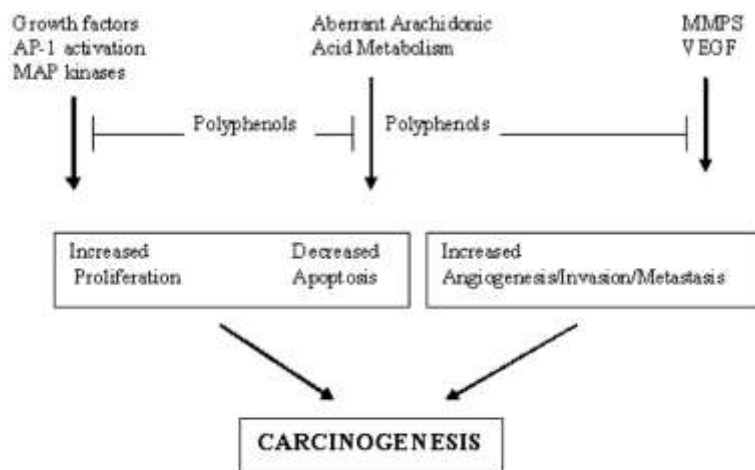


Many fruits and vegetables contain a lot of these vitamins, which work by scavenging free radicals to protect cells. Tocopherols and tocotrienols in vitamin E transfer hydrogen atoms and scavenge singlet oxygen and other reactive species, preventing PUFA peroxidation in the biological membrane and LDL. [31] Due to the presence of an unsaturated side chain, tocotrienols are more mobile within the biological membrane than tocopherols, allowing them to penetrate tissues with saturated fatty layers, such as the liver and brain, more effectively. They are a better liver oxidation inhibitor and have a greater recycling capacity. [32] Selenium works together to prevent lipid peroxidation. Ascorbic acid, or vitamin C, removes molecular oxygen, quenches singlet oxygen radicals, and donates hydrogen atoms to lipid radicals. A well-known antioxidant mechanism is the synergistic action of ascorbic acid and tocopherol on the scavenging of aqueous radicals. [33]

**Polyphenols:**

Polyphenols are a large group of phytochemicals that plants make as secondary metabolites to protect themselves from reactive oxygen species and photosynthetic stress. There are approximately 8,000 distinct classes of polyphenols, with flavanols, flavones, flavan-3-ols, flavanones, and anthocyanins being the most significant. Most polyphenols are synthesized by the highly branched phenylpropanoid pathway. Flavonoids and phenolic acids are the polyphenols that are found in food the most frequently. The fact that significant in vitro evidence suggests that dietary polyphenols can alter a wide range of cellular processes, including gene expression, apoptosis, platelet aggregation, and intercellular signalling, may have implications for anticarcinogenic and anti-atherogenic effects [34] as shown in Figure 4.

**Fig. 4** Proposed mechanistic scheme for prevention of cancer by dietary polyphenols



In addition, polyphenols aid in the prevention of neurodegenerative diseases and diabetes mellitus and have antioxidant, anti-inflammatory, anti-microbial, and cardioprotective properties. [35]. Based on their structural chemistry, polyphenols are mostly known for their antioxidant properties. On a molar basis, polyphenols have been shown to be more effective antioxidants than vitamin E and C *in vitro*. Polyphenols' biological activity is significantly influenced by their bioavailability. This is contingent on the polyphenol's chemical properties, conjugation in the intestines, intestinal absorption, and the enzymes that are available for metabolism. [36] A fascinating aspect of polyphenols has also been the subject of research. Glutamylcysteine synthetase, an important rate-limiting enzyme in glutathione synthesis, has been found to be influenced by flavonoids. Polyphenol-mediated regulation of glutathione significantly alters cellular effects, such as detoxification of xenobiotics and glutathionylation of proteins, in addition to glutathione's role in redox regulation of transcription factors and signal transduction enzymes. [37]

#### **Role of Nutraceutical in various disease:**

- ✓ Cardiovascular diseases
- ✓ Obesity
- ✓ Diabetes
- ✓ Cancer
- ✓ Immune boosters
- ✓ Alzheimer's disease
- ✓ Parkinson's disease
- ✓ Vision improving agents
- ✓ Allergy

