

# Overview Of Nutraceuticals

Tejasvinee Sahebrav Chaudhari<sup>1</sup>, Mohan Parsharam Patil<sup>2</sup>, Rohit Ramsing Girase<sup>3</sup>,  
Habiburrehman Shiakh<sup>4</sup>, Saeed Ahmed<sup>5</sup>

Dr. Uttamarao Mahajan College Of B Pharmacy

## ABSTRACT

Nutraceuticals are essential foods with nutritional and medicinal properties. The addition of active ingredients such as carotenoids, hydrolyzed collagen and dietary fiber contributes to the healthfulness of this food. Nutraceuticals have been shown to benefit cardiovascular and immune health and play a role in preventing disease and cancer. Healthy food products are divided into various groups according to their products and processing methods. In this review, the classification of various nutraceuticals and their therapeutic benefits in diseases such as anti-inflammatory, anti-inflammatory, anti-inflammatory and drug-killing diseases will be discussed. Additionally, current trends and future prospects for nutraceuticals will be discussed, as well as various methods of application, use, and safety of these products for consumers.

**Keywords:** Nutrients, Dietary Supplements, Nutraceuticals And Diseases.

## INTRODUCTION

Nearly 2000 years ago, Hippocrates was right: "Let food be thy medicine, and medicine be thy food." People realized that "nutraceuticals" played an important role in improving health, sparking worldwide interest. Dr. Stephen De Felice, president of the Foundation for Medical Innovation, created the term "nutraceutical" in 1989 by combining the terms "nutrition" and "pharmaceutical." "Nutraceutical" is a marketing term used to sell nutritional products that are intended to treat or prevent disease and do not have a legal definition. Thus, "nutraceutical" is a food or product that can be considered a food that has medical or health benefits, including the prevention and treatment of disease. Examples of products include isolated foods, dietary supplements and foods, "natural" food substitutes, herbs, and processed foods (such as cereals, soup, and beverages). There are more than 470 nutraceutical and functional foods on the market with proven health benefits [1]. "Nutraceuticals and functional foods are attracting great attention due to their safety, nutritional and medical benefits." The nutraceutical industry and the quality of the business are good to invest in consumers' interest in these products. Whether you are a large pharmaceutical company, a health food company, a multinational food chain or a small vitamin company, everyone is aware of changes and trends in people. Use healthy food. As a result, these value-added products emerged not only to protect health but also to prevent and treat many diseases, from heart diseases to cancer. [2]. Nutraceuticals have been claimed to provide physiological benefits or provide protection against the diseases listed below (and/or have been discovered to behave as):-

- Cardiovascular agents
- Antiobese agents
- Antidiabetics
- Anticancer agents
- Immune boosters

- Chronic inflammatory disorders
- Degenerative diseases
- Rheumatoid Arthritis
- Cholesterol Lowering
- Blood pressure
- Digestive problems
- Osteoporosis

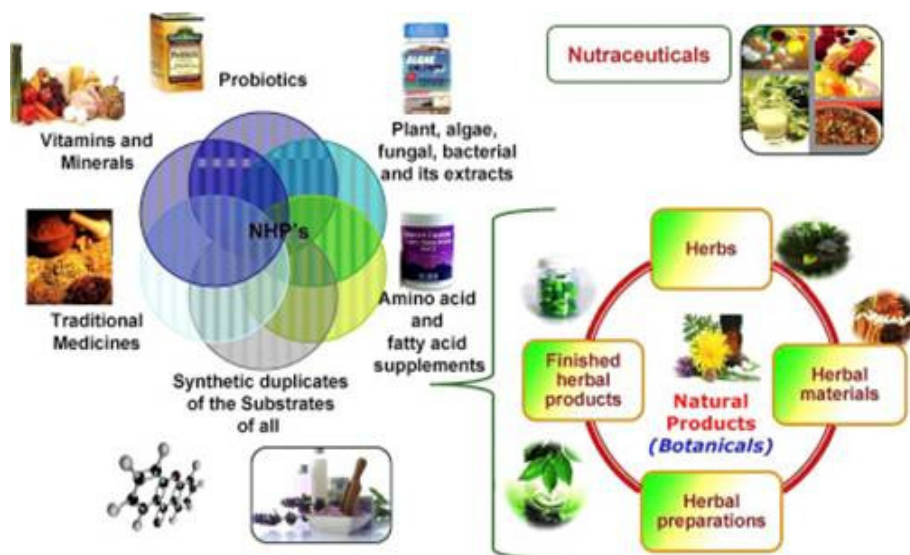


Fig No 1: Nutraceutical

**Nutraceuticals are mainly consist of :-**

- 1) Nutrients – Substances which have established Nutritional functions e.g. Vitamins, Minerals, Amino acids, Fatty acids, etc.
- 2) Herbals/ Phytochemicals – Herbs or Botanical products.
- 3) Dietary supplements – Probiotics, Prebiotics, Antioxidants, Enzymes, etc. VARIOUS

**NUTRACEUTICALS USED AGAINST DIFFERENT DISEASE –**

Sr. No	Diseases	Example
1	Alzheimer	Vitamin E and Vitamin C
2	Cardiovascular	Flavonoids (onion, black grapes)
3	Parkinson	Vitamin E
4	Obesity	Chitosan, Vitamin C
5	Diabetes	Calcium, Vitamin D, Emblica officinalis
6	Diabetes	Glucosamine, Chondroitin sulfate

7	Constipation	Buck wheat
8	Vision improving	Carrot, Mangoes, Spinach, Kiwi
9	Antioxidant	Oats, Fruits, Carrots
10	Anti – inflammatory	Turmeric
11	Hypertension	Curry leaf, green tea
12	Hyperlipidemia	Curry leaf, green tea

