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Review

A Comprehensive Review On Nutraceuticals: Classification, Therapeutic Applications

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Abstract

As non-specific biological medicines, nutraceutical items are used to control symptoms, prevent malignant processes, and improve general health. "Nutraceutical" is a combination of the terms "nutrient," which describes a healthy food ingredient, and "pharmaceutical," which describes a therapeutic therapy. They are primarily divided into three categories: commercial, non-commercial, and traditional nutraceuticals. Prebiotics, probiotics, nutritional supplements, functional foods, pharmaceutical foods, and other subcategories are important to prevent disease like diabetes, obesity, cancer, Alzheimer's disease. Because their health benefits, nutraceuticals are in high demand worldwide. Due to their potential nutritional and therapeutic benefits as well as their assumed safety, nutraceuticals have notable attention. Pharmaceutical and nutritional firms are aware of the financial gains from exploiting consumers who are becoming more health-conscious and the shifting trends that are leading to the emergence of these value-added goods that target everything from cancer to heart health. Classification, applications, marketed nutraceutical goods, global market demand, regulatory frameworks, and current and future characteristics of nutraceuticals are the main topics of this article.

Keywords: Dietary supplements, Food supplements, Global market, Health problems, Nutraceuticals, Prebiotic, Probiotics.

INTRODUCTION

Approximately two thousand years ago, Hippocrates remarked, quite rightly, "Let food be your medicine, and medicine be your food." Realising the importance of "nutraceuticals" in enhancing health has raised interest worldwide. The terms "nutrition" and "pharmaceutical" were put together in 1989 by Dr. Stephen De Felice, chairman of the Foundation for Innovation in Medicine, to form the phrase "nutraceutical". "Nutraceutical" is a marketing phrase used to refer to a nutritional supplement meant to treat or prevent disease; it has no precise regulatory definition. A "nutraceutical" is therefore any substance that can be regarded as a food or a component of a food that has health or medical benefits, such as preventing or treating illness. Diets, dietary supplements,

and separated nutrients are among them; genetically modified "designer" foods; herbal products; and processed foods including beverages, cereals, and soups. Currently on the market are over 470 functional foods and nutraceuticals with demonstrated health benefits1. Several popular nutraceuticals include ginseng, echinacea, green tea, glucosamine, omega-3, lutein, folic acid, and cod liver oil. The majority of nutraceuticals offer a number of medicinal advantages[2].

NUTRACEUTICALS

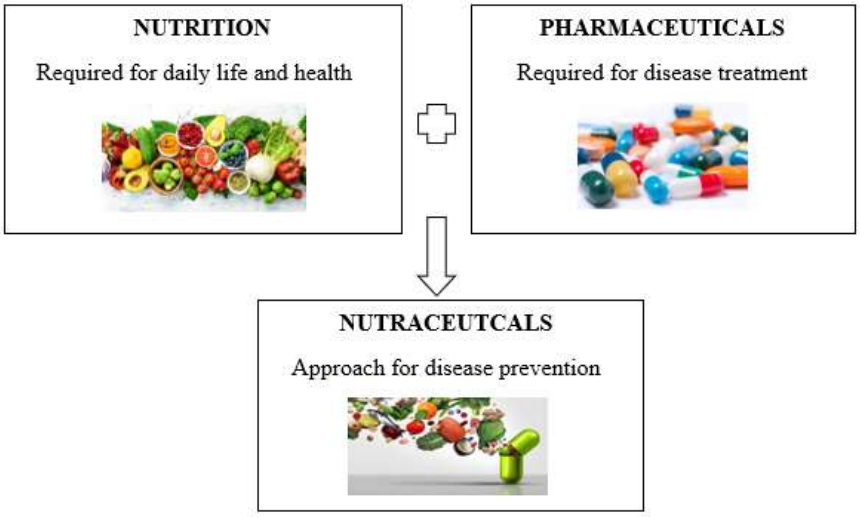

Fig 1: concept of Nutraceutical

Pharmacy nutraceuticals offer therapeutic advantages beyond simple diet by fusing medications and scientific nutrition. Herbal medicines, functional foods that are intended to elevate health, or address particular medical conditions fall under this category[3]. Nutrients i.e) Minerals and Vitamins or other substances with nutritional or physiological effects that are marketed in "Dose" form like pills, tablets, capsules[4]. Nutraceuticals are crucial in pharmacy because they provide additional or alternative approaches to health management while enhancing conventional pharmacological therapies. As professionals in medications, chemists play a crucial role in counselling patients regarding the selection, application, and possible interactions of nutraceutical products[3].

