

## Enormous Health Benefits of Nutraceutical in Prevention of Human Health Diseases: A Review

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### ABSTRACT

*Nutraceutical combines the words "nutrition" and "pharmaceutical." Nutraceuticals, in general, are foods or components of foods that play a vital role in changing and maintaining normal physiological function in healthy individuals. Dietary fiber, prebiotics, probiotics, polyunsaturated fatty acids, antioxidants, and other types of herbal natural foods are used as nutraceuticals. Obesity, cardiovascular disease, cancer, osteoporosis, arthritis, diabetes, cholesterol, and other diseases may be prevented by nutraceuticals. Overall, the term "nutraceutical" has ushered in a new era of medicine and health, in which the food industry has evolved into a research-driven industry. The purpose of this article is to provide knowledge about nutraceuticals and their applications in various diseases.*

**Keywords:** Nutraceutical, classification, global marketing demand, nutraceutical & diseases.

### INTRODUCTION

DeFelice introduced the term 'nutraceutical' in 1989, combining the words 'nutrition' and 'pharmacy,' and originally defined it as "a food (or part of a food) that provides medical or health benefits, including the prevention and treatment of disease." A nutraceutical may be a nutrient-dense food like spirulina, garlic, or soy, or a specific dietary component like omega-3 oil from salmon. Medical foods, nutritional supplements, and dietary supplements are all terms used to describe them. Isolated nutrients, dietary supplements,

genetically engineered "designer foods," herbal products, and processed foods like cereals and soups are all included in nutraceuticals. Because of their presumed safety and possible nutritional and therapeutic properties, they have attracted a lot of attention. The role of dietary active compounds in human nutrition is one of the most important research areas, with consequences for consumers, healthcare professionals, regulators, and the industry. Foods and nutrients are essential for the body's normal functioning.

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They aid in the maintenance of an individual's health and the prevention of various diseases. Worldwide acceptance of this fact formed a recognition link between "nutrition" and

"health", and thus the concept of "nutraceuticals" evolved (Rajasekaran et al., 2008).

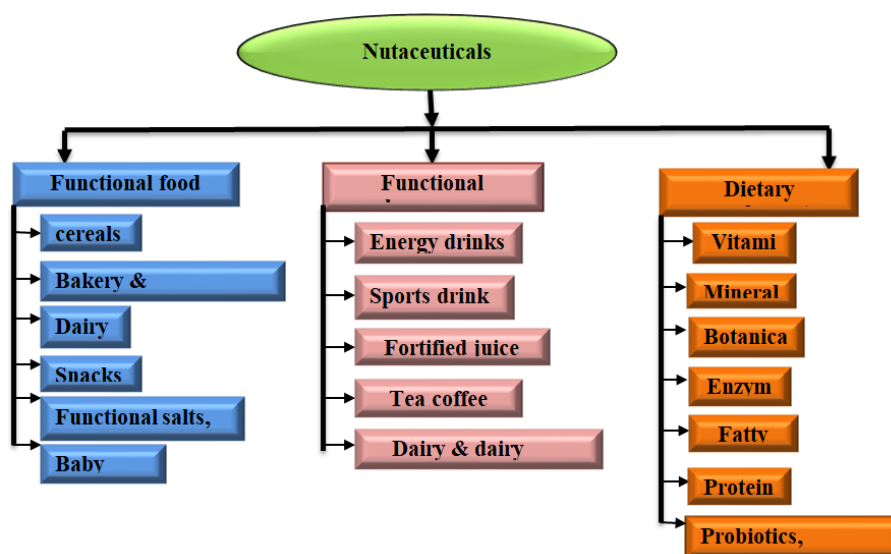


Fig.1 Types of Nutraceuticals Product

#### Classification:

The food sources used as nutraceuticals are all natural and can be classified as (Kalia et al., 2005).