## Dietary supplements

Nutritional supplements, such as vitamin B supplements, are available by prescription. Dietary supplements are liquids or capsules that contain nutrients from fortified foods. According to the US Dietary Supplement Health and Education Act (DSHEA) of 1994, "Dietary supplements are oral foods containing "nutritional ingredients" intended to improve nutrition" [3]. Substances such as vitamins, minerals, herbs or other plants, amino acids and enzymes, tissues, glands, and metabolites are examples of "food ingredients" in these products. Nutritional products are extracts or concentrates and come in many forms, including tablets, capsules, soft gels, liquids and powders. The U.S. Food and Drug Administration (FDA) does not require food products to be approved before marketing, but companies are required to register their manufacturing facilities with the FDA. Food products may be sold for the sole purpose of supporting the structure or function of the body and are not guaranteed to cure disease or illness depending on certain specific conditions. It must also include a label stating: "These statements have not been evaluated by the Food and Drug Administration." This product is not intended to diagnose, treat, cure, or prevent any disease. "It does this by using the power of nutraceuticals to cleanse the body, prevent vitamin and nutrient deficiencies, and restore good digestion and eating habits. [4]. They are grouped on the basis of :-

## Chemical Constituents

- A) Nutrients
- B) Herbals
- C) Phytochemicals

Phytochemicals basically is plant nutrients with particular biological activities in supporting human health, they work by following way-

- Substrate for biochemical reactions.
- Cofactors of enzymatic reactions.
- Enhance the absorption and/or stability of essential nutrients.
- Selective growth factor for beneficial bacteria.
- Fermentation substrate for beneficial bacteria.
- Selective inhibitors of deleterious intestinal bacteria.
- Scavengers of reactive or toxic chemicals.
- Ligands that agonize or antagonize cell surface or intracellular receptors.

## Probiotic Microorganisms

They drive out pathogens like yeasts, other bacteria, and viruses that could otherwise cause sickness and form a mutually beneficial symbiotic relationship with the human gastrointestinal system. They have an antimicrobial effect by altering the microflora, preventing pathogen adhesion to the intestinal epithelium, competing for nutrients required for pathogen survival, producing antitoxin, and reversing some of the effects of infection on the intestinal epithelium, such as secretory changes and neutrophil migration.

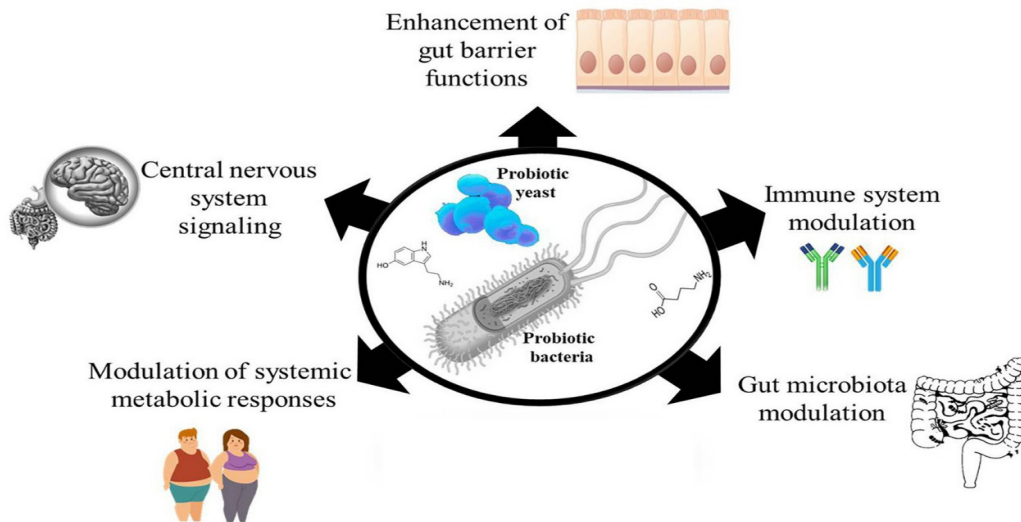


Fig No 2 Probiotic

Lactose intolerance can be cured by probiotics, which produce a specialised enzyme ( $\beta$ galactosidase) that hydrolyzes the offending lactose into its component sugars. The following factors should be considered when choosing probiotic benchmarks: safety, functionality, and technology, show a possible health benefit [5].

- Commonly gram positive organism.
- Probiotics should come from humans.
- Can survival after passage through acid and bile.
- Can adherence to the human intestinal cells and grow in the gut.

### Nutraceutical Enzymes

Lactose intolerance can be treated with probiotics that produce a special enzyme (beta galactosidase) that hydrolyzes harmful lactose into its sugar. When choosing a probiotic formula that demonstrates health benefits, the following reasons should be considered: safety, performance, and technology.

