

A REVIEW ON ROLE OF NUTRACEUTICALS IN HEALTH CARE

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ABSTRACT

The terms "nutrition" and "pharmaceutical" are combined to form the term "nutraceutical." In general, nutraceuticals are foods or dietary components that significantly contribute to regulating and preserving the regular physiological processes that keep people healthy. The present demographic and health trends are the main drivers of the global nutraceutical market's growth. Dietary fiber, probiotics, prebiotics, polyunsaturated fatty acids, antioxidants, and other herbal/natural food products can all be classified as nutraceuticals. These nutraceuticals aid in the fight against some of the century's biggest health issues, including diabetes, cholesterol, osteoporosis, cancer, cardiovascular disease, and obesity. All things considered, "nutraceuticals" have ushered in a new era of health and medicine, where the food sector is now a research.

Keywords: Dietary fiber, Probiotics, Prebiotics, Polyphenols, Spices, Human diet

1. INTRODUCTION

Nutraceutical is the hybrid of 'nutrition' and 'pharmaceutical'. Nutraceuticals, in broad, are food or part of food playing a significant role in modifying and maintaining normal physiological function that maintains healthy human beings. The principal reasons for the growth of the nutraceutical market worldwide are the current population and the health trends. In recent years, a new diet health paradigm is evolving which places more emphasis on the positive aspects of diet. The new lifestyle adopted by people today has changed the basic food habits of the latter. Consumption of the junk food has increased manifold leading to a number of diseases caused due to improper nutrition. Obesity is now recognized as a global issue. Heart disease continues to be a primary cause of death in most of the developing countries worldwide, followed by cancer, osteoporosis, arthritis and many others. Consumers being frustrated with the expensive, high-tech, disease-treatment approach in the modern medicines are seeking complementary or alternative beneficial products and the red tape of managed care makes nutraceuticals particularly appealing. "Let food be thy medicine and medicine be thy food", quoted by Hippocrates about 2,500 years ago is certainly the tenet of today. Nutraceuticals are the emerging class of natural products that makes the line between food and drugs to fade Although the use of nutraceuticals by people has a long history, only recently scientifically supported nutritional and medical evidence has allowed nutraceuticals to emerge as being potentially effective . The nutraceuticals of both plant and animal origin holds exciting opportunities for the food industries to create novel food products in future. Nutritional studies are now focusing on the examination of foods for their protective and disease preventing potential .Nutraceuticals have become increasingly popular, especially for preventive and proactive health care and disease management. The discovery, development, and marketing of food supplements, nutraceuticals, and related products are currently the fastest-growing segments of the food industry. Nutraceuticals are products of food origin with added health benefits in addition to their basic nutritional value. Nutraceuticals can be considered a nonspecific biological therapy for promoting general health, controlling symptoms, and preventing malignant processes. Nutraceuticals can be classified according to the chemical nature, food availability, and mechanism of action of their bioactive compounds. Nutraceuticals have many ingredients, including vitamins and minerals that directly contribute to health.

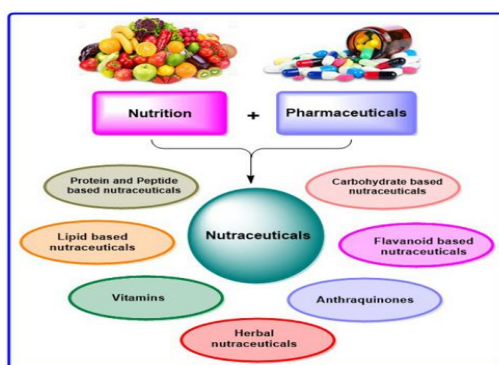


Fig 1: Nutraceutical

Nutraceuticals :

Nutraceutical is a term given by Dr. Stephen De Felice in 1989 and came from two words “nutrition” and “pharmaceutical”. These are foods or a part of foods that are beneficial in providing various health benefits including the treatment and/or prevention of the disease.

Nutraceuticals are characterized as ‘specially designed preparations’, formulated with the aim of fulfilling specific dietary requirements and/or offer preventive health care .