1. Dietary Fiber
2. Probiotics
3. Prebiotics
4. Polyunsaturated fatty acids
5. Antioxidant vitamin
6. Polyphenols
7. Spice

#### Dietary fibres

Dietary fibre is an essential component of a balanced diet. A dietary substance, especially

from plant material, that is not hydrolyzed by enzymes secreted by the human digestive tract but may be digested by gut microflora.

**OR**

Dietary fiber refers to carbohydrate polymers containing ten or more monomeric units that are not digested by the small intestine's endogenous enzymes.

Non-starch polysaccharides (NSP) such as celluloses, certain hemicelluloses, gums, pectins, lignin, resistant dextrins, and starches, are included in this category (Garima Verma et al., 2016).

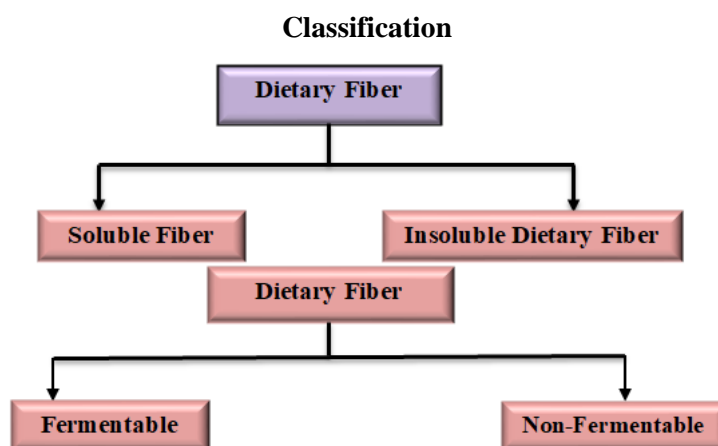


Fig.2 classification of dietary fiber

**Table 1: Major Dietary Fiber Polymers found in Major Food Groups (Garima Verma et al., 2016)**

Food Groups	Polymers Present
Cereals	Cellulose, Arabino Xylans, B – D-glucans, Other non-cellulosic polysaccharides, Phenolic Esters, Lignin
Vegetables& Fruits	Cellulose, Pectic substances, Xyloglucans, Other non-cellulosic polysaccharides, Lignin
Seeds	Cellulose, Pectic substances, Xyloglucans, Other non-cellulosic polysaccharides, Galactomannans
Food Additives	Gums, Alginates, Sulphated Galatians, Cellulosic esters and ethers, Modified starches (carboxy methyl cellulose)

**Therapeutic uses of dietary fiber**

- Regulation of bowel function Constipation
- Diverticulosis
- Hemorrhoids
- In irritable bowel syndrome

**Prebiotic**

Prebiotics are substances that stimulate the growth or activity of microorganisms (such as bacteria and fungi) that benefit their host. Prebiotics have the ability to change the composition of organisms in the gut microbiome, which is the most prevalent example. However, in principle it is a more general term that can also refer to other areas of the body. For example, hand moisturizers have been suggested to work as prebiotics to improve the activity or composition of the skin microbiota. Prebiotics are all fiber, but not all fiber is prebiotic (Michail et al., 2006).

**Health benefits of prebiotics**

- Lower the frequency and duration of diarrhoea caused by infections or antibiotics.
- Inflammation and symptoms of inflammatory bowel disease can be reduced.
- Prevent colon cancer by exerting preventive actions.

- Increase mineral bioavailability and uptake, such as calcium, magnesium, and perhaps iron.

**Probiotic**

Probiotic is a term that means "for life." They are considered probiotic bacteria that confer a therapeutic effect when taken in tolerable quantities (Holzapfel et al., 2001). These microorganisms are sensitive bacteria that help in digestion and nutrition absorption. They primarily push out pathogens such as yeasts, other bacteria, and viruses that may cause disease and create a mutually beneficial symbiotic relationship with the human digestive tract (Oak et al., 2019). They have antibacterial effects by changing the microflora, preventing pathogen adherence to the gut wall competing for nutrients required for pathogen survival, producing an antitoxin and reversing some of the effects of infection on the intestinal epithelium, such as secretory changes and neutrophil migration. Probiotics, for instance, can help people with lactose intolerance by increasing the production of a specific enzyme ( $\beta$ -galactosidase), which can hydrolyze the offending lactose into its constituent sugars (Maia et al., 2001). Table (Sazawal S et al., 2010) shows some bacteria and their action.