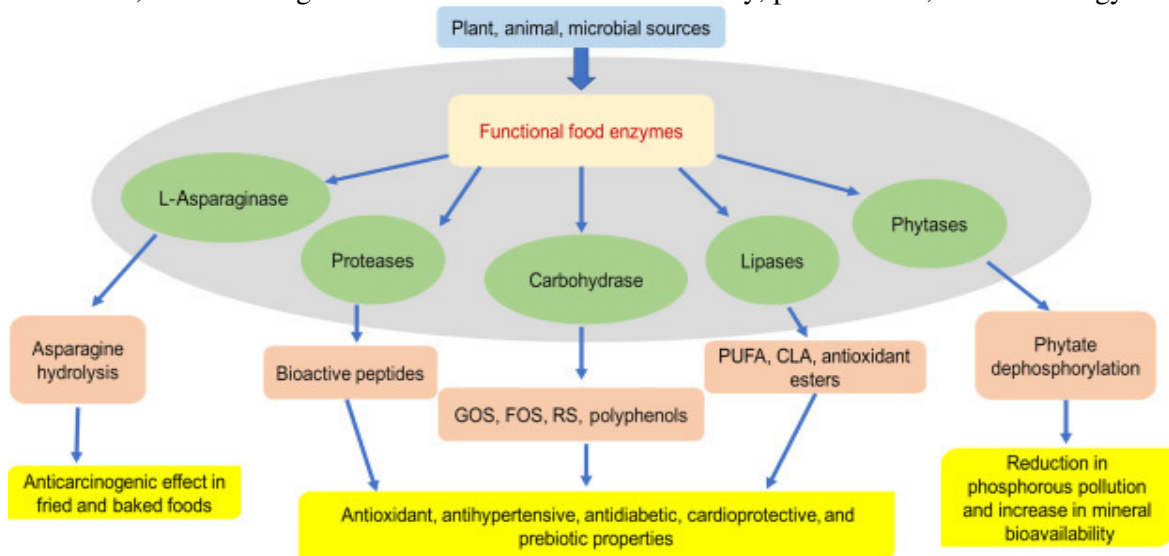


Fig No : 3 Nutraceutical Enzyme

## Prebiotics

Prebiotics are compounds that are not digested by humans and have recently been added to our vocabulary. Instead, they serve as food for beneficial bacteria. This encourages the growth of probiotic bacteria in a good environment, reducing the risk of dangerous bacteria gaining a foothold in our digestive system. Inulin is a prebiotic used in many foods. It is the fiber obtained from the roots of plants such as endive, Jerusalem artichoke and even dandelion. [6].



Fig No : 4

## Non-traditional nutraceuticals

Are artificial foods prepared with the help of biotechnology. Food samples contain bioactive components which are engineered to produce products for human- wellness. They are arranged into.

- Fortified nutraceuticals.
- Recombinant nutraceuticals.

## Fortified nutraceuticals

They are enriched with vitamins, minerals, usually at a range up to 100 percent of the Dietary Reference Intake for that nutrient. It constitutes fortified food from agricultural breeding or added nutrients and/or ingredients added folic acid. Some examples are milk fortified with cholecalciferol used in vitamin D deficiency.

## Recombinant nutraceuticals

Biotechnology is used to make energy-giving foods including bread, wine, fermented starch, yoghurt, cheese, vinegar, and others. Biotechnology allows for the manufacture of probiotics and the extraction of bioactive components using enzyme/fermentation methods, as well as genetic engineering.

## Commercial Nutraceuticals

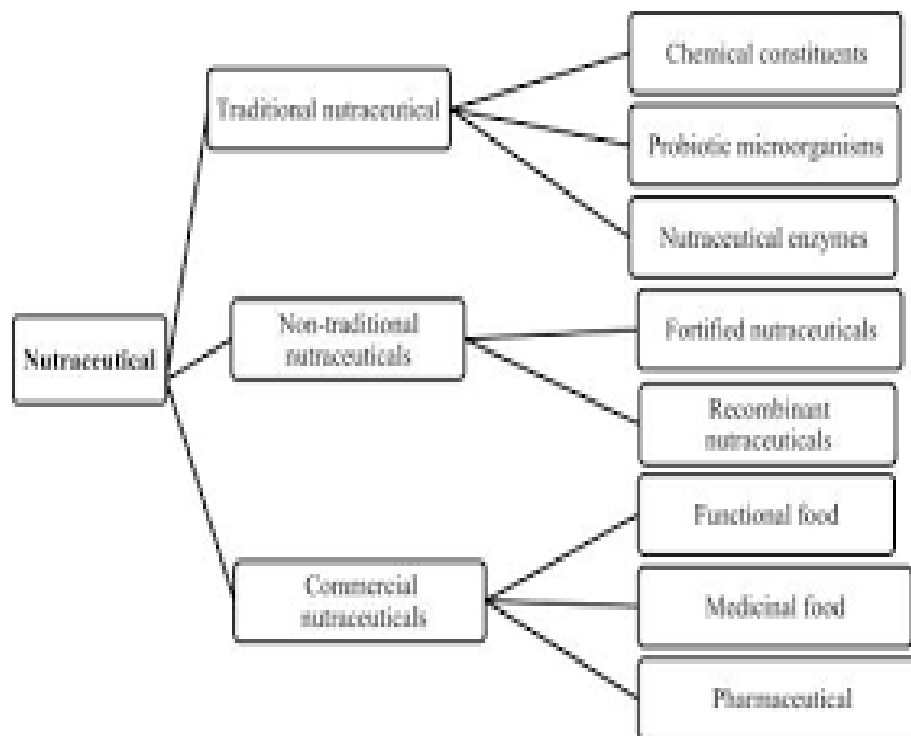
Finding a new chemical is more difficult, expensive, and risky than ever before. Many pharmaceutical companies are now attempting to create nutraceuticals due to the enormous and rapidly growing market. Anti- arthritic, cold and cough, sleeping difficulties, digestion, and the prevention of some malignancies, osteoporosis, blood pressure, cholesterol management, pain relievers, depression, and diabetes are just a few of the therapeutic areas covered by nutraceuticals. One of the most promising advances in human nutrition and disease prevention research in the last three decades is the recognition of health benefits from consumption of omega-3 rich sea foods

- Functional food,
- Dietary supplements,
- Medicinal food,
- Pharmaceuticals.