Benefits:

1. May enhance the health value of our diet.
2. May help us live longer.
3. May help us to avoid particular medical conditions.
4. May have a psychological benefit from doing something for one self.
5. May be superficial to be more "natural" than traditional medicine and less likely to produce unpleasant side effects.
6. May present food for populations with extraordinary needs (e.g. nutrient-dense foods for the elderly).

The reasons for shift towards nutraceuticals are:

1. Increasing numbers of consumers, concerned about healthcare costs.
2. Dissatisfied with pharmaceutical agents in promoting health, are turning to nutraceuticals to improve their health and prevent chronic disease.
3. Health care provider recognize the fact that our heavily processed food supply, coming from crops grown with chemical fertilizers, pesticides, herbicides, and often genetically modified seeds, lacks sufficient nutrients necessary for optimum Health.
4. People believing more in prevention than a cure.
5. People who have chronic diseases and have found no solution in allopathic medicines.
6. Economically challenged patients.

Nutraceuticals can play a role in promoting human health in several ways. Here are some of the key roles they can have:

Nutritional supplementation: Nutraceuticals can provide additional nutrients that may be lacking in a person’s diet. They can help address nutrient deficiencies or imbalances and support overall nutritional status.

Disease prevention: Certain nutraceuticals, such as antioxidants, omega-3 fatty acids, and phytochemicals, have been associated with a reduced risk of chronic diseases, including cardiovascular diseases, diabetes, certain cancers, and age-related macular degeneration. They may have protective effects due to their ability to combat oxidative stress, reduce inflammation, and support cellular health.

2. INCREASED DEMAND IN NUTRACEUTICAL

Modern day work profile has led to the development of a new set of diseases popularly termed as life–style disorders. The common causative agents of these types of disorders are improper diet and dependence on fast foods, lack of physical inactivity, non-alignment with biological clock, incorrect body posture, excessive stress and inadequate rest. Nutraceuticals represent a unique blend of modern science and natural agents and perhaps the best possible solutions for management of life style diseases. Besides these lifestyle disorders are also considered responsible for the predisposition of several complex clinical conditions. Diverse marketed nutraceuticals variants can also help to block the transformation of life style disorders into fatal diseases. Consumer acceptance of nutraceuticals started gaining from 1980 onwards when scientists started indulging into efficacy evaluations of such products followed by their representation in mass media. Other factors like steep rise in medical management costs, increased life expectancy, increased health awareness and available scientific data confirming health benefits of nutraceuticals have also contributed to consumer acceptance of such products. Global nutraceutical market which was approximately 400 billion USD in 2019 is expected to cross 700 billion USD with a CAGR of 8.3% by 2027. Fast expansions of nutraceuticals product bouquet along with a healthy pipeline of innovative products booming the market are all contributors to the predicted growth. The entry of generic products may cause a dip in nutraceutical product costs but because of high consumer acceptance, the overall market for such products is expected to remain stable.

2.Nutraceuticals can be classified as follows:

A) On the basis of natural source:

Products can be obtained from-

1. Plants- e.g. Indole-3-carbinol(cabbage), lycopene (tomatoes)
2. Animals- e.g. EPA and DHA (fish oil)
3. Minerals- e.g. selenium, iodine
4. Microbes- e.g. Phycocyanobilin (Spirulina), lactobacillus (yogurt)

B) On the basis of pharmacological conditions, or as per chemical constituents of the products:

C) Nutraceuticals on basis of below properties:

1. Potential Nutraceuticals (plant-foods polyphenols for diabetes)
2. Established Nutraceuticals (provitamins, omega-3 fatty acids)

Most widely used food sources as Nutraceuticals are of natural sources and can be categorized as follows:

1. Dietary fiber- e.g. beans, fruits
2. Probiotics- e.g. yogurt, dark chocolate
3. Prebiotics- e.g. Asparagus, almonds, apples
4. Polyunsaturated fatty acids- e.g. olive oil, walnuts
5. Antioxidants vitamins- e.g. vitamin C, vitamin E
6. Polyphenols- e.g. tea, coffee, spinach
7. Spices- E.G. Garlic, Turmeric

Categories of Nutraceuticals:

Nutraceuticals are non-specific biological therapies used to encourage wellness, prevent malignant processes and control symptoms. They are categorized as follows.