**Table 2: list of bacteria and their effect**

Name of bacteria	Action
<i>L. rhamnosus</i>	Reduces the respiratory damages caused by viruses Atopic dermatitis in children: prevention and severity reduced Lowering the chance of getting allergic disease Potential anti-diabetic properties Necrotizing enterocolitis prevention in infants In the treatment of Acute gastroenteritis in children Lowering the risk of rhinovirus infections in premature babies
<i>L. acidophilus</i>	It's used to treat diarrhoea caused by travelling, and also acute diarrhoea. It's used to treat bacterial vaginitis. Boost immune function by suppressing infections and creating lactocidin and acidophili
c. <i>L. Plantarum</i>	Irritable bowel syndrome symptoms like abdominal pain, bloating, flatulence, and constipation are reduced. Nitric oxide levels are increased by eliminating nitrate. Reduces risk of bleeding Immune responses are improved. Antifungal action, prevention of endotoxin generation

### Omega-3- fatty acid

Omega-3 fatty acids are a type of essential fatty acid that our bodies require to function normally. These are the facts of life which support in the proper functioning of our cells. Omega-3 is a fatty acid that our bodies cannot produce and should be obtained from food [Nistha Nema et al., 2018].

#### Sources of Omega-3 Fatty Acids

Omega-3 fatty acids can be found in the following foods: Sardines, salmon, tuna, trout, and cod, nuts and seeds like walnuts and flaxseed. Spinach, cauliflower, Brussels sprouts, other vegetables, Flaxseed oil, soybean oil etc. Beans: kidney, pinto, mango beans, eggs.

#### Types of Omega-3 acids

There are three very important types of Omega 3 acids.

1. Alpha-linolenic acid (ALA)
2. Eicosapentaenoic acid (EPA)
3. Docosahexaenoic acid (DHA)

**1. Alpha- Linolenic acid:**  $\alpha$ - Linolenic acid is a type of omega-3 fatty acid. It's one of two essential fatty acids, they're important for human health but can't be produced by the body.

**2. Eicosapentaenoic acid:** Omega-3 fatty acid eicosapentaenoic acid it is referred to as 20:5

in physiological literature. Timnodonic acid is another name for it.

**3. Docosahexaenoic acid:** Docosahexaenoic acid is an omega-3 fatty acid that is found in the brain, cerebral cortex, skin, sperm, testicles, and retina of humans.

#### Functions of Omega-3 fats

Omega -3 fats play a major role in a number of functions in our body. Here are they

- Relaxation and contraction of muscles
- Blood clotting
- Digestion
- Fertility
- Cell division
- Growth
- Movement of calcium and other substances in and out of cells.

#### Health benefits

- Promotes cellular growth and reduces the risk of cancer.
- It also reduces the risk of arthritis, mental disorders, osteoporosis, and other diseases.
- Decrease formation of blood clots.

#### Antioxidant

Antioxidants are compounds that can prevent or slow damage to cells caused by free radicals, unstable molecules the body produces

as a reaction to the environment. They are sometimes called "free-radical scavengers." The sources of antioxidants can be natural or artificial. Certain plant-based foods are considered to be rich in antioxidants. Plant-based antioxidants are a kind of phytonutrient, or plant-based nutrient. Endogenous antioxidants are antioxidants that are produced by the body. Exogenous antioxidants are those that occur from outside the body. Free radicals are waste products produced by cells when they digest food and respond to their environment. If the body cannot process and remove free radicals efficiently, oxidative stress can result. Cells and physiological functions are impacted. Reactive oxygen species (ROS) are another name for free radicals (ROS). Heart disease, cancer, arthritis, stroke, respiratory disorders, immunological insufficiency, asthma, Parkinson's disease, and other inflammatory or ischemic problems have all been associated to oxidative stress (Shilpa Chaudhari et al., 2017).

