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A REVIEW ARTICLE ON NUTRACEUTICALS

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ABSTRACT

Nutraceuticals are necessary food elements that have both nutritional and therapeutic properties. The inclusion of active substances such as carotenoids, collagen hydrolysate and dietary fibres contributes to the health advantages of these foods. Nutraceuticals have been discovered to have a good impact on cardiovascular and immune system health, as well asplay a role in the prevention of infection and cancer. Nutraceuticals are divided into classes based on their nature and mechanism of action. Various nutraceutical classifications and their potential therapeutic action in disease, such as anti-cancer, antioxidant, anti-inflammatory, and anti-lipid activity, will be discussed in this review. Furthermore, the various mechanisms of action, uses, and safety of these products on consumers, as well as current trendsand future prospects of nutraceuticals, will be covered.

Keywords: Nutrients, Dietry Supplements, Nutraceuticals And Diseases.

I. INTRODUCTION

Hippocrates, some 2000 years ago, properly stated, "Let food be your medicine, and medicine be your food." The recognition that "nutraceuticals" play a vital role in health enhancement has sparked a surge in global interest.

Dr. Stephen De Felice, Chairman of the Foundation for Innovation in Medicine, created the phrase "Nutraceutical" in 1989 by merging the terms "Nutrition" and "Pharmaceutical". "Nutraceutical" is a marketing phrase for a nutritional supplement sold with the goal of treating or preventing disease, and it has no regulatory definition. As a result, a "nutraceutical" is any substance that can be regarded a food or a component of a food that has medical or health benefits, including illness prevention and treatment. Isolated nutrients, dietary supplements, and diets are examples of such items, as are genetically altered "designer" foods, herbal products, and processed foods including cereals, soups, and beverages. There are already over 470 nutraceutical and functional food items with established health benefits on the market[1].

"Because of their perceived safety and possible nutritional and therapeutic advantages, nutraceuticals and functional foods have attracted a lot of attention." The nutraceutical and functional food industries are in a good position to take advantage of consumer interest in these products. Whether it's a big pharmaceutical corporation, a nutritional company, a large food multinational, or a tiny vitamin-selling company, all are aware ofchanging patterns and the growing health-conscious customer trend. As a result, there is a proliferation of these value-added goods targeted at not only maintaining one's health but also the prevention and treatment of a variety of conditions ranging from heart disease 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

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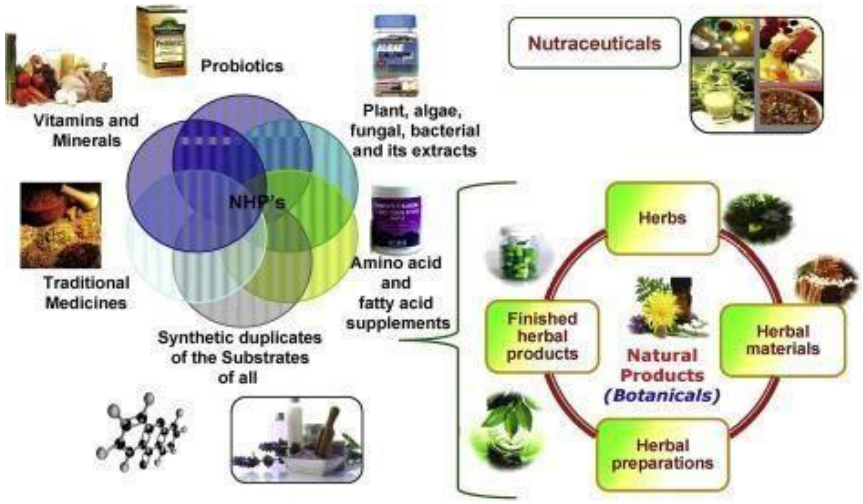

Figure 1: Nutraceuticals

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 – Probioics, Prebiotics, Antioxidents, Enzymes, etc.

VARIOUS NUTRACEUTICALS USED AGAINST DIFFERENT DISEASE -

Sr. no.	Disease	Examples
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	Osteoarithritis	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	Emblica officinalis

Dietary supplements

Typical dietary supplements, such as vitamin B supplements, are sold in pill form. A dietary supplement is a liquid or capsule-based solution that contains nutrients derived from foods that have been concentrated. "A dietary supplement is a product taken by mouth that contains a "dietary element" designed to augment the diet," according to the Dietary Supplement Health and Education Act (DSHEA) of 1994 in the United States[3].