(a) Nutrients

Substances with recognized nutritional functions, such as vitamins, minerals, amino acids and fatty acids, Common nutrients and their related health benefits.

Table 1: List of nutrients and their relevance

Nutrients	Health benefit
Vitamin A	Antioxidant, essential, for growth and development and in the treatment of certain skin disorders
Vitamin E	Antioxidant, helps form blood cells, muscles, lung and nerve tissue, boosts the immune system
Vitamin K	Essential for blood clotting
Vitamin C	Antioxidant, for healthy bones, gums, teeth and skin, in wound healing, prevent common cold and attenuate its symptoms.
Vitamin B1	Helps to convert food in to energy, essential in neurologic functions.
Vitamin B2	Helps in energy production and other chemical processes in the body, helps maintain healthy eyes, skin and nerve function.
Vitamin B3	Helps to convert food in to energy and maintain proper brain function.
Folic acid	Produce the genetic materials of cells, in pregnancy for preventing birth defects, RBCs formation, protects against heartdisease

(b) Herbals

Herbs or botanical products as concentrates and extracts. ordinary herbs and their therapeutic relevance.

(c) Dietary Supplement:

Dietary supplements are products administered through mouth that contain a dietary ingredient intended to add incredible to the foods you eat. Examples of dietary supplements are black cohosh for menopausal symptoms, ginkgo biloba for memory loss, and glucosamine/chondroitin for arthritis. They also serve precise functions such as sports nutrition, weight-loss supplements and meal replacements. Supplement ingredients may contain vitamins, minerals,

herbs or other botanicals, amino acids, enzymes, organ tissues, gland extracts, or other dietary substances. They are available in different dosage forms, including tablets, capsules, liquids, powders, extracts, and concentrates.

Macronutrients and micronutrients:

Vitamins:

There is much information about the important roles of various vitamins in maintaining normal metabolism and health status. Deficiency of any kind of vitamins can cause evident clinical symptoms. Scientific knowledge about vitamin metabolism and functions are well accumulated. Therefore, the majority nutraceutical or nutritional therapy products contain some vitamins, such as common vitamins like vitamin A, vitamin Bs, vitamin C, vitamin D, and vitamin E. A great portion of vitamin sources for human beings is from plant foods, plant biotechnology thus has been used for improvement of contents of vitamins in crops. An excellent example is "Golden Rice", a transgenic rice with a high level of the pro-vitamin A bcarotenoid in its grains. Currently, absorption studies with Golden rice are being carried out with humans, to test the effectiveness of absorption and exchange of beta-carotene into vitamin.

Minerals:

Ca, I, Zn, Fe, Mn, Mg, and other mineral elements are necessary components for human health. Deficiency of any one of these minerals may cause grave health problems. Dietary Ca, Zn, Fe, and other minerals are taken from both meats and plant foods. Due to a variety of reasons, mineral deficiencies, mainly Ca, Zn, and Fe deficiencies, are the major health problems in rising countries, particularly for infants and children. Zn or Fe deficiency causes poor growth, impaired immune function, and delayed mental development. Although numerous mineral supplements or mineral-containing nutraceuticals are accessible on the market, poor absorption of Ca, Zn, and Fe by the humans significantly restrictions effectiveness of these supplements. Many reasons, such as dietary habits, lipids and vitamin cofactors, or mineral-mineral interactions during absorption, as well as health status of individual, can persuade their absorption. Nevertheless, increasing dietary Ca, Fe, and Zn in plant foods is an significant strategy to improve mineral nutrition.

Flavonoids:

As various benefits of eating flavonoid rich plant foods for human health are well documented, increasing exacting bioactive flavonoid species in plant foods has become of great interest.

Terpenoids:

Terpenoids are the most diverse and largest class of plant natural products with wide industrial application, as provitamin A, vitamin E, flavors, pharmaceuticals, perfumes, insecticides, and anti-microbial agents. Other valuable terpenoid compounds that have been modified include the introduction of b-carotene to tomato fruits and rice and zeaxanthin to potato tubers. Tomato is a major food crop and the principal source of the carotenoid lycopene. Epidemiological studies have clearly shown the great benefits of consumption of tomato to human health due to tomato carotenoids, mainly lycopene, b- carotene, and lutein.