NEED AND OBJECTIVES OF NUTRACEUTICALS

- The most of categories are covered by nutraceuticals, including anti-arthritic, cold and cough, sleep problems, digestion, cancer prevention, osteoporosis, blood pressure, cholesterol control, pain relievers, depression, and diabetes[2].
- Therapy has not succeeded in offering a solution.
- Patients with limited financial resources.
- Increase vitality, reduce anxiety, and enhance general health.
- Boost quantity and quality of sleeping and mental clarity.
- Prevent chronic illnesses and lessen urges for drugs.
- Increase life expectancy and postpone the ageing process[5].

CLASSIFICATION OF NUTRACEUTCALS

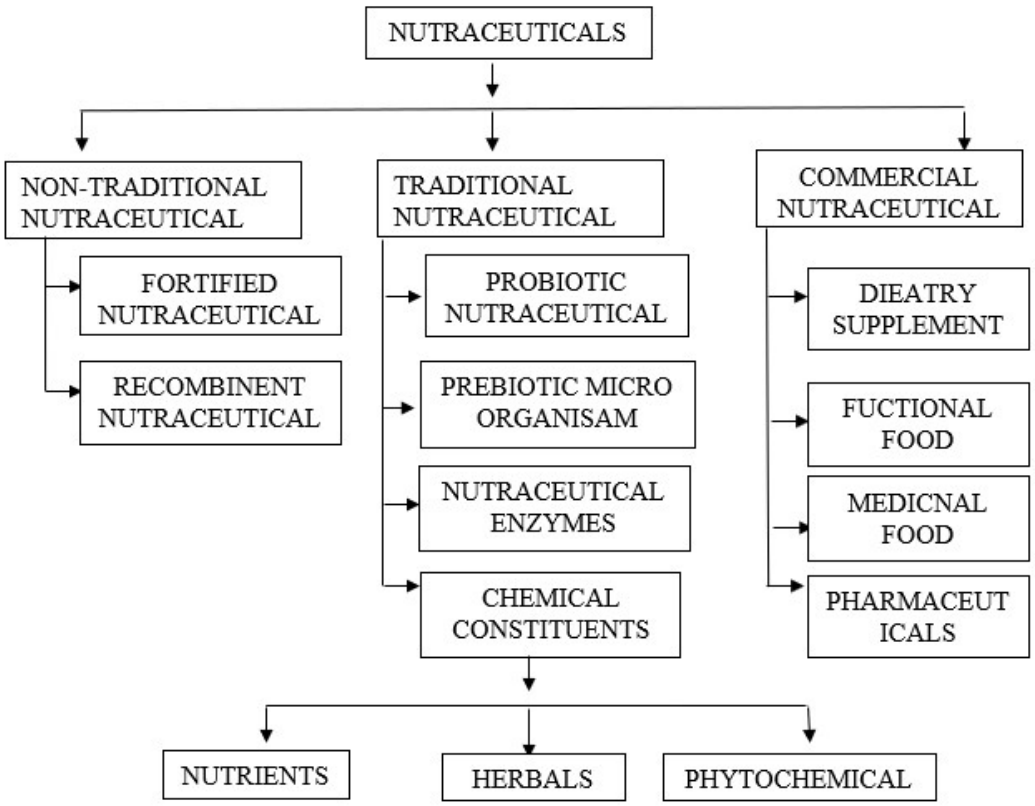

Fig 2 : Classification based on food availability

NON-TRADITIONAL NUTRACEUTICAL

Biotechnology is used to prepare these fake foods. The bioactive components in food samples are intended to produce products that improve human health[2].

A] FORTIFIED NUTRACEUTCAL

Vitamins and minerals are added to them as supplements, usually up to 100% of the dietary reference intake for the nutrient. Folic acid, extra nutrients, and/or agricultural breeding have all been used to fortify this cuisine. One example is milk fortified with cholecalciferol, which is used to treat vitamin D deficiency[1].

Table 1: The fortified foods with their Ayurvedic nutraceutical[3].

FORTIFED FOOD	AYURVEDC NUTRACEUTICALS
Turmeric Milk	Curcumin: Anti inflammatory, antioxidant properties
Ashwagandha Tea	Ashwagandha: Adaptogenic herb, stress reduction, immune support
Triphala Churna Bread	Triphala: Digestive support, antioxidant property
Brahmi Infused Water	Triphala: Digestive support, antioxidant property
Neem Leaf Cookies	Neem: Antibacterial, properties, supports oral health

B] RECOMBINENT NUTRACEUTICAL

Genetic alteration, the production of probiotics, and the extraction of bioactive components through fermentation and enzyme techniques are all accomplished through biotechnology. Energy-boosting foods like bread, wine, fermented starch, yoghurt, cheese, vinegar, and more are produced via biotechnology[2].