Vitamins, minerals, herbs or other botanicals, amino acids, and substances such as enzymes, organ tissues, glandulars, and metabolites are examples of "dietary ingredients" in these goods.

Dietary supplements are extracts or concentrates that come in a variety of forms, including tablets, capsules, softgels, gelcaps, liquids, and powders. The Food and Drug Administration (FDA) does not need dietary supplements to be approved before being marketed, but companies must register their production facilities with the FDA.

Dietary supplements may only be marketed to support the structure or function of the body, and may not claim to treat a disease or condition, with the exception of a few well-defined exceptions. They must also include a label that states: 'These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any illness." It accomplishes this purpose by utilising theefficacy of nutraceuticals in cleansing the body, preventing

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vitamin and mineral shortages, and restoring good digestive 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.

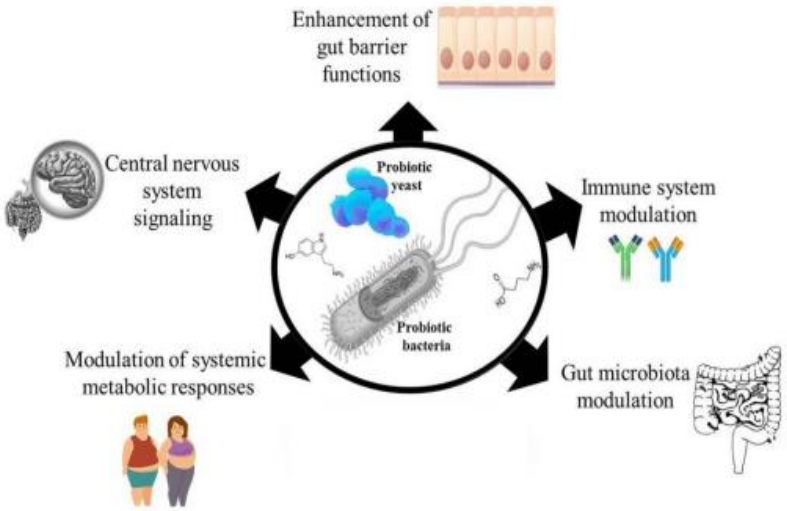

Figure 2 Probiotic

Lactose intolerance can be cured by probiotics, which produce a specialised enzyme (ß-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].

- Commanly 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

Enzymes are vital components of life; without them, our bodies would stop working. Those suffering from medical illnesses such as hypoglycemia, blood sugar imbalances, digestive issues, and obesity might reduce their symptoms by adding enzyme supplements to their diet. These enzymes come from a variety of sources, including bacteria, plants, and animals.

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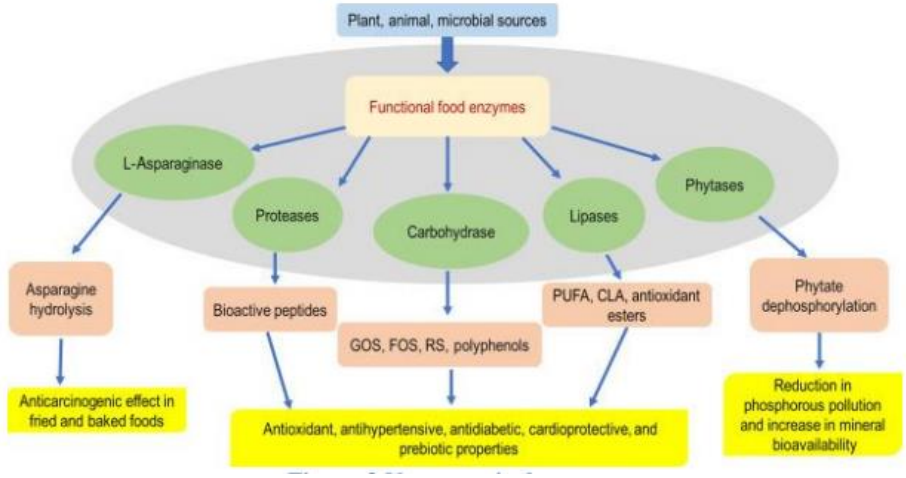

Figure 3: Nutraceutical enymes

Prebiotics

Prebiotics are compounds that are not digested by humans and are a more recent addition to our language. Instead, they serve as a food supply for beneficial probiotic bacteria. This promotes the growth of probiotic bacteria in a favourable environment, lowering the possibilities of dangerous microbes establishing a foothold in our digestive tract. Inulin is a prebiotic that has found its way into a variety of processed foods. It's a sort of fibre that comes from the roots of plants including chicory, Jerusalem artichoke and even dandelions[6].