3)Health Benefits of Nutracuticals:

Cardiovascular diseases:

Heart disorders, such as hypertension (high blood pressure), coronary heart disease (heart attack), and various forms of cerebrovascular disease (stroke), are all associated with cardiovascular diseases . Overconsumption of calorie-dense, nutrient-deficient, deeply processed, and easily absorbable meals can result in systemic inflammation, decreased insulin sensitivity, including several metabolic abnormalities, including obesity, hypertension, dyslipidemia, and glucose intolerance . Polyphenols present in grape and grape derivatives, cocoa, and tea have been studied for their potential to reduce cardiovascular disease. By altering cellular metabolism, vitamin D, coenzyme Q10, folic acid, omega-3 fatty acids, and polyphenols help to prevent artery disease. Flavonoids found in onion, grape, apples, and cherries inhibit the Angiotensin Converting Enzyme (ACE), lowering blood pressure and reducing the risk of coronary artery disease and myocardial infarction. Flavonoids prevent platelet stickiness and accumulation (by opposing the "suicide" enzyme cyclooxygenase that breaks down prostaglandins), and they also keep the vascular system and support small capillaries that carry oxygen and necessary nutrients to the entire cell.

Diabetes:

In terms of diabetes and herbal medications, nutraceuticals provide a more promising treatment option with fewer side effects. Nutraceuticals are described as non-specific biological treatments that employ all natural goods to maintain and promote wellbeing, stop cancerous processes, and manage symptoms. It has been asserted that nutritional supplements offer powerful disease-prevention, disease-cure, and health-promoting properties. Diabetes is a complex, chronic disease characterised by a state of hyperglycaemia brought on by a lack of insulin secretion, insulin action, or both. Diabetic has been shown to be targeted by a number of nutraceuticals used in clinical practise, favourably modulating a number

of biochemical and clinical endpoints. Many traditional medical systems employ hypoglycaemic medications to prevent, regulate, and cure diabetes mellitus

It is a chronic metabolic illness in which the body's ability to utilize carbohydrates is harmed due to an absolute or relative lack of the hormone insulin produced by the β -islets of Langerhans in the pancreas. Diabetes mellitus is characterized by abnormally high levels of blood glucose, either due to inadequate insulin production or its ineffectiveness. Nutraceuticals and a wide range of bioactive components, such as phenolic compounds, sulfur compounds, herbs, and natural antioxidants, are all involved in glucose metabolism and may help to prevent the development of diabetes and other complications. Some dietary supplements, such as L-carnitine-lipoic acid, omega-3 fatty acids, berberine, chromium, soy, and phytoestrogens, are currently available in markets and are widely prescribed by clinicians. Dietary fibres from psyllium have been used for glucose control in diabetic patients. Lipoic acid, an antioxidant is used for treatment of diabetic neuropathy. Ethyl esters of n-3 fatty acids may be useful in diabetic patients.

Obesity:

it develops as a result of excessive consumption of high-fat and energy-dense foods, which leads to the formation of fatty plaques on the inside surface of arteries, which restrict blood flow to various sections of the body. Angina pectoris, heart attack, cardiac arrest, transient ischemic attacks, and stroke can all be caused by a lack of blood supply in certain organs. It is characterized by an excess of body fat; however, the threshold value that defines what amount of body fat is "unhealthy" is unclear, and the ability to reliably degree body fat mass necessitates specialized equipment that is not readily available in most clinical settings. Following that, body mass index (BMI) records are used to define people as "normal weight" (BMI 18.5-24.9 kg/m²), "overweight" (BMI 25-29.9 kg/m²), or "obesity" (BMI 30 kg/m²), which stratifies health risk based on the link between weight and height. Fortified margarine (Plant sterol and stanol esters), oolong tea (catechins), green tea (Organosulfur compounds), garlic (Organosulfur compounds), Psyllium (Soluble fiber), and soybean (protein) are all beneficial in the treatment and prevention of obesity. These functional foods remove excess fat from the body by a variety of processes, including inhibiting pancreatic lipase, increasing thermogenesis, limiting adipocyte differentiation, improving lipid metabolism, and decreasing hunger.