#### **Diseases of the heart:**

Chronic diseases like cancer, diabetes, obesity, and cardiovascular diseases are rapidly rising worldwide. Chronic diseases were responsible for approximately 59% of the world's reported 56.5 million deaths and 46% of the disease burden in 2001. Hypertension (high blood pressure), coronary heart disease (heart attack), cerebrovascular disease (stroke), heart failure, peripheral vascular disease, and other conditions all fall under the category of cardiovascular diseases (CVD). By 2010, CVD would be the leading cause of death in developing nations, accounting for a third of all deaths worldwide in 1999. Most CVDs can be avoided or controlled. It was reported that cardiovascular disease mortality is correlated with low fruit and vegetable intake. [38,39] A diet high in fruits and vegetables has been shown to protect against cardiovascular disease in numerous studies. [40] Additionally, for the prevention and treatment of cardiovascular disease (CVD), nutraceuticals in the form of antioxidants, dietary fiber, omega-3 polyunsaturated fatty acids (n-3 PUFAs), vitamins, and minerals are suggested. Polyphenols, which are found in wine and grapes, have been shown to alter cellular metabolism and signalling, which is consistent with reducing arterial disease. [41] Optimal nutrition, nutraceuticals, vitamins, antioxidants, minerals, losing weight, quitting smoking, limiting alcohol and caffeine, and other changes to one's lifestyle can prevent, delay, treat, and manage hypertension. -Lipoic acid, magnesium, Vitamin B6 (pyridoxine), Vitamin C, N-acetyl cysteine, Hawthorne, Celery, and other nutrients with calcium channel blocking activity (also known as antihypertensive activity) are just a few examples. [42] Onions, endives, cruciferous vegetables, black grapes, red wine, grapefruits, apples, cherries, and berries all contain flavonoids. [43] Flavonoids in plants that are available as flavones (chamomile contains the flavonoid apigenin); flavonones, such as citrus fruits' hesperidin; milk thistle flavanols, or silybin (tea: grapefruit's quercetin, kaempferol, and rutin; rutin buckwheat; polyphenols are simple phenolic molecules to highly polymerized compounds with molecular weights of more than 30,000 Da (ginkgo flavonglycosides). [44] The Mediterranean diet's association with stilbenes, anthocyanins, condensed tannins (proanthocyanins) in wine and grapes, tetrahydro-carbolines, dietary indoleamines, melatonin, and serotonin in various plant foods is hypothesized to provide health benefits. [45]

**Obesity:**

An unhealthy body mass index—also known as obesity—is a well-established risk factor for a wide range of conditions, including angina pectoris, congestive heart failure, hypertension, hyperlipidemia, respiratory disorders, renal vein thrombosis, osteoarthritis, cancer, decreased fertility, and other conditions. [46] With approximately 315 million people estimated to fall into the WHO-defined categories of obesity, obesity is now a global public health issue. The increased availability of foods high in fat and high in energy is one of the primary factors contributing to the rapid rise in obesity rates. [47] Consuming snacks, processed foods, and beverages that are high in energy can lead to weight gain, so the diet should limit saturated and trans fats in addition to sugar and salt. It has been demonstrated that reducing calories and increasing physical activity are only moderately effective at controlling obesity. As a result, many doctors and obese people are turning to pharmaceuticals and nutraceuticals to treat their condition. For body weight reduction, it is desirable to have a tolerable and effective nutraceutical that can either increase energy expenditure or decrease caloric intake. Ephedrine, caffeine, ma huang-guarana, chitosan, and green tea are examples of herbal stimulants that have been shown to help people lose weight. However, because of their propensity to have unfavourable effects, their use is contentious. As food-based natural fibres, buckwheat seed proteins help with obesity and constipation. [50] Green tea extract and 5-hydroxytryptophan may aid in weight loss, with the former reducing appetite and the latter increasing energy expenditure [51]

**Diabetic:**

Diabetes mellitus is characterized by abnormally high blood glucose levels, either as a result of insulin's ineffectiveness or insufficient production. Type 1 diabetes, which is an autoimmune condition that affects 5% of people, and type 2 diabetes, which is linked to obesity and accounts for 95% of cases, are the most common types of diabetes. Diabetes during pregnancy is common. [45] Diabetes is expected to affect 366 million people worldwide by 2003, up from 171 million in 2000. [52] Diabetes, like the majority of chronic diseases, has a significant financial impact not only on society as a whole but also on individual patients and their families. In 1992, it was estimated that the healthcare costs associated with diabetes accounted for \$85.7 million, or 11.9% of total healthcare costs. [53] In diabetic predisposed individuals, it has been suggested that omega-3 fatty acids reduce glucose tolerance. Insulin is required for the synthesis of long-chain n-3 fatty acids; As a result, their depletion may be more likely to affect the heart in diabetes. N-3 fatty acid ether esters may be beneficial to diabetic patients [54] Lipoic acid is a common antioxidant that is currently being used in Germany to treat diabetic neuropathy. As a long-term dietary supplement intended to prevent complications in diabetic patients, lipoic acid may be more effective. [55] The primary treatment for gestational diabetes mellitus is diet therapy. Although herbal supplements that are thought to be beneficial to type 2 diabetes mellitus are widely used, few have been demonstrated to do so in appropriately designed randomized trials. Phytoestrogens are isoflavones. They have been consumed by humans worldwide and share structural and functional similarities with human estrogen. The most research has been done on soy isoflavones, which are phytoestrogens. Type II diabetes, heart disease, osteoporosis, and some cancers are less likely to occur and die in people who consume a lot of isoflavones (between 20 and 100 mg per day). [56]