TRADITIONAL NUTRACEUTICAL

Food products that are completely sourced from nature and have not been modified from their natural component state fall under this category. These include foods that offer benefits beyond only nutrition, such as fruits, vegetables, grains, meat, fish, eggs, and dairy products[6].

A) PROBIOTIC NUTRACEUTICALS

By eliminating the harmful intestinal flora and preserving a healthy environment, probiotics such as Bacillus bulgaricus are crucial for improving quality of life. The microflora was typically altered by the antibacterial property, which grounded the epithelial tissues and created an environment that allowed the supplements to be better retained something the body needs. By producing related enzymes (ß-galactosidase) and hydrolysing lactose into its sugar components, probiotics are also very helpful in treating lactose intolerance. The most widely utilised bacterial species in commercial probiotics are Saccharomyces cerevisiae, Bifidobacterium, and Lactobacillus[7].It has been demonstrated that probiotic consumption enhances immune function against infections, decreases autoimmune reactions, and shortens the duration of infectious diarrhea[8].

B] PREBIOTIC NUTRACEUTICAL

The term "prebiotics" is a relatively new addition to our vocabulary, referring to substances that our bodies cannot metabolise when consumed. Instead, they work as a food supply for the good probiotic bacteria. By creating a suitable environment for probiotic bacteria to grow, this reduces the chance that harmful microorganisms may start to multiply in our digestive system. Inulin, for example, is a common prebiotic found in processed foods. It is essentially a type of fibre that is taken from the roots of plants such as chicory, Jerusalem artichokes, and dandelions[4].

C] NUTRACEUTICAL ENZYMES

Without enzymes, which are essential for our bodies to operate, life would not be possible. People with gastrointestinal disorders, obesity, hypo glycemia, and blood sugar abnormalities can eliminate their symptoms by including enzyme supplements in their diet. The sources of these enzymes are microbial, plant, and animal.
In the nutraceuticals sector, papain is a common protease enzyme that aids in the digestion of proteins. They break down protein chains to create tiny peptides, which ultimately liberate the amino acids for the body to absorb[2].

D] CHEMICAL CONSTITUENTS

1. HERBAL: Since the beginning of human civilisation, herbs have been used to treat a wide range of acute and chronic conditions. Saw Palmetto berries, cernilton (pollen extract), and other herbal extracts contain bsitosterols. Pygeumafricum, the African plum, is being evaluated clinically for the treatment of benign prostatic hyperplasia[6].
2. PHYTOCHEMICALS: Phytochemicals are essentially plant nutrients with particular biological activities that support human health. They operate in the way that is explained below. Carotenoids (isoprenoids), found in a variety of fruits, vegetables, and egg yolks, have anti-carcinogenic qualities, boost natural killer immune cells, and protect the eye from UV rays. Non-carotenoids reduce cholesterol and prevent cancer. They are present in grains, palm oil, and legumes (soybeans and chickpeas[4].
3. NUTRIENTS: Plant-based natural products assist treat a variety of conditions, including low haemoglobin levels and brittle bones. They also strengthen bones and muscles, aid in neurone transmission, and keep the heart muscles in rhythm[7].

COMMERCIAL NUTRACEUTCAL

In addition to being more costly and dangerous than ever, new molecules are hard to find. Due to the undeniably huge and growing market, several pharmaceutical companies are currently making an effort to manufacture nutraceuticals. The discovery of the health benefits of consuming seafood high in omega-3 fatty acids has been one of the most exciting developments in human nutrition and disease prevention research over the past three decades[2].

A] DIETARY SUPPLEMENTS

Dietary supplements are oral products that include a nutritional component intended to enhance your diet. Examples of dietary supplements include ginkgo biloba for memory loss, glucosamine/chondroitin for arthritis, and black cohosh for menopausal symptoms. They also serve specific functions including sports nutrition, weight-loss supplements, and meal replacements. Supplement ingredients include vitamins, minerals, herbs, and other botanicals[9].

B] FUNCTINAL FOOD

Nowadays food items that have been enhanced or fortified with extra nutrients, vitamins, minerals, or bioactive chemicals to offer certain health advantages above and basic nourishment are known as functional foods. Iron, calcium, and vitamin D are just a few of the vitamins and minerals that are frequently added to breakfast cereals to promote general health. Live beneficial bacteria included in probiotic yoghurt help to strengthen the immune system and improve digestive health. Omega-3 Enriched Eggs: Eggs that have been enhanced with omega-3 fatty acids, which are thought to promote brain and heart health. Bread that has been fortified with additional fibre to support digestive health and control blood sugar levels is known as fiber-enriched bread[3].