Fig No 5 Commercial Nutraaceutical



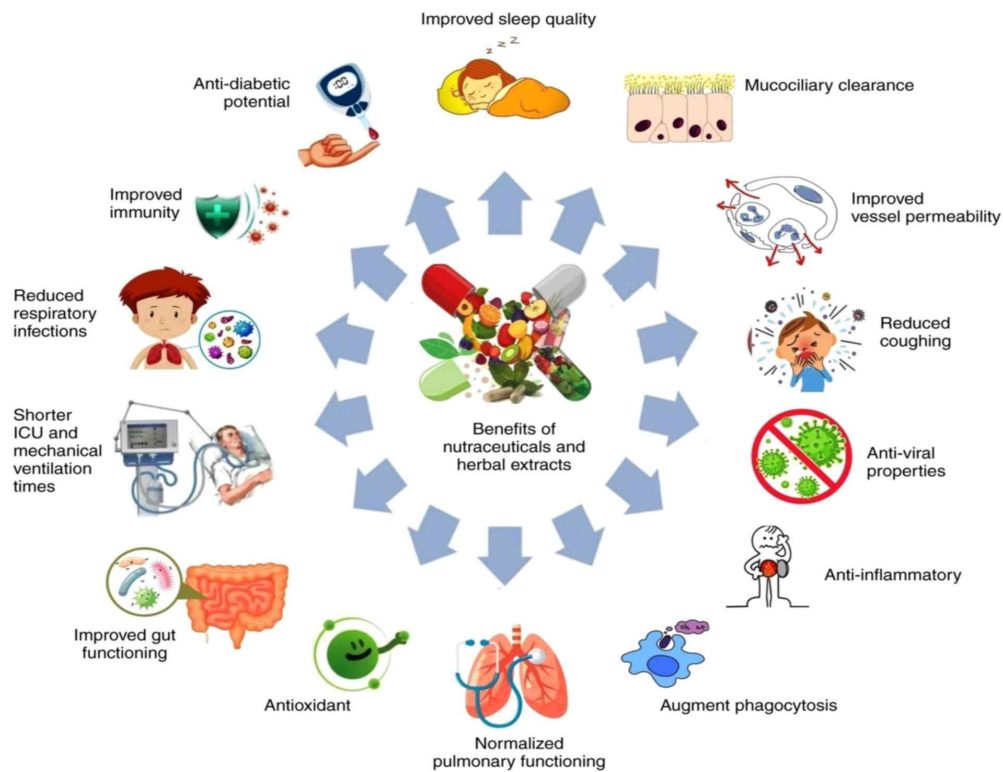


Fig No : 6 Benefits Of Nutraceutical

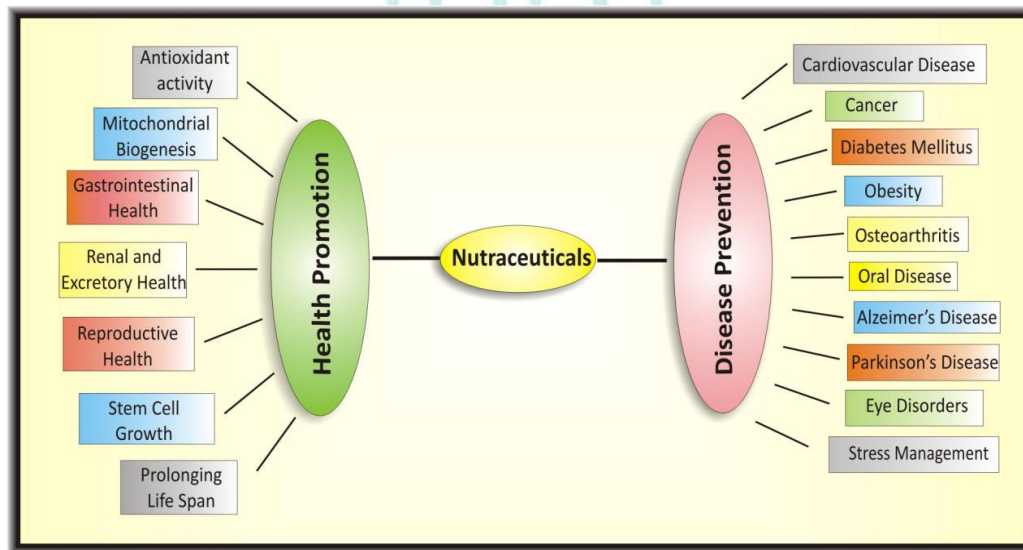


Fig No 7: Nutraceutical and Diseases

**NUTRACEUTICALS AND DISEASES :-**

**Cardiovascular diseases**

The global burden of chronic diseases such as heart disease, cancer, diabetes and obesity is rapidly increasing. High blood pressure (high blood pressure), heart disease (heart attack), cerebrovascular disease (stroke), heart failure, peripheral vascular disease, and other diseases of the heart and blood vessels are classified as cardiovascular disease (CVD). Most heart diseases can be prevented and

managed. Fewer fruits and vegetables are associated with more heart disease. Many studies have shown that a diet rich in fruits and vegetables is associated with the risk of heart disease. Additionally, nutraceuticals such as antioxidants, dietary fiber, omega-3 polyunsaturated fatty acids (n-3 PUFA), vitamins and minerals, and physical activity can also be used to prevent and treat CVD. Polyphenols found in fruit and wine have been shown to affect cell metabolism and communication, similar to reducing vascular disease.

### Nutraceuticals for Hypertension

High blood pressure can be prevented, delayed, weight reduced, treated and controlled with proper nutrition, nutrition, vitamins, antioxidants, minerals, weight loss, exercise, smoking, alcohol and caffeine restriction and other lifestyle changes. - Supplement with lipoic acid, magnesium, vitamin B6 (pyridoxine), vitamin C, N-acetyl cysteine, hawthorn, celery, omega-3 fatty acids and other nutrients and calcium channel blocking activity. (therefore antihypertensive activity) [8].

### Current status of nutraceuticals in CVD

Because CVD has a long history, it remains difficult to establish the relationship between diet and physical activity and major CVD events. The evidence on the relationship between calcium and the risk of hypertension is mixed and uncertain, and an association between calcium and the risk of gestational hypertension and preeclampsia seems unlikely [ 9 ]. Beta-carotene, vitamin A and vitamin E supplements can be fatal. The effects of vitamin C and selenium on mortality need to be further investigated. Nutraceuticals may be designed to reduce and control the risk of thrombosis in women with thrombogenic gene mutations [10].

