International Journal of Pharmaceutics & Drug Research
ISSN: 2347-6346
Available online at http://ijpdr.com

Review Article

HEALTH SUPPLEMENT IN NUTRACEUTICALS: A REVIEW

Aashita Raut, Sahadev Kumar Yadav*, B. K. Dubey, Deepak Kumar Basedia, Mukesh Kumar Patel

Technocrats Institute of Technology-Pharmacy, Bhopal (M.P.)

***Correspondence Info:**
Sahadev Kumar Yadav
Technocrats Institute of Technology-Pharmacy, Bhopal (M.P.)
Email: drskyadav55@gmail.com

***Article History:**

Received: 18/04/2023
Revised: 15/05/2023
Accepted: 27/05/2023

ABSTRACT

Health supplements in nutraceuticals play a significant role in preventive healthcare and the management of chronic conditions by providing essential nutrients and bioactive compounds. This review examines the current landscape of nutraceutical health supplements, focusing on their types, mechanisms of action, and clinical applications. It explores various categories of nutraceuticals, including vitamins, minerals, herbal extracts, and functional foods, and their roles in promoting health and preventing diseases. The review also addresses regulatory aspects, safety considerations, and the challenges of ensuring product efficacy. By synthesizing recent research and trends, this review aims to provide a comprehensive understanding of the benefits and limitations of health supplements in the nutraceutical sector.

Keywords: Health supplements, Nutraceuticals, Vitamins, Minerals, Herbal extracts, Functional foods, Preventive healthcare, Product efficacy

INTRODUCTION

Nutraceuticals is a term derived from “nutrition” and “pharmaceutics.” The term is applied to products that are isolated from herbal products, dietary supplements (nutrients), specific diets, and processed foods such as cereals, soups, and beverages that other than nutrition are also used as medicine. Nutraceuticals are products, which other than nutrition are also used as medicine. A nutraceutical product may be defined as a substance, which has physiological benefit or provides protection against chronic disease. Nutraceuticals may be used to improve health, delay the aging process, prevent chronic diseases, increase life expectancy, or support the structure or function of the body. Nowadays, nutraceuticals have received considerable interest due to potential nutritional, safety and therapeutic effects. Herbal nutraceuticals are effective on hard curative disorders related to oxidative stress including allergy, Alzheimer, cardiovascular, cancer, diabetes, eye, immune, inflammatory and Parkinson's diseases as well as obesity (Ruby *et al*., 2021).

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 (Misra, 2013).

Classification

- Phytochemicals.
- Dietary supplements
- Probiotic organisms.
- Prebiotics
- Fortified nutraceuticals.
- Recombinant Nutraceutical.
- Medicinal food
- Functional foods
- Vitamins
- Anti-Oxidant

Phytochemicals

Phytochemicals, such as lutein and lycopene, are advantageous, concentrated or purified compounds derived from plants that are involved in human biochemical and metabolic processes. To preserve the chemical balance of the brain, phytochemicals can help, which has a neuroprotective effect. In addition, a high intake of fruits and vegetables that include phytochemicals can lower your chance of developing cancer, heart disease, and neurological diseases (AlAli *et al*., 2021; Kumar and Khanum , 2012).

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 (Maurya *et al*., 2022).

Probiotic organisms

The scientific interest in probiotics boosted from the work of Metchinkoff to transform the toxic flora of the large intestine into a host-friendly colony of Bacillus bulgaricus was found by Hord. ‘Probiotics’ mean ‘for life’ and are defined as live microorganisms, which when consumed in adequate