C] MEDICINAL FOOD

Standard food items or substances that have been utilised for their therapeutic qualities in many cultures worldwide are known as medicinal foods. Among the various instances of therapeutic foods are: Indian gooseberry, or amla: Ayurveda uses amla, which is high in vitamin C and antioxidants, for its immune-boosting and restorative qualities. Often referred to as the "miracle tree," moringa is used to prevent malnutrition and enhance general health since it is a source of vitamins, minerals, and antioxidants. Sea weed: Used in traditional Asian cooking, seaweed is high in iodine, vitamins, and minerals and is thought to boost thyroid function and aid in detoxification[3].

D] PHARMACEUTICALS

Drugs and pharmaceuticals are carefully designed and created to treat, cure, or prevent diseases that are not normally a part of our physiology[2]. The technique of carefully and successfully delivering an active medicinal substance into the body is known as drug delivery. The introduction of novel delivery systems to the nutraceutical business is a result of its complexity, high cost, and time commitment. The latest cutting-edge technologies in the formulation of nutraceuticals include lipid-based carriers, nanoparticles, nanospheres, nanoemulsion, nanohydrogel, and nanoliposomes[5].

COMPARISON NUTRACEUTICAL WITH PHARMACETICAL

Fig 3: Nutraceutical Vs Pharmaceutical

Table 2: Nutraceutical VS Pharmaceutical[10].

NUTRACEUTICAL	PHARMACEUTICAL
Nutraceuticals are food ingredients or dietary supplements that offer health advantages over and above basic nourishment.	Drugs or therapies designed particularly to identify, treat, cure, or prevent illnesses and medical problems are known as pharmaceuticals.
Encourage overall well-being, encourage preventive wellness, and supplement nutritional needs	Diagnose, treat, or cure illnesses ranging from chronic diseases to infections.
usually regarded as dietary supplements and are not as strictly regulated.	subject to strict regulation and testing.
frequently sold over-the-counter (OTC) and without a prescription in a variety of retail locations, such as health food stores and online..	They are usually only accessible with a prescription, and access is managed by medical personnel to guarantee proper use.

THERAPEUTIC APPLICATION OF NUTRACEUTICALS

ALZHEIMER DISEASE

One governing ailment is Alzheimer's disease. Memory loss and dementia are the main clinical symptoms. Alzheimer disease is the most prevalent type. It is incurable and typically results in a person's death. Lute in, lycopene, beta-carotene, curcumin, and turmeric in Alzheimer disease treatment. mitigate the negative effects of some illnesses, such as oxidative stress, mitochondrial malfunction, and neurodegenerative disorders[11].

CANCER

Anticancer compounds with a variety of constitutions, configurations, and bioactivities have long been thought to be abundant in natural goods. Many of the pharmaceutical drugs currently on the market in the field of cancer research were found in nature, either by altering the structures of the isolated natural products or by using them as lead compounds to create new scaffolds. Phytochemicals obtained from herbal or dietary sources are known as nutraceuticals. Because of their potent ability to cause cancer cells to undergo apoptosis, they are

frequently used in conjunction with chemotherapy. Nutraceuticals with strong anticancer properties include sulfur-containing chemicals, carotenoids, flavonoids, and stilbenes. Poly phenolic compounds like flavones, flavonols, curcumin alter the signal path ways to remove cancer cells[12].

GASTROINTESTINAL DISORDER

By restoring the balance of the gut microbiota, probiotics—Some foods and supplements include helpful bacteria that can help with digestion and reduce the symptoms of conditions like irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD)[3].

Constipation Inadequate bowl movement or difficult passing intestinal contents are signs of this common GIT ailment. Laxatives are substances that either promote a bowel movement or loosen faeces. Popular treatments is senna, which under the significant class of anthraquinone medications, which are botanic laxatives. The class is also rich in comparable plants and herbs in the form of glucoside derivatives of anthracene, such as the anthraquin, and includes cascara, frangula, aloe, and rhubarb[13].

Irritable bowel syndrome Defecation disruption and stomach pain or discomfort are symptoms of IBS, a functional bowl condition. IBS is unique among G.I. disorders in that it is frequently linked to psychiatric conditions such as anxiety, sadness, and somatization. The ginger family includes the herb Curcuma longa, which has anti-inflammatory, anti-cancer, and antioxidant qualities as well as the capacity to alter gut flora[13].