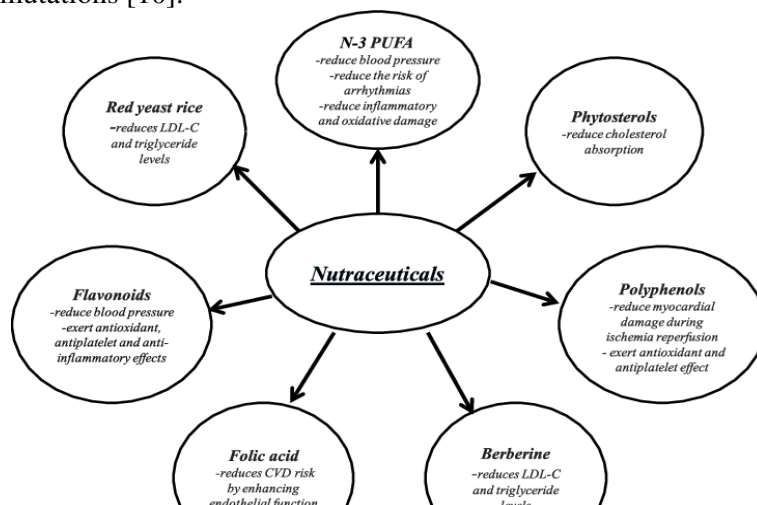


Fig No : 8 Nutraceuticals of Cardiovascular Diseases

### Obesity

It is beneficial for many diseases such as obesity, angina, congestive heart failure, hypertension, hyperlipidemia, respiratory diseases, renal vein thrombosis, osteoarthritis, cancer and fertility. Obesity has become a global health problem, with approximately 315 million people falling into the World Health Organization's classification of obesity. A diet high in fat is one of the main causes of obesity (11). Eating too much food (snacks, treats and drinks) can cause weight gain, so saturated and trans fats, as well as sweets and salt, should be avoided. Studies have shown that calorie restriction and physical activity have limited effectiveness in treating obesity. That's why many doctors and obese people turn to medications and nutraceuticals to help them lose weight. Tolerable and effective nutraceuticals that increase energy utilization and/or reduce calorie intake are ideal for weight loss.



## **Current status of nutraceuticals**

In Obesity In obese people, a nutritional supplement including glucomannan, chitosan, fenugreek, G sylvestre, and vitamin C lowered body weight and increased fat reduction. More research is needed to determine longterm efficacy and potential side effects. Obesity has a significant incidence worldwide, and nutrition and exercise play a critical role in its prevention and treatment. Nutraceutical therapies are currently being studied as prospectivetreatments for obesity and weight loss on a broad scale. Conjugated linoleic acid (CLA), capsaicin, MomordicaCharantia (MC), and Psyllium fibre are examples of nutraceuticals with putative antiobese properties [14].

## **Diabetes**

Diabetes mellitus is characterised by abnormally high blood glucose levels, which can be caused by insufficient insulin synthesis or inefficient insulin. Type 1 diabetes (5 percent), which is an autoimmune illness, and type 2diabetes (95 percent), which is linked to obesity, are the two most frequent typesof diabetes. Gestational diabetes is a kind of diabetes that develops during pregnancy. Diabetes, like most chronic health diseases, not only has a significant economic impact on society as a whole, but it also has a significant impact on individual patients and their families.

## **Current status of nutraceuticals in Diabetes**

Diet treatment is the cornerstone of gestational diabetes mellitus management. Although herbal dietary supplements that are thought to help type 2 diabetes mellitus are widely used, only a few have been confirmed to do so in well-designed randomised trials.

Isoflavones are phytoestrogens that are structurally and functionally identical tohuman oestrogen and have been ingested by people all over the world. Soy isoflavones have been examined the most out of all phytoestrogens. High isoflavone intake (20– 100mg/day) has been linked to a lower risk of type 2 diabetes, heart disease, osteoporosis, and some cancers [15]. Omega-3 fatty acids have been linked to a reduction in glucose tolerance in diabetic patients. Insulin is required for the production of long-chain fatty acids, hence the heart may be particularly vulnerable to their depletion in diabetes. In diabetic patients, ethyl esters of fatty acids may be beneficial [16].

## **Immune boosters**

Various nutrients in the diet are important for maintaining a "optimal" immune response, as well as the organism's immunological status and susceptibility to a variety of diseases. Phytoestrogens, a class of phytopharmaceuticals with purported hormonal activity, are advised for the prevention of a variety of disorders linked to a disrupted hormonal balance. In this regard, soy isoflavones (genistein, daidzein, and biochanin) are receiving fresh attention as potential superior alternatives to synthetic selective oestrogen receptor modulators (SERMs), which are currently usedin hormone replacement treatment. Phytochemicals integrate hormonal ligand activities and interfere with signaling cascades; their therapeutic use may not be restricted to hormonalailments only, but may have applications in chemoprevention and/or certain inflammatory disorders as well [17].

## **Current status of nutraceuticals as Immunity boosters**

Nutraceuticals that belong to the category of immune boosters or anti- viral agents are usefulto improve immune function and accelerate wound healing. They include extracts from the cone-flowers, or herbs of the genus Echinacea, such as Echinacea purpurea, Echinacea angustifolia, Echinacea pillida, and mixtures thereof extractsfrom herbs of the genus Sambuca, such as elderberriesand Goldenseal extracts. The cone-flowers in particular are a popular herbal remedy used in the central United States, an area to which they are indigenous. The extract derived from the roots contains varying amounts of unsaturated alkyl ketones or isobutylamides. Goldenseal is an immune booster with antibiotic activity, and includes compounds like berberine and hydrastine, which stimulate bile secretion and constrict peripheral blood vessels respectively. Astragalusmembrane aceous, Astragalusmongolicus, and other herbs of the genus

Astragalus are also effective immune boosters in either their natural or processed forms. Astragalus stimulates development and transformation of stem cells in the marrow and lymph tissue to active immune cells. The effect of plant and bacteria on systemic immune and intestinal epithelial cell function has led to new credence for the use of probiotics and nutraceuticals in the clinical setting. The probiotics have been found to effective in conditions like in infectious diarrhea in children and recurrent *Clostridium difficile* induced infections. Evidence is being acquired for the use of probiotics in other gastrointestinal infections, irritable bowel syndrome and inflammatory bowel disease. The dietary approach to allergy has evolved to include active stimulation of the immature immune system in order to support the establishment of tolerance. Supplementation with probiotics may provide maturational signals for the lymphoid tissue and improve the balance of pro- and anti- inflammatory cytokines. Enteral polymeric feeding is effective in Crohn's disease. Dietary nucleotides may improve growth and immunity, optimize maturation, recovery and function of rapidly dividing tissues. Usage of Probiotics (live viable microbial organisms) in the treatment of specific diseases has evolved into an extremely valuable option. The ability to reduce antibiotic use, the apparently very high index of safety, and the public's positive perception about "natural" or "alternative" therapies. These products manipulated the intestinal microflora to maintain the normal balance between pathogenic and non-pathogenic bacteria. Therapeutic effects of most commercial preparations are unsubstantiated. Certain probiotics will be effective in the treatment or prevention of certain conditions. *Lactobacillus* has been shown to be effective in the treatment or prevention of a number of problems including acute diarrhea in children, travelers' diarrhea in adults, Crohn's disease, and reduction of the incidence of antibiotic-associated diarrhea in infants [18]. Most probiotic preparations are comprised of one or more lactic acid bacteria (LAB). Within this group, strains of *Lactobacillus*, *Bifidobacterium* sp. and occasionally *Streptococcus* are most commonly used [19]. A supplementary use of oral digestive enzymes and probiotics is also an anticancer dietary measure towards decreasing the incidence of breast, colon-rectal, prostate and bronchogenic cancer.