**Cancer:**

Malignant tumors were the cause of 12% of the nearly 56 million deaths worldwide from all causes in the year 2000. The World Cancer Report estimates that there will be 15 million new cases of cancer in 2020, representing a 50% increase. Similar to industrialized nations, cancer has emerged as a major public health issue in developing nations. Cancer prevention can be aided by a healthy diet and lifestyle. The incidence of colon cancer was lowest among people who consumed a lot of foods high in lutein, such as chicken eggs, spinach, tomatoes, oranges, and leafy greens. [59] Chronic inflammation is linked to a high risk of cancer. During chronic inflammation, free radicals and aldehydes can be produced at the molecular level, causing harmful gene mutations and posttranslational modifications of important proteins linked to cancer. A risk factor for cancer is immune suppression, which is linked to chronic inflammation. An illustration of an anti-inflammatory molecule is ginseng, which targets numerous key players in the inflammation-to-cancer pathway. [60] Phytochemicals that prevent cancer have recently received a lot of attention. Some phytochemicals derived from herbs and spices may also have potential anticarcinogenic and antimutagenic activities, in addition to other beneficial health effects, in addition to chemopreventive components found in fruits and vegetables. The term "phytoestrogens" refers to a wide variety of phytopharmaceuticals that are said to have hormonal activity and are suggested for the prevention of prostate and breast cancer. [61] Citrus fruit flavonoids appear to act as antioxidants, preventing cancer. [62] Isoflavones, the polyphenolic phytochemicals exemplified by tea's epigallocatechin gallate, can only be found in foods made from soy. [ Curcumin, which comes from curry, and soy isoflavones have anti-cancer properties. [64] Prostate cancer cell growth is inhibited by the main soybean isoflavones, genistein, daidzein, and biochanin. [65,66] Carotenoids are a class of phytochemicals that give foods their various colors. Lycopene's impact on human health has sparked recent interest in carotenoids. Lycopene is a powerful antioxidant and a singlet oxygen quencher because it is unsaturated. [67] Cancer, cardiovascular disease, and gastrointestinal tract disease are all prevented by lycopene. It protects against cancer primarily in the skin, testes, adrenals, and prostate. [68] The importance of value-added fruits in a person's diet has increased due to the connection between carotenoids and retinoids and the prevention of cancer, coronary artery disease, and advanced age-related macular degeneration. According to recent reports, lycopene-rich fruits and vegetables protect humans from cancer by reducing oxidative and other DNA damage. [69]

**Immune booster:**

Immune boosters The organism's immune status and susceptibility to a variety of diseases are directly influenced by the various nutrients in its diet, which play a crucial role in maintaining an "optimal" immune response. The use of a wide variety of phytopharmaceuticals known as "phyto-estrogens," which have been claimed to have hormonal activity, is suggested for the

purpose of preventing a variety of illnesses that are caused by an imbalance in the body's hormones. Soy isoflavones (genistein, daidzein, and biochanin) are receiving renewed attention as potential superior alternatives to the synthetic selective estrogen receptor modulators (SERMs) used in hormone replacement therapy. Phytochemicals disrupt signaling pathways and integrate the activities of hormonal ligands; Their therapeutic applications may extend beyond hormonal disorders to include cancer chemoprevention and/or certain inflammatory disorders. [70] Immune function can be enhanced and wound healing accelerated with nutritional supplements that fall into the immune booster or antiviral category. Coneflower extracts, herbs of the genus Echinacea, such as Echinacea purpurea, Echinacea angustifolia, and Echinacea pillida, and combinations thereof, are among them. elderberry extracts, which come from herbs in the genus Sambuca; and extracts of goldenseal. Coneflowers are native to the central United States, where they are used as a popular herbal remedy. Unsaturated alkyl ketones or isobutyl amides are found in varying amounts in the root extract. Goldenseal contains compounds like berberine and hydrastine, which respectively constrict peripheral blood vessels and stimulate bile secretion, making it an immune booster with antibiotic properties. In their raw or processed forms, Astragalus membranaceus, Astragalus mongolicus, and other herbs in the genus Astragalus are also potent immune boosters. The effect of astragalus and bacteria on the systemic immune and intestinal epithelial cell functions has given probiotics and nutraceuticals new support in the clinical setting. Astragalus stimulates the development and transformation of stem cells into active immune cells in the marrow and lymph tissue. Children's infectious diarrhea and recurrent infections caused by Clostridium difficile have both been found to benefit from the probiotics. The use of probiotics in other gastrointestinal infections, such as irritable bowel syndrome and inflammatory bowel disease, is gaining support. [71]