Herbal stimulants, such as ephedrine. Caffeine, ma huang-guarana, chitosan and green tea assist in body weight loss

Cancer:

Flavonoids which block the enzymes that create estrogen reduce of estrogen-induced cancers. Soy foods are resource of Iso-flavones, curcumin from curry and soya isoflavones acquire cancer chemo preventive properties. Beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes were reported to possess anti-tumor activity.

Cancer is defined as abnormal cell division in any part of the body, and malignant cells can influence our normal cells. Cancer is caused by a combination of complicated elements that develop in a stepwise manner, eventually leading to the uncontrolled spread and proliferation of malignant cells throughout the body, a process known as metastasis. It is one of the most important global health firms, with continuing increases in revenue and morality. Oxidative stress and redox waving, in addition to environmental variables, are important in the origin and spread of cancer. Cancer cells' receptivity to therapeutic interventions is also harmed by reactive oxygens. Chronic inflammation is linked to a higher risk of cancer. Chronic inflammation has also been linked to immunological suppression, which is a cancer risk factor. At the molecular level, free radicals and aldehydes produced by chronic inflammation can promote gene alterations and posttranslational modifications of cancerrelated proteins. Natural products or antioxidants (e.g., microbial and plant secondary metabolites) are employed as adjuvants to chemotherapy medications to increase their effectiveness, rather than other pharmaceutical drugs. Ginger, garlic, flaxseed, cabbage, soybeans, fenugreek, green tea, and umbellifers vegetables are examples of foods and herbs with high anticancer activity. Nutraceuticals, especially phytochemicals, play a role in cancer recovery. To date, all widely used cancer medications have come from natural sources. Cancer patients should eat foods that have a low carbohydrate content and a moderate amount of protein, dietary fiber, and fat. Nutraceuticals are also helpful in reducing toxin associated with chemotherapy and radiotherapy, therefore lead to better life conditions by reducing cancer cachexia. Phytochemicals have shown different medium of conduct at different cellular situations. Cancer is a rising health issue around the world particularly with the steady rise in life expectation, adding urbanization and the posterior changes in environmental conditions and life.

Nutraceuticals in osteoporosis

Low bone mass, thinning bone tissue, and disruption of bone microarchitecture are all symptoms of osteoporosis. Many factors that influence low bone mass are divided into two categories: those that cannot be changed and those that can. Gender, age, body size, and race are unchangeable, whereas hormonal status, lifestyle factors such as food, smoking, and alcohol consumption patterns, and physical activity levels can be changed. Nutraceuticals such as herbs, minerals, and dairy products are increasingly being utilized to combat this condition. Calcirol D-3 is a popularly marketed

nutraceutical product that contains calcium and vitamins to aid in the treatment of osteoporosis. Probiotics are effective in alleviating osteoporosis symptoms and lowering osteoporosis risk

Nutraceuticals in osteoarthritis

Osteoarthritis is characterized by articular cartilage loss, synovial membrane inflammation, and subchondral bone resorption. It is the most well-known form of arthritis, afflicting millions of individuals all over the world. When the protecting cartilage on the extremities of the bones breaks down over time, it causes this condition. It can cause pain in any joint in the body. It most usually affects the joints of the hands, knees, hips, and spine. Although there is no cure for osteoarthritis, there are therapies that can help with pain relief and joint mobility. Chondroitin Sulfate (CS) and Glucosamine (GLN), also known as 2-amino-2-deoxy-d-glucose (C₆H₁₃NO₅), are widely utilized to alleviate the symptoms of osteoarthritis. MSM (Methyl Sulfonyl Methane) is a synergistic combination of glucosamine and chondroitin that is used to treat osteoarthritis and joint problems. Glucosamine (GLN) is an amino monosaccharide that is found in the exoskeletons of crustaceans and mushrooms. It is a component of glycosaminoglycan (GAG) chains. GAG is made up of two sugars that alternate: glucuronic acid and acetyl-d-galactosamine sulfate.[6]

Nutraceuticals in Parkinson's disease:

It is a neurodegenerative disease characterized by a shortage of dopaminergic neurons in the substantia nigra, resulting in striatal dopamine exhaustion. Numerous nutraceuticals have been proven to provide neuroprotection in animal settings and may be useful as alternatives to synthetic pharmacological molecules such as L-Dopa, which has a long list of negative side effects. Iron chelation, modulation of cell signaling pathways, Reactive Oxygen Species (ROS)/free radical scavenging, anti-inflammation, antiapoptosis, and mitochondrial homeostasis are some of the mechanisms by which they work, although several nutraceuticals essentially work through a slew of unthinking pathways rather than a single mechanism. Plant polyphenols, stilbenes, soybeans, and other phytoestrogens, as well as vitamins C, D, E, coenzyme Q10, and unsaturated fatty acids, have been shown to protect against Parkinson's disease progression

Nutraceuticals in Alzheimer's disease:

Alzheimer's disease is the most common form of dementia and a degenerative neurological illness. This sickness has no cure and will ultimately kill everyone. Necrobiosis in Alzheimer's disease results from the mass of beta-amyloid protein fragments forming solid plaques that affect the ability of acetylcholine to affect synaptic communication and initiate inflammatory progression and variations in the chemical nature of the specific proteins and also leads to necrobiosis in Alzheimer's disease wherein neuron's microtubules couples with other tubules creating neurofibrillary tangles that cause tubule.[6] β-carotene, curcumin, lutein, lycopene, and turmeric have antidisease Alzheimer's properties by neutralizing the negative effects of oxidative stress, mitochondrial malfunction, and neuronal degeneration.[1]

Anti-inflammatory activities:

Cucurmin which is a polyphenol of turmeric have anti-carcinogenic, anti-oxidative and anti-inflammatory properties. Linoleic acid are used for treating harms with inflammation and auto-immune diseases e.g. green leafy vegetables, nuts, vegetable oils.

Vision improving agents:

Lutein also known as helenien is used for the management of visual disorders e.g. mangoes, corn, sweet potatoes, carrots, squash, tomatoes.

Scope And Types of Products Available in the Market

Nutraceutical from Nutrition and Pharmaceutical, in 1989 refers to foods having a medicinal effect on health of human beings. It consists of food supplements, herbal products, probiotics and prebiotics, medical foods meant for prevention and treatment of diseases. Major malt Nutraceuticals possess iple therapeutic effects with lacking of unwanted effects. A Nutraceutical is demonstrated to have a physiological benefit or against chronic disease. I try to redefine functional foods and Nutraceuticals. When food is being cooked or provide protection pared using scientific intelligence with or without knowledge is called functional food. Thus, functional food provides the body with the required amount of vitamins, fa ts, proteins, carbohydrates, etc., needed for its healthy survival when functional foo Nutraceutical. Nutraceuticals are none aids in the prevention, treatment of disease and disorder other than anaemia, it is called a toxic food components which claimed to possess multiple therapeutic benefits. Some popular Nutraceuticals include glucosamine e, ginseng, Echinacea, folic acid, cod liver oil, omega3 fatty acid (MUFA, PUFA), calcium enriched orange juice, green tea, plant phenols etc. Nutraceuticals can be organized in several ways depending upon its easier understanding and application, i.e. fo r academic instruction, clinical trial design, functional food 0 50 100 150 200 250 300 350 400 450 India Japan Europe US development or dietary recommendations. So me of the most common ways of classifying

3. CONCLUSION

Humans' constantly shifting lifestyles frequently overload their antioxidant defense systems, leading to oxidative stress. Furthermore, as people age, their antioxidant defense mechanism levels noticeably decline. Numerous illnesses could arise as a result of them. As a result, research has mostly concentrated on various nutraceuticals throughout the last few decades. Products containing antioxidants can either specifically activate the body's defenses or work naturally to scavenge free radicals (e.g., vitamins, PUFA). The possible benefits and drawbacks of nutraceuticals for healthy people are discussed in this review. However, genetic predisposition and lifestyle factors like smoking and excessive alcohol use are the main factors that determine an individual's susceptibility to any given disease. Thus, each person may react differently to nutraceuticals. Consuming nutraceuticals has been shown to offer health advantages.

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