OSTEOARTHRITIS

Weight gain and energy imbalance result from joint pain that restricts physical activity. Chondroitin sulphate, glucosamine, diacerin, banana, ginger, green tea, pomegranate, boswellia, oxaceprol, tipi, willow bark, curcumin, avocado, soybean, and collagen hydrolysates are among the nutraceuticals that are used to alleviate the issues14.

PARKINSON'S DISEASE

Dopamine (DA) is drastically reduced in Parkinson's disease (PD), a neurological condition caused by damaged dopaminergic neurones in the brain's substantia nigra par compacta. Neurodegeneration that results in Parkinson's disease (PD) is caused by a number of factors, including oxidative stress, antioxidant depletion, mitochondrial damage, etc. Dopamine supplementation, neuroprotection, and the prevention of motor irregularities and gait symptoms are some of the ways anti-Parkinson's illnesses alleviate symptoms. Unchecked oxidative stress and free radicals, along with aberrantly misfolded proteins, neuroinflammation, and malfunctioning mitochondria, impair cellular metabolism and energy, which affects brain function and causes neurodegenerative diseases like Parkinson's disease. For instance, vitamin A, lycopene, vincamine, gallic acid, omega-3 fatty acids, and curcumin[15.]

DIABETES

Diabetes is a long-term metabolic disease in which the body cannot use carbohydrates because there is either a complete or partial absence of insulin, a hormone that is naturally produced by the pancreatic ß cell of the islets of Langerhans. Isoflavones are phytoestrogens that are taken by people all over the world and share structural and functional similarities with human oestrogen. People with diabetes can benefit from cinnamon tea and green tea. Psyllium dietary fibres have been utilised to lower lipid levels in hyperlipidaemia and manage blood sugar in diabetic patients[7].

CARDIOVASCULAR DISEASE

Globally, chronic illnesses including cancer, diabetes, heart disease, and obesity are getting more and more costly. At 59% of the 56.5 million recorded deaths globally in 2001, chronic diseases were responsible for 46% of the overall disease burden. Cardiovascular diseases (CVDs) include heart attack, heart failure, hypertension (high blood pressure), peripheral artery disease, cerebral vascular disease, stroke, coronary heart disease, and other conditions that impact the heart and blood vessels. In 1999, cardiovascular disease (CVD) accounted for one-third of all deaths worldwide, and by 2010, it would be the leading cause of death in emerging nations. Many studies have found that a diet high in fruits and vegetables helps prevent CVD. In addition to physical exercise, nutraceuticals such antioxidants, dietary fibre, omega-3 polyunsaturated fatty acids (n-3 PUFAs), vitamins, and minerals are advised for the prevention and treatment of CVD. It has been shown that substances like polyphenols, which are found in grapes and wine, change cellular signalling and metabolism, which is linked to a decrease in artery disease. Cruciferous vegetables, onions, endives, black grapes, red wine, grapefruits, apples, cherries, and berries are rich sources offlavonoids. Products made from cocoa, such as coffee and chocolate, are widely consumed worldwide. Of particular interest are their cardioprotective properties and how they combine with other medications to prevent bleeding and hypercoagulation[16.]

EXAMPLE FOR MARKETED NUTRACEUTCALS

Table 3: Marketed Nutraceuticals[17]

PRODUCT NAME	CATEGORY	USE
Omega women	Antioxident, Vitamins	Immune additives
Calcirol D 3	Calcium and vitamins	Calcium additives
Proteinex	Predigested proteins	Protein supplement
Retival	Vitamins and minerals	Daily health supplement
Muscle Optimeal	Protein, vitamins, dietary fibre	Meal replacement drink mix
Wel Life	Granulated L gulatamine	Amino acid supplement
GRD	Proteins, vitamins	Nutritional supplement

FUTURE ISSUES AND PROPOSALS

The creation of a scientific evaluation criteria for disease prevention is one of the main concerns with nutraceuticals. creation of an assessment framework for illness prevention through various human trials & creation of a smooth method to transfer knowledge from fundamental research to various industrialisation stages. Since nutraceuticals are not primarily made of a single substance, the anticipated outcome for disease prevention may involve a rather complex interaction between the product's many components. It's also critical to differentiate the preventative effects of various food k.Its enormous expansion affects the food, pharmaceutical, medical, and agricultural sectors[18].

CONCLUSION

To sum up, the rise in nutraceutical use represents a major change towards proactive health management and individualised wellness solutions. The market for nutraceuticals is growing as people get more awareness of the possible benefits of these products in addressing particular health issues and enhancing general health. Given that people all over the world place a high value on health and wellbeing, it is anticipated that the consumption of nutraceuticals will continue to rise, influencing healthcare in the future to take a more proactive and all-encompassing approach.

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