#### Food sources

Plant-based foods, particularly fruits and vegetables, are the best sources of antioxidants.

"Superfoods" and "functional foods" are terms used to describe foods that are unusually high in antioxidants.

The various source of food in antioxidants are as follows (Shilpa Chaudhari et al., 2017).

- **Vitamin A:** vitamin A mostly found in dairy products, eggs, and liver
- **Vitamin C:** chief source of vitamin C citrus fruits such as berries, oranges, and bell peppers and vegetable
- **Vitamin E:** vitamin E mostly found in nuts and seeds, sunflowers and vegetable like green, leafy vegetables
- **Beta-carotene:** carrots, peas, spinach, and mangoes bright colour fruits and vegetables are rich in beta carotene.
- **Lycopene:** tomato are rich source of lycopene and other examples are watermelon red and pink fruits and vegetable

- **Lutein:** Green, leafy vegetables, corn, papaya, and oranges are rich source of lutein
- **Selenium:** selenium is mostly found in rice, corn, wheat, and other whole grains, as well as nuts, eggs, cheese, and legumes

#### Therapeutic applications

- Antioxidants are important in the treatment of Friedreich ataxia, a rare degenerative neurological disorder.
- Antioxidants' Significance in Red Cells
- Antioxidant therapy in the treatment of acute CNS injury

#### Nutraceuticals and Diseases

##### Cardiovascular diseases

Antioxidants, Dietary fibres, Omega-3 polyunsaturated fatty acids, vitamins, and minerals can help prevent cardiovascular disease. Polyphenols (found in grapes) help to prevent and manage arterial diseases. Flavonoids (found in onions, vegetables, grapes, red wine, apples, and cherries) inhibit ACE and help to strengthen the tiny capillaries that transport oxygen and nutrients to all cells. Rice bran improves cardiovascular health by lowering serum cholesterol levels, lowering the level of (LDL) and increasing the level of (HDL). The greater the ratio, the greater the risk of coronary heart disease (Temple et al., 2003). Rice bran includes the antioxidants Lutein and Zeaxanthin, which improve vision and lower the risk of cataracts. Rice bran contains omega-3, omega-6, omega-9, and folic acid, all are beneficial to eye health. It is reported that low intake of fruits and vegetables is associated with a high mortality in CVD (Vyas et al., 2010).

##### Diet-related diseases

Diet-related diseases are becoming more common in Western countries, owing to the increased availability of high-calorie foods and a poor diet. Obesity, diabetes, atherosclerosis, and neurodegeneration are all important diet-related diseases with low-grade inflammation as a shared pathogenic denominator. Because of their ability to produce anti-inflammatory responses, functional foods and nutraceuticals may represent a unique therapeutic approach to prevent or reduce diet-related disease.

Intestinal T regulatory cells activation and homeostatic modulation of the gut microbiota, in particular, have the potential to lower low-grade inflammation in diet-related diseases (Garima Verma et al., 2016).

### **Heart attack and lung cancer**

Corn contributes to heart health not only because of its fibre, but also because of the high levels of folate it contains. Corn maintains homocysteine, an intermediate product in the methylation cycle, which is an important metabolic process. Homocysteine is directly linked to blood vessel damage, such as heart attack, stroke, and peripheral vascular disease. It is believed that taking 100 per cent of the daily value (DV) of folate will reduce the number of heart attacks by 10%. Cryptoxanthin, a natural carotenoid pigment, is also found in corn (Garima Verma et al., 2016). Cryptoxanthin has been shown to reduce the risk of lung cancer by 27% when used on a regular basis (Nistha Nema et al., 2018).