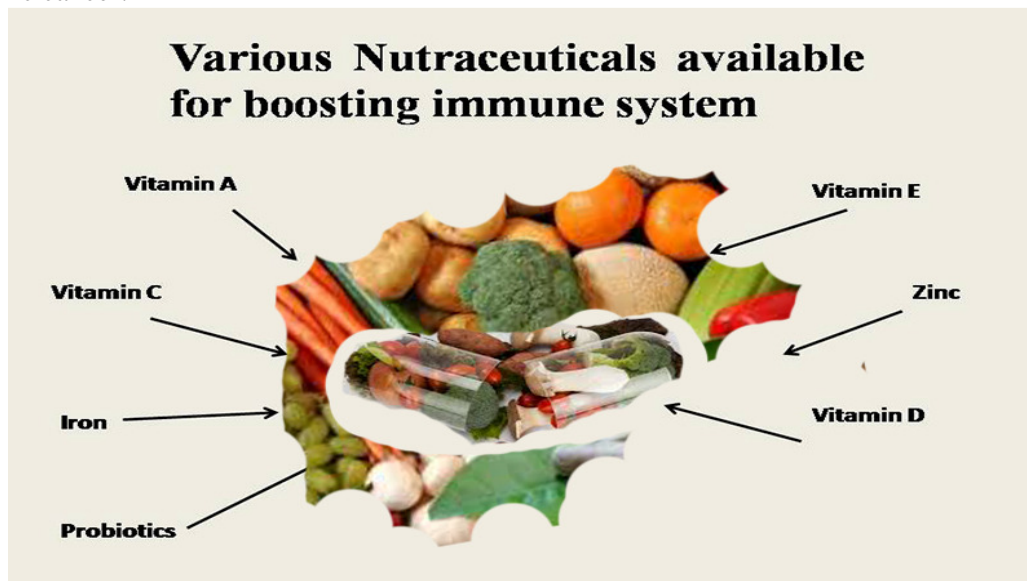


Fig No 9 :Neutraceutical for Immune Booster

### Osteoarthritis

The most common form of arthritis in the United States is osteoarthritis (OA), a crippling joint illness that affects an estimated 21 million people. Joint discomfort caused by OA and other joint problems may cause people to become less active, resulting in an energy imbalance and weight gain. Weight gain might aggravate existing disorders by putting additional strain on joints. To treat osteoarthritis symptoms, glucosamine (GLN) and chondroitin sulphate (CS) are commonly utilised. These

nutraceuticals have both nutrient and medicinal qualities and they appear to modulate gene expression and NO and PGE2 generation, which could explain their anti-inflammatory actions[20].

## Allergy

Allergy is a condition in which the body has an exaggerated response to either a drug or food.

### Current status of nutraceuticals in Allergy

Quercetin (QR) belongs to a group of polyphenolic substances known as flavonoids. QR is a member of the class of flavonoids called flavonols. It is widely distributed in the plant kingdom in rinds and barks. Especially rich sources of QR include onions, red wine and green tea. QR is a natural antihistamine and opposes the actions of the histamine in the body. Histamines are responsible for allergic and inflammatory reactions. It can help reduce the inflammation that results from hay fever, bursitis, gout, arthritis, and asthma. QR inhibits some inflammatory enzymes, such as lipid peroxidases, and decreases leukotriene formation. QR has anti-inflammatory, antiviral, immune modulatory, anticancer and gastro protective activities [21]. QR blocks an enzyme that leads to accumulation of sorbitol, which has been linked to nerve, eye, and kidney damage in those with diabetes. QR also possesses potent antioxidant properties. It protects LDL cholesterol from becoming damaged. QR prevents damage to blood vessels by certain forms of cholesterol and other chemicals produced by the body. LDL cholesterol is an underlying cause of heart disease. QR also works as an antioxidant by scavenging damaging particles in the body known as free radicals. People with diabetes are at higher risk of blood vessel damage from free radicals [22]



Fig No 10 :Nutraceutical For Allergy

## Alzheimer's disease

Alzheimer's disease (AD) is characterized by progressive dementia with memory loss as the major clinical manifestation. Women are more affected than men at a ratio of almost 2:1 due in part to the larger population of women who are over 70. Several lines of evidence strongly suggest that oxidative stress is etiologically related to a number of neurodegenerative disorders including Alzheimer's disease [23].

### Current status of nutraceuticals in Alzheimer's disease

Nutraceutical antioxidants like  $\beta$ -carotene, curcumin, lutein, lycopene, turmeric may exert positive effects on specific diseases by neutralizing the negative effects oxidative stress, mitochondrial dysfunction, and various forms of neural degeneration. A great deal of research has pointed to deleterious roles of metal ions in the development of Alzheimer's disease, by the augmentation of oxidative stress by metal ion. The growing trend in nutraceutical intake is in part a result of the belief

that they postpone the development of dementias such as Alzheimer's disease. However, pathogenic events centered on metal ions are expected to be aggravated by frequent nutraceutical intake [24].