#### ***Alzheimer's disease:***

Memory loss is the primary clinical manifestation of Alzheimer's disease (AD), which is characterized by progressive dementia. [72] A number of pieces of evidence strongly suggest that several neurodegenerative diseases, including Alzheimer's, are etiologically related to oxidative stress. By neutralizing the negative effects of oxidative stress, mitochondrial dysfunction, and various forms of neural degeneration, nutraceutical antioxidants like  $\beta$ -carotene, curcumin, lutein, lycopene, and turmeric, among others, may exert positive effects on specific diseases. [73] A lot of research has shown that metal ions increase oxidative stress and play a negative role in the development of Alzheimer's disease. The belief that nutraceuticals delay the onset of dementias like Alzheimer's is one reason why supplement consumption is on the rise. However, frequent consumption of nutritional supplements is anticipated to exacerbate pathogenic events centered on metal ions. [74]

#### ***Parkinson's disease:***

Parkinson's disease is a brain disorder characterized by muscle rigidity, shaking, and difficulty walking caused by nerve damage in particular brain regions. [75] It usually happens in middle to late adulthood. According to Canadian researchers, food containing vitamin E may protect against Parkinson's disease. [76] Creatine appeared to alter Parkinson's disease characteristics, as evidenced by a decrease in clinical symptoms. [77] Glutathione's antioxidant power and effect on nerves have also been studied by researchers. It is still unclear what the best long-term dosage, side effects, and administration method are. While preliminary studies of nutritional supplements have shown some promising results, it is essential to keep in mind that there is currently insufficient scientific data to recommend them for Parkinson's disease. Patients should be informed that in addition to being expensive, over-the-counter medications do have side effects and interactions with other medications.

#### ***Agents for improving vision:***

One of the carotenoids, lutein, can be found in a wide variety of fruits and vegetables, including tomatoes, mangoes, corn, sweet potatoes, carrots, squash, and dark, leafy greens like kale, collards, and bok choy. Helianthus autumnalis is a plant that contains lutein dipalmitate. Visual disorders can be treated with lutein, also known as helenin. In traditional Chinese medicine, zeaxanthin is mostly used to treat vision problems. Corn, egg yolks, and green vegetables and fruits like broccoli, green beans, green peas, brussels sprouts, cabbage, kale, collard greens, spinach, lettuce, kiwi, and honeydew are all sources of zeaxanthin. In addition, lutein and zeaxanthin can be found in algae, nettles, and the petals of numerous yellow flowers. Lutein and zeaxanthin are found in non-esterified forms in egg yolk, green fruits, and vegetables. They can also be found in plants as mono- or diesters of fatty acids. An extract from the marigold flower (Tagetes erecta) that contains approximately 86% by weight of the carotenoid's lutein and zeaxanthin is a new source of these carotenoids, a crystalline lutein product. [78]

#### ***Allergy:***

An allergy is a condition in which the body reacts more strongly than usual to a substance or a food. Quercetin (QR) is a member of the flavonoids family of polyphenolic compounds. The class of flavonoids known as flavanols includes QR. In the plant kingdom, it can be found in a lot of rinds and barks. Onions, red wine, and green tea are all particularly rich in QR. QR fights the effects of histamine in the body and is a natural antihistamine. Allergic and inflammatory reactions are caused by histamines. It may aid in the reduction of asthma, bursitis, gout, arthritis, and hay fever-related inflammation. [79] QR reduces leukotriene formation and inhibits some inflammatory enzymes like lipid peroxidases. QR has effects on inflammation, viruses, the immune system, cancer, and gastroprotection. QR prevents an enzyme from accumulating sorbitol, which has been linked to diabetes-related damage to the kidney, eye, and nerves. Additionally, QR has potent antioxidant properties. It prevents deterioration of LDL cholesterol. Certain forms of cholesterol and other body chemicals can't damage blood vessels without QR. Heart disease is caused in part by LDL cholesterol. In addition, QR acts as an antioxidant by removing harmful free radicals from the body. Free radical damage to blood vessels is more likely to occur in diabetics [80]

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