### **Diabetes**

In diabetic patients, n-3 fatty acid ethyl esters are very useful. Docosahexaenoic acid is important for neurovisual development as well as insulin resistance. Antioxidant lipoic acid is used to treat diabetic neuropathy. Psyllium dietary fibres have been used to control blood sugar in diabetic individuals and to lower lipid levels in hyperlipidemia patients (Garima Verma et al., 2016).

### **Obesity**

Obesity is defined as the accumulation of unhealthy body fat and is a global public health problem. Angina pectoris, congestive heart failure (CHF), hypertension, hyperlipidemia, respiratory diseases, renal vein thrombosis, osteoarthritis, cancer, and impaired fertility are all well-known major risk factors (Caterson et al., 2002).

### **Cancer**

Estrogen-induced cancers are prevented by flavonoids, which suppress estrogen-producing enzymes. A wide spectrum of phytopharmaceuticals with purported hormonal activity, known as "phytoestrogens," is recommended to prevent prostate/breast

cancer. Isoflavones found in soyfoods, curcumin from curry, and soya isoflavones all have cancer-preventive properties. Lycopene is found in high concentrations in the skin, testes, adrenals, and prostate, where it helps to prevent cancer (Garima Verma et al., 2016).

### **Anti-inflammatory activities**

Curcumin (diferuloylmethane), a polyphenol found in turmeric, has anti-carcinogenic, antioxidant, and anti-inflammatory activities. Anti-tumour activity has been reported in beetroots, cucumber fruits, spinach leaves, and turmeric rhizomes. Gamma linolenic acid (found in green leafy vegetables, almonds, vegetable oils such as evening primrose oil, blackcurrant seed oil, and hemp seed oil, as well as in spirulina and cyanobacteria) is used to treat inflammatory and auto-immune diseases. Osteoarthritis is treated with glucosamine and chondroitin sulphate, which modulate gene expression and PGE2 synthesis. Cat's claw is a powerful anti-inflammatory agent. *Uncaria guianensis*, traditionally used for wound treatment, and *Uncaria tomentosa*, which has several medical benefits and is most usually found in supplements, are the two known species of cat's claw. 17 alkaloids, glycosides, tannins, flavonoids, sterol fractions, and other phytochemicals are rich in cat's claw (Balch et al., 2003).

### **Alzheimer's disease**

$\beta$ -carotene, curcumin, lutein, lycopene, and turmeric may have a protective effect against certain diseases by reducing the harmful effects of oxidative stress, mitochondrial malfunction, and various forms of neuronal degeneration (Garima Verma et al., 2016).

### **Parkinson's disease**

Food containing vitamin E may protect against Parkinson's disease. According to Canadian researchers, vitamin E in food may protect against Parkinson's disease. Creatine appears to alter the symptoms of Parkinson's disease, as evidenced by a decrease in clinical indicators. Although exploratory studies have shown some promising benefits with nutritional supplements, it is important to remember that there is currently insufficient scientific evidence to prescribe them for

Parkinson's disease (Garima Verma et al., 2016). Patients should be informed that over-the-counter medications have negative effects, can interact with other medications, and are also costly.

### **Osteoarthritis**

The most common form of arthritis in the United States is osteoarthritis (OA), a painful joint disorder that affects an estimated 21 million people. The direct and indirect healthcare costs associated with all types of arthritis totalled about 86 billion dollars in 2004. Individuals with OA and other joint disorders may experience less physical activity due to joint discomfort, leading to energy imbalance and weight gain. Weight gain can exacerbate existing problems by putting additional strain on joints. To treat OA symptoms, glucosamine (GLN) and chondroitin sulphate (CS) are commonly used (Kalaria AC et al., 2006). These nutraceuticals have both dietary and medicinal properties, and they seem to control gene expression and NO and PGE2 generation, which might explain their anti-inflammatory benefits.