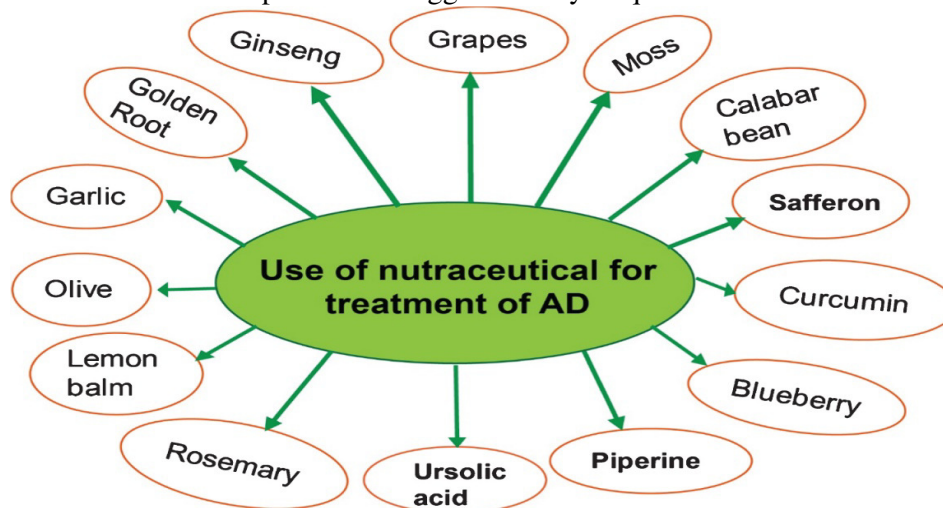


Fig No : 11 Nutraceutical for Alzheimer Diseases

### Parkinson's Disease

Parkinson's disease is a brain disease that originates from the nerves in some parts of the brain, causing muscle stiffness, tremors and difficulty walking. It is usually seen in middle and young aged people.

### Current status for nutraceutical for Parkinson's disease

According to Canadian experts, dietary vitamin E can prevent Parkinson's disease [25]. Creatinine appears to alter many aspects of Parkinson's disease, as evidenced by reductions in symptoms [26]. Glutathione has also been studied to understand how it affects blood vessels and its benefits as an antioxidant. How long it will last, side effects and the best form of management are still unknown. Although research studies have shown that food products have some beneficial effects, it is important to note that there is currently not enough evidence to prove that drinking food products can improve Parkinson's disease. Patients should be warned that over-the-counter medications may have side effects, interact with other medications, and are expensive.

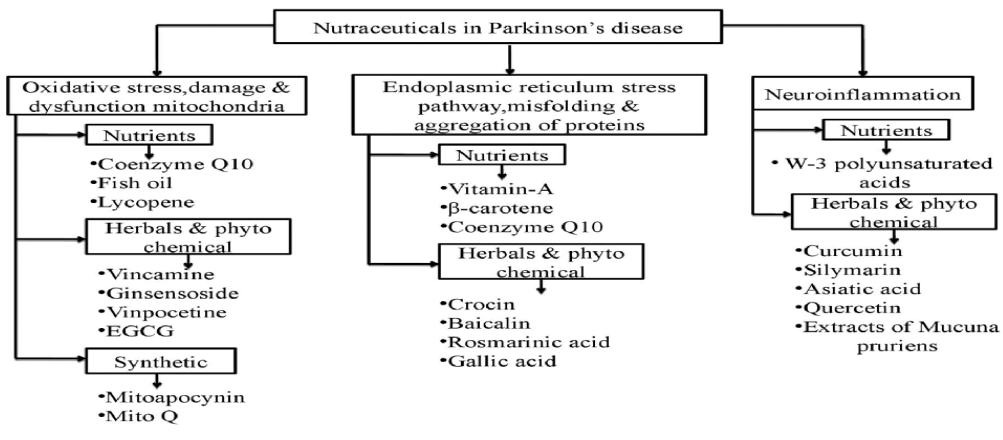


Fig No 12 Nutraceutical for Parkinson Disease



## CONCLUSION

Nutraceuticals are now thought to be beneficial against heart disease, obesity, diabetes, cancer, osteoporosis, and other diseases such as Parkinson's and Alzheimer's. Evidence suggests that the behavior of natural products has many natural mechanisms, including activation of antioxidant protection, signaling pathways, gene expression related to cell survival, cell proliferation, and isolation and maintenance of mitochondrial integrity. He found that these ingredients play an important role in preventing flu. The health benefits of phytonutrients found in many foods, fruits, and vegetables are well documented. For example, beta-carotene and lycopene may protect skin from UV damage, lutein and lycopene may benefit the cardiovascular system, and lycopene may help prevent prostate cancer. Due to these and other health benefits, it should be consumed regularly to reduce problems such as high cholesterol, high blood pressure and diabetes. Some of the most popular nutraceuticals currently sold are St. John's wort, echinacea, ginkgo, saw palmetto and ginseng. To gain awareness about nutraceuticals, the society needs to be educated to ensure that all consumers know the recommended daily bolus dosage of these nutraceuticals. The list of nutraceuticals included in the study is constantly changing, taking into account continuous research, adaptation to needs and customer satisfaction. (30).