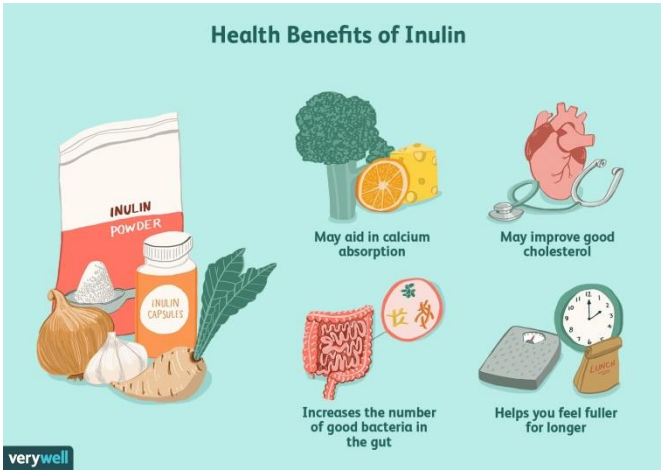

Figure 4

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.

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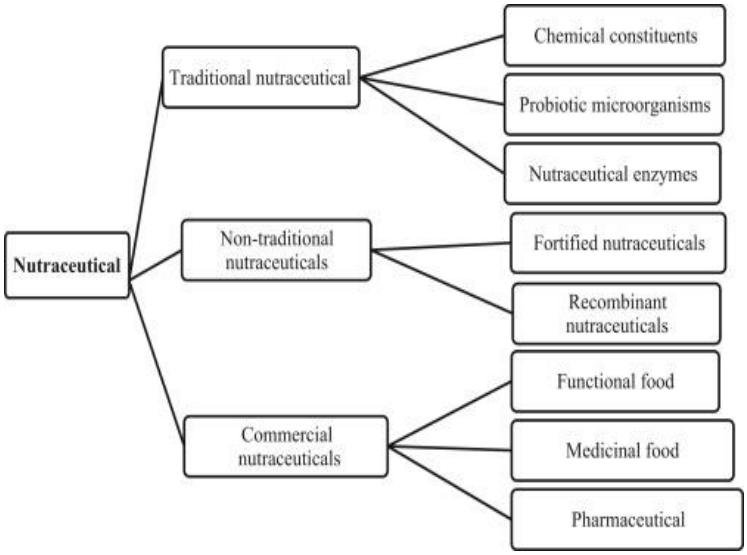
Commercial Nutraceuticals

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.

Figure 5: Commercial Nutraceuticals



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Benefits of Nutraceuticals –

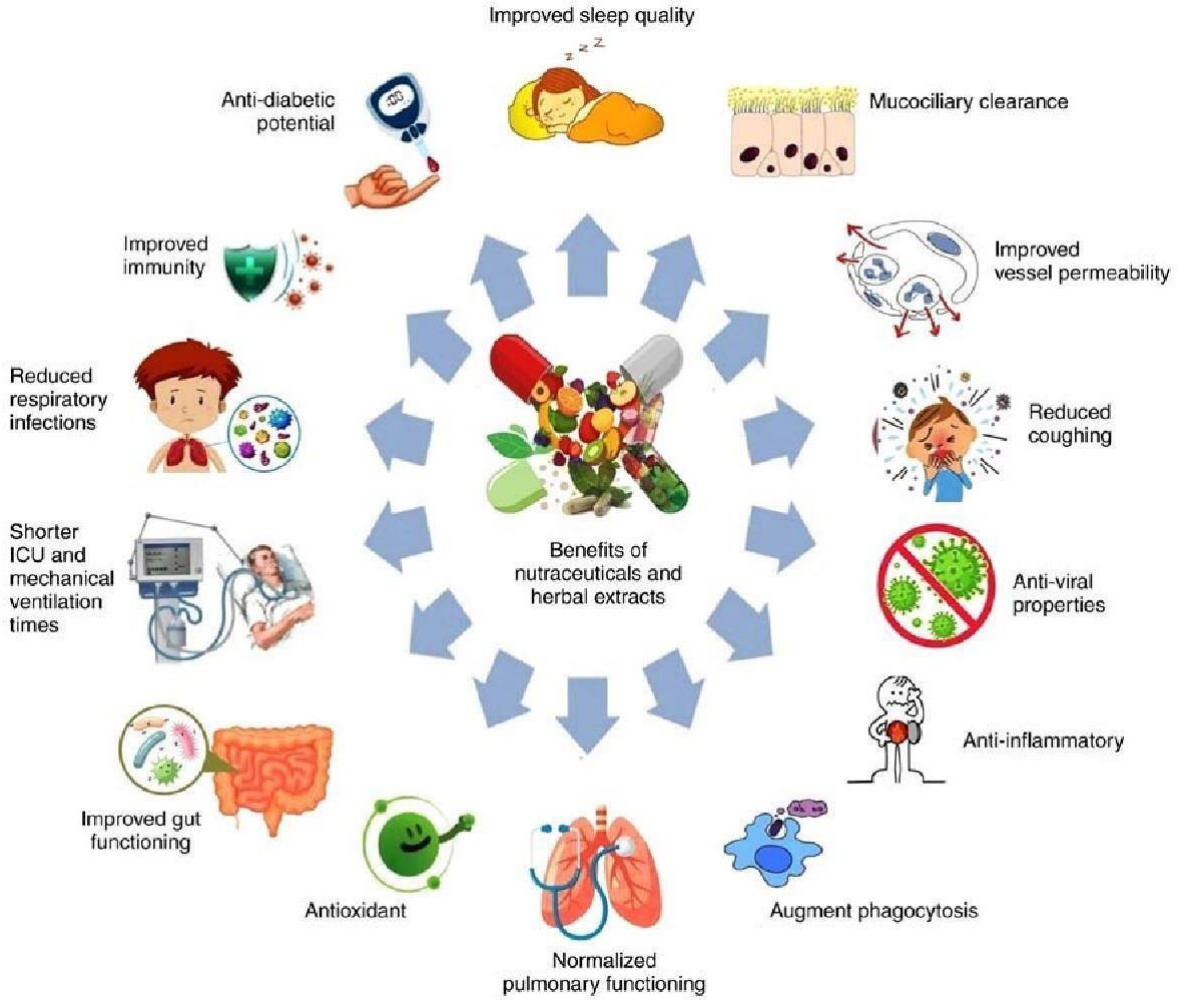

Figure 6: Benefits of Nutraceuticals

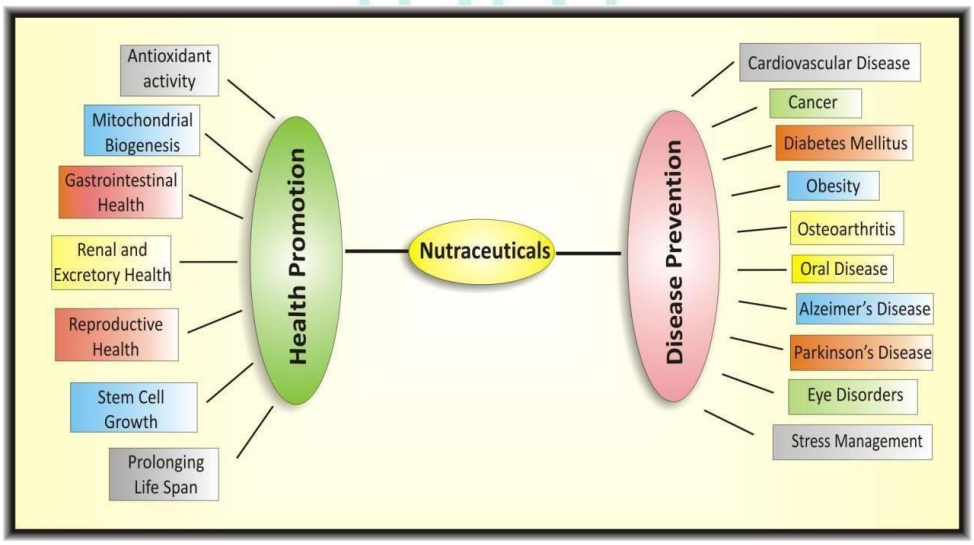

Figure 7: Nutraceuticals and Diseases

NUTRACEUTICALS AND DISEASES :-

Cardiovascular diseases

The global burden of chronic diseases such as heart disease, cancer, diabetes, and obesity is quickly rising. Hypertension (high blood pressure), coronary heart disease (heart attack), cerebrovascular disease

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(stroke), heart failure, peripheral vascular disease, and other heart and blood vessel illnesses are all classified as cardio vascular diseases (CVD).

The majority of CVDs are preventive and manageable. Low intake of fruits and vegetables has been linked to a higher mortality rate in cardiovascular disease. A diet rich in fruits and vegetables has been linked to a lower risk of cardiovascular disease in numerous studies.

Apart from that, nutraceuticals such as antioxidants, dietary fibres, omega-3 polyunsaturated fatty acids (n-3 PUFAs), vitamins, and minerals, as well as physical activity, are indicated for the prevention and treatment of CVD.

Polyphenols found in grapes and wine have been shown to influence cellular metabolism and communication, which is consistent with the reduction of vascular disease.

Nutraceuticals for Hypertension

Hypertension can be prevented, delayed, reduced in severity, treated, and controlled through optimal diet, nutraceuticals, vitamins, antioxidants, minerals, weight loss, exercise, quitting smoking, limiting alcohol and caffeine, and other lifestyle changes. - Lipoic acid, magnesium, Vitamin B6 (pyridoxine), Vitamin C, N-acetyl cysteine, Hawthorne, Celery, -3 fatty acids, and other nutrients and nutraceuticals have calcium channel blocking activity (therefore antihypertensive activity) [8].

Current status of nutraceuticals in CVD

Because of the lengthy history of CVD, determining the causal relationship between nutrition and physical activity on major CVD events is still difficult. The evidence for a link between calcium and the risk of hypertension is mixed and unclear and a link between calcium and the risk of pregnancy-induced hypertension and preeclampsia seems unlikely [9].

Beta carotene, vitamin A, and vitamin E supplementation may increase mortality. The effects of vitamin C and selenium on mortality should be investigated further. Nutraceuticalscould be developed to reduce and manage thrombosis risk in women who have thrombophilic gene mutations [10].

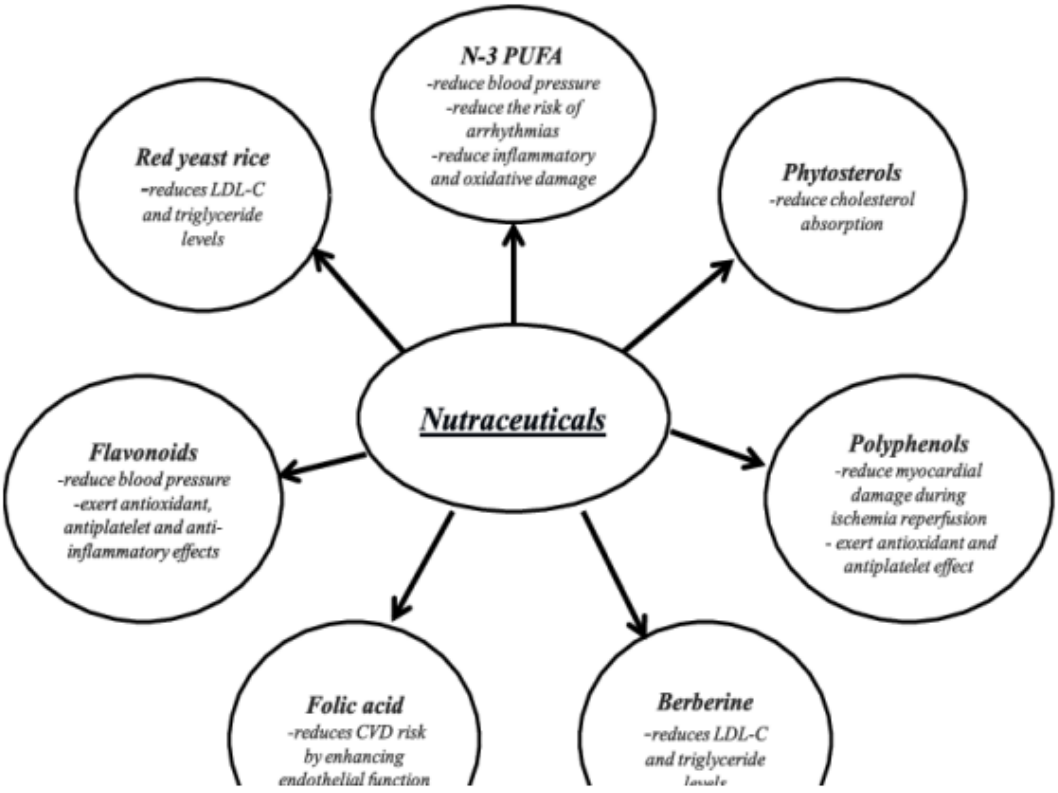

Figure 8: Nutraceuticals for Cardiovascular disease

Obesity

Obesity is a well-known risk factor for a variety of diseases, including angina pectoris, congestive heart failure, hypertension, hyperlipidemia, respiratory problems, renal vein thrombosis, osteoarthritis, cancer, and impaired fertility. Obesity has become a global public health issue, with an estimated 315 million

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individuals falling into the WHO's obesity classifications.

Increased availability of high-fat, energy-dense meals is one of the key drivers of this rapid rise in obesity rates [11]. Excessive consumption of energy-dense meals (snacks, processed foods, and beverages) can lead to weight gain, thus saturated and trans fats, aswell as sweets and salt, should be limited in the diet. Caloric restriction and increased physical activity have only been found to be marginally effective in the treatment of obesity. As a result, many health care providers and obese people are turning to medications and nutraceuticals to assist them lose weight. A tolerable and effective nutraceutical that can increase energy expenditure and/or decrease caloric intake is desirable for body weight reduction.

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 long-term 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, Momordica Charantia (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 types of 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.

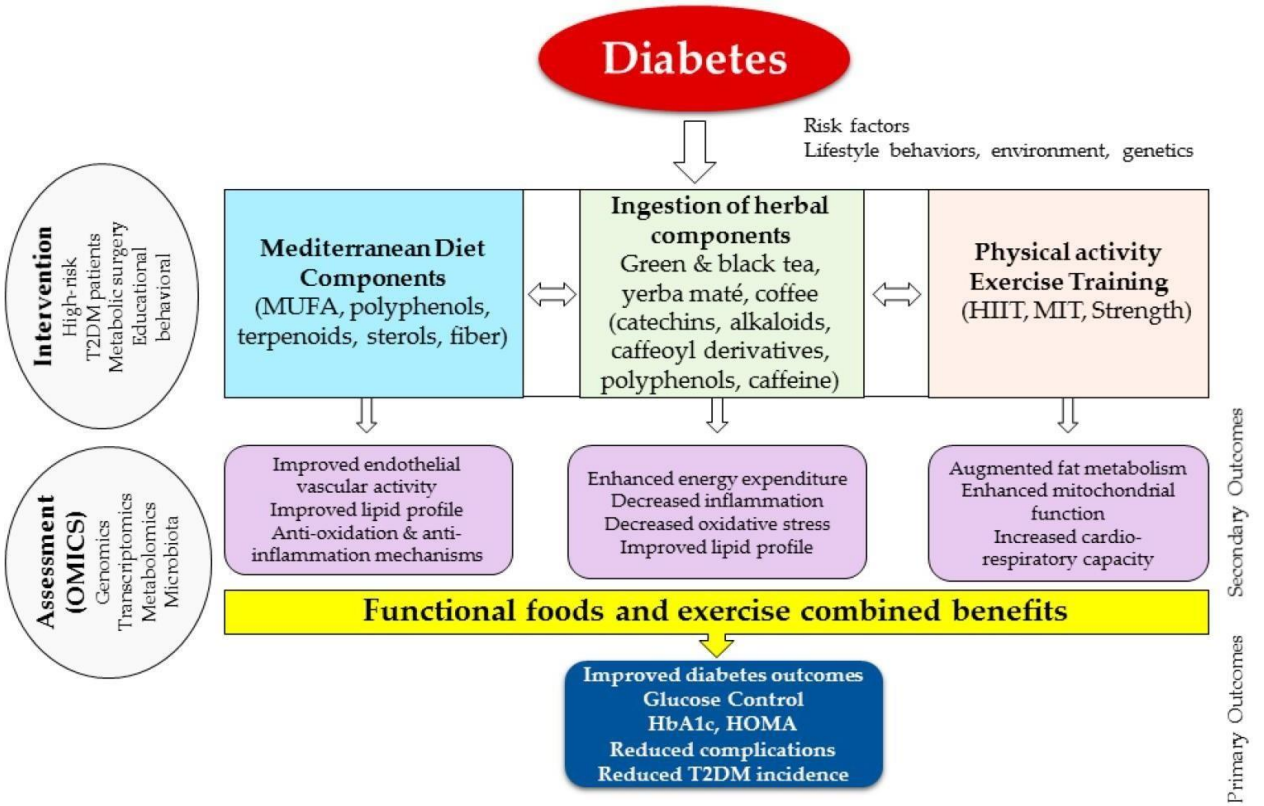

Figure 9: Nutraceuticals for Diabetes

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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 varietyof diseases.

Phyto-estrogens, 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 coneflowers, or herbs of the genus Echinacea, such as Echinacea purpurea, Echinacea angustfolia, Echinacea pillida, and mixtures thereof extracts from herbs of the genus Sambuca, such as elderberriesand Goldenseal extracts.

The coneflowers 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.

Astragalus membranaceous, Astragalus mongolicus, 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

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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.

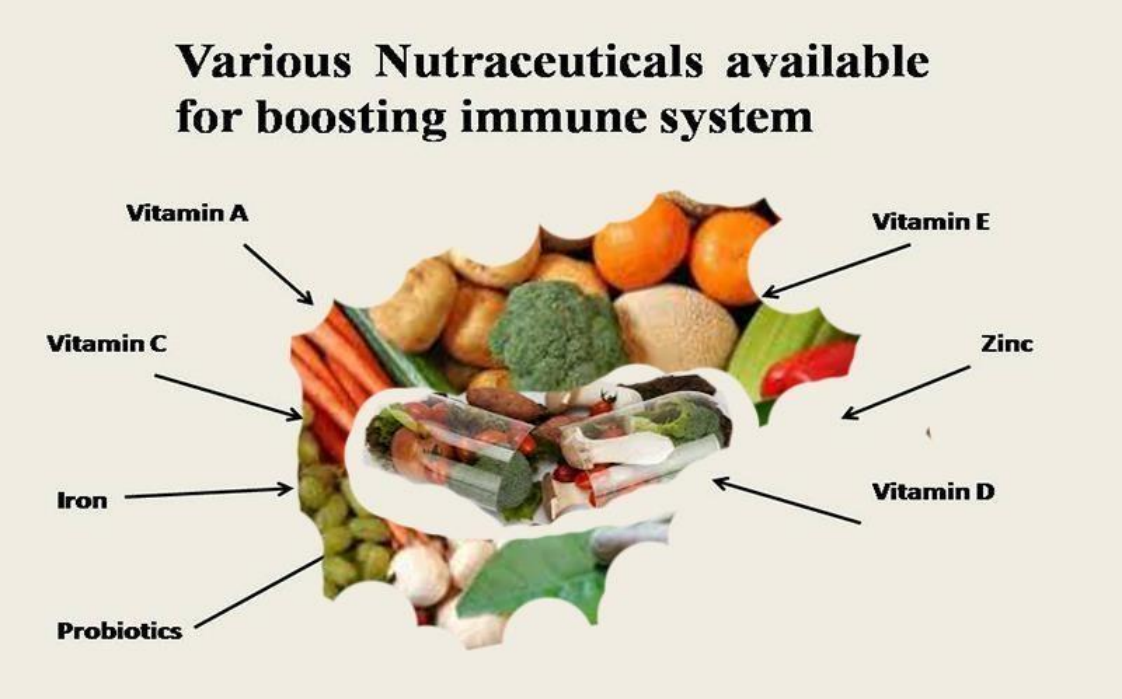

Figure 10: Nutraceuticals for Immunity booster

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, immunomodulatory, anticancer and gastroprotective 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.

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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].

Figure 11: Nutraceuticals 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 β-carotene, curcumin, lutein, lycopene, turmerin etc 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].

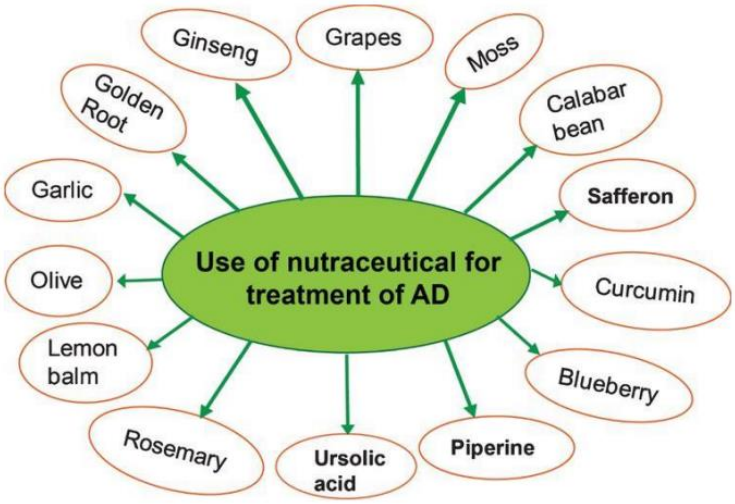

Figure 12: Nutraceuticals for Alzheimer's disease

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Parkinson's disease

Parkinson's disease is a brain ailment caused by nerve damage in certain areas of the brain, which causes muscle rigidity, shaking, and difficulty walking. It usually strikes people in their mid to late adolescent years.

Current status of nutraceuticals in Parkinson's disease

According to Canadian experts, vitamin E in meals may protect against Parkinson's disease [25]. Creatine seems to alter the aspects of Parkinson's disease, as evidenced by a decrease in clinical signs [26].

Glutathione has also been investigated to see how it affects nerves and how effective it is as an antioxidant. Long-term dose, adverse effects, and the most efficient mode of delivery are still unknown. Although exploratory studies have shown some potential benefits with nutritional supplements, it is vital to remember that there is currently insufficient scientific evidence to prescribe them for Parkinson's disease. Patients should be informed that over-the-counter medications have negative effects, interact with other prescriptions, and are costly.

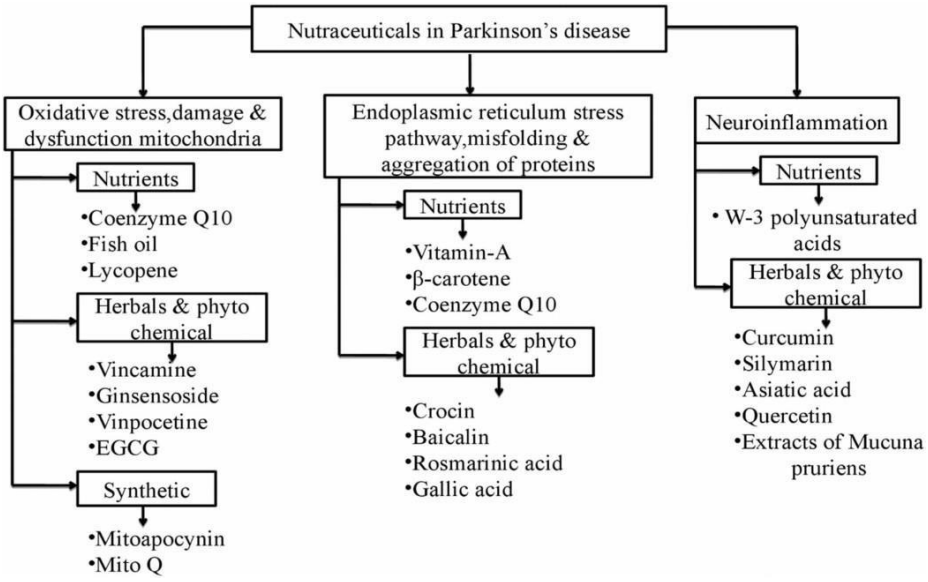

Figure 13: Nutraceuticals for Parkinson's disease

II. CONCLUSION

Nutraceuticals are presently entering recognition as being salutary in coronary heart disease, obesity, diabetes, cancer, osteoporosis and other habitual and degenerative conditions similar as Parkinson's and Alzheimer's conditions. Attestations indicate that the mechanistic conduct of natural composites involve a wide array of natural processes, including activation of antioxidant defenses, signal transduction pathways, cell survival- associated gene expression, cell proliferation and isolation and preservation of mitochondrial integrity.

It appears that these parcels play a pivotal part in the protection against the It's veritably imperative that the nutrients plant in numerous foods, fruits and vegetables are responsible for the well- proved health benefits.

For illustration, beta-carotene and lycopene cover the skin from ultraviolet radiation damage, lutein and lycopene may profit cardiovascular health and lycopene may help help prostate cancer. Because of these and other pronounced health benefits of these, it must be taken regularly and to reduce the threat factors like high cholesterol, high blood pressure and diabetes. Some of the most popular nutraceutical products retailed moment are botanicals similar as St.John's wort, echinacea, ginkgo biloba, saw palmetto and ginseng.

In order to have scientific knowledge about the nutraceuticals, publics should be educated, where recommended diurnal boluses of these nutraceuticals should be known by each consumer.

The list of nutraceuticals being studied is changing continually and reflects ongoing exploration, request developments and consumer interest (30).

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