### **Adrenal Dysfunction**

Adaptogens are natural herbs with generic, balancing effects on physiology; they influence normal body functions only enough to enhance non-specific stress resistance. *Eleutherococcus senticosus*, *Ginkgo biloba*, *Ocimum sanctum*, *Panax ginseng*, *Withania somnifera*, and the fungus *Cordyceps Sinensis* are all adaptogens. A brief description of each follows. *Ginkgo biloba* used by the Chinese from ancient times to treat a variety of ailments, including vertigo, short-term memory loss, and an inability to concentrate or vigilance [Le Bars et al., 2000]. *Ginkgo* extracts show antioxidant and neuroprotective properties, including the ability to slow the progression of dementia (Sembulingam et al., 1997).

### **Global demand of nutraceuticals:**

The nutraceutical sector is divided into three main segments: functional foods, nutritional supplements, and natural products. The globally nutraceutical market is estimated to be worth USD 118 billion (INR 5148 billion).

Nutraceutical sales are estimated to reach \$74.7 billion in 2007, with a 9.9% annual growth rate (Shilpa Chaudhari et al., 2017). This suggests that the global economy will rebound in 2003, and price competition would reduce (Joanne et al., 2013). According to a recent estimate, India's entire nutraceutical market is increasing at a rate of 21% per year. It is presently valued at INR 44 billion (€621 million) but in four years it might be worth more than INR 95 billion. In India, the term of "Nutraceuticals" is still in its infancy. However, it has grown at a far higher rate than global rates, with a CAGR of 18% over the past three years, primarily in the functional food and beverage categories (Onyeka Nwosu et al., 2020). The fastest expanding areas of the market were dietary supplements (18.6 per cent each year) and natural products (11.6 per cent per year) (Chauhan et al., 2013).

### **Future prospects of nutraceuticals:**

The world is becoming more complex and fascinating. To address the growing need for healthy nourishment, foods are becoming more palatable, appealing, and fortified. With the creation and recent advances in Living Modified Organisms (LMOs) and Genetically Modified Foods (GMFs), food for all agendas will be accomplished in the future, or malnutrition will be a thing of the past, but new obstacles may arise. The possibilities of nutraceuticals are endless, with pills bursting into the body as nutrients to feed the body with a complete Recommended Dietary Allowance (RDA), including fiber to ensure intestinal or bowel emptying. The potential of nutraceuticals can help food and nutrition societies achieve their goal of a world free of destitution in the future. The rising attentiveness of consumers to how nutraceuticals might contribute to excellent health is at the heart of the value-added market performance. With the expanding consumer demand for nutraceuticals, consumers will not only utilize supplement products to enhance overall dietary consumption in the coming days, but they will also view supplementation as an effective strategy to improve health (Chauhan et al., 2013).

**Table 4 list of some marketed nutraceuticals**

Product	Group	Content	Company
Calciferol D-3®	Calcium supplement	Calcium & vitamin	Cadillac health limited India
Coral calcium	Calcium supplement	Calcium & trace mineral	Natures answers Happaage, NY, USA
Wellife®	Amino acid supplement	Granulated –L- glutamine	Daesang America Inc,Hackensach,NJ USA
Proteinex©	Protein supplement	Predigested protein,vitamin	Pfizer Ltd., Mumbai India
Daytime restores & day time repose	Restful sleep	Ginseng, ginkgo biloba	Xigo
Cognisant	Amino acid supplement	Proline-rich polypeptide complex	Metagenic Inc

### CONCLUSION

Nutraceuticals have been proven that provides health benefits and the capacity to prevent disease. It should be consumed in accordance with their approved recommended consumption. In today's self-medication era, nutraceuticals play a vital role in therapeutic development. However, their success is dependent on their ability to maintain their quality, purity, safety, and efficacy.

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### Conflict of interest

The author declares no conflict of interest

### Author contribution

No author's contribution

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