## REFERENCES

- [1] Misra, L. Traditional Phytochemical Systems, Scientific Validations and Current Popularity as Nutraceuticals. 2013. Available online: <https://www.semanticscholar.org/paper/Traditional-PhytochemicalSystems%2C-ScientificandMisra/7df8a6c6cc432a4cd711b8b6a96702f1908353d4> (accessed on 23 April 2020).
- [2] Helal, N.A.; Eassa, H.A.; Amer, A.M.; Eltokhy, M.A.; Edafiogho, I.; Nounou, M.I. Nutraceuticals' Novel Formulations: The Good, the Bad, the Unknown and Patents Involved. *Recent Pat. Drug Deliv. Formul.* 2019, 13, 105–156. [CrossRef]
- [3] Petrovska, B.B. Historical review of medicinal plants' usage. *Pharmacogn. Rev.* 2012, 6, 1–5. [CrossRef]
- [4] Nasri, H.; Baradaran, A.; Shirzad, H.; Rafieian-Kopaei, M. New Concepts in Nutraceuticals as Alternative for Pharmaceuticals. *Int. J. Prev. Med.* 2014, 5, 1487–1499. [PubMed]
- [5] Caramia, G.; Silvi, S. Probiotics: From the Ancient Wisdom to the Actual Therapeutic and Nutraceutical Perspective. In *Probiotic Bacteria and Enteric Infections: Cytoprotection by Probiotic Bacteria*; Malago, J.J., Koninkx, J.F.J.G., Marinsek-Logar, R., Eds.; Springer: Dordrecht, The Netherlands, 2011; pp. 3–37.
- [6] Ried, K. Garlic Lowers Blood Pressure in Hypertensive Individuals, Regulates Serum Cholesterol, and Stimulates Immunity: An Updated Meta-analysis and Review. *J. Nutr.* 2016, 146, 389S–396S. [CrossRef] [PubMed]
- [7] Affuso, F.; Ruvolo, A.; Micillo, F.; Saccà, L.; Fazio, S. Effects of a nutraceutical combination (berberine, red yeast rice and policosanols) on lipid levels and endothelial function randomized, double-blind, placebo-controlled study. *Nutr. Metab. Cardiovasc. Dis.* 2010, 20, 656–661. [CrossRef] [PubMed]
- [8] Chen, G.-L.; Chen, S.-G.; Chen, F.; Xie, Y.-Q.; Han, M.-D.; Luo, C.-X.; Zhao, Y.-Y.; Gaob, Y.-Q. Nutraceutical potential and antioxidant benefits of selected fruit seeds subjected to an in vitro digestion. *J. Funct. Foods* 2016, 20, 317–331. [CrossRef]
- [9] Pitchaiah, G.; Akula, A.; Chandi, V. Anticancer Potential of Nutraceutical Formulations in MNU-induced Mammary Cancer in Sprague Dawley Rats. *Pharmacogn. Mag.* 2017, 13, 46–50.
- [10] Singla, V.; Pratap Mouli, V.; Garg, S.K.; Rai, T.; Choudhury, B.N.; Verma, P.; Deb, R.; Tiwari, V.; Rohatgi, S.; Dhingra, R.; et al. Induction with NCB-02 (curcumin) enema for mild-to-moderate distal ulcerative colitis—A randomized, placebo-controlled, pilot study. *J. Crohn's Colitis* 2014, 8, 208–214. [CrossRef] [PubMed]
- [11] J. Crohn's Colitis 2014, 8, 208–214. [CrossRef] [PubMed]
- [12] Chaplin, D.D. Overview of the Immune Response. *J. Allergy Clin. Immunol.* 2010, 125, S3–S23. [CrossRef]
- [13] Carr, A.C.; Maggini, S. Vitamin C and Immune Function. *Nutrients* 2017, 9, 1211. [CrossRef]



- [14] Ruchi, S. Role of nutraceuticals in health care: A review. *Int. J. Green Pharm.* 2017, 11.[CrossRef]
- [15] Singh, J.; Sinha, S. Classification, regulatory acts and applications of nutraceuticals for health. *Int. J. Pharm. Bio Sci.*2012, 2,177–187.
- [16] Scrinis, G. Functional foods or functionally marketed foods? A critique of, and alternatives to, the category of “functional foods”.*Public Health Nutr.* 2008, 11, 541–545. [CrossRef] [PubMed]
- [17] Prabu, S.L.; SuriyaPrakash, T.N.K.; Kumar, C.D.; SureshKuma, S.; Ragavendran, T. Nutraceuticals: A review. *Elixir Int. J.*2012, 46,8372–8377.
- [18] Bhowmik, D.; Kumar, K.P.S.; Paswan, S.; Srivastava, S. Tomato-A Natural Medicine and Its Health Benefits. *J. Pharmacogn.Phytochem.* 2012, 1, 33–43.
- [19] Singh, B.; Singh, J.P.; Kaur, A. Saponins in pulses and their health promotingactivities: A review. *Food Chem.*2017, 233,540–549.[CrossRef]
- [20] Smith, L.K.; Guentzel, L.J. Mercury concentrations and omega-3 fatty acids in fish and shrimp: Preferential consumption formaximum health benefits. *Mar. Pollut. Bull.* 2010, 60, 1615–1618. [CrossRef]
- [21]Heldman, D.R. Food ScienceText Series. 1994. Available online: <http://www.springer.com/series/5999> (accessed on 22 April2020).
- [22] Ghayur MN, Gilani, AH Afridi MB and Houghton PJ. Cardiovascular effects of ginger. *Vascular Pharmacology.* 2005; 43: 234-241.
- [23] Chrubasik S, Pittler M H, Roufogalis B D Zingiberisrhizoma: a comprehensive reviewon the ginger effect and efficacy profiles. *Phytomedicine.* 2005; 12: 684-701.
- [24] Dutta P C, Phytosterols as functional food components and nutraceuticals, Marcel Dekker, Edinburgh, 2003.
- [25] Si-quan L and Zhang, Q H. Advances in the development of functional foods frombuckwheat. *Critical reviews infoodscience and nutrition.* 2001;41:451-464.
- [26] Hamid AA and Luan YS. Functional properties of dietary fiber prepared from defatted rice bran. *Food Chemistry.* 2000; 68: 15-19.
- [27] Gita C. Functional Food Attributes of n-3 Polyunsaturated and Conjugated Linoleic Acid Enriched Chicken Eggs. *Current TopicsinNutraceutical Research.* 2004;2: 113-121.
- [28] Tucker G Nutritional enhancement of plants. *Current Opinion in Biotechnology.* 2003; 14: 221-225.
- 29] Sirtori C R and Galli C Fatty acids and the Omega 3. *BiomedecineandPharmacotherapy.* 2002; 56: 397-406.
- [30] Sidhu KS Health benefits and potential risks related to consumption of fish or fish oil.*RegulToxicolPharmacol.* 2003; 38: 336-344.
- [31] Kato S, Karino K, Hasegawa J, Nagasaki A, Eguchi M and Ichinose T. Octacosanol affects lipid metabolism in rats fed on a high fat diet. *Br J Nut.* 1995; 73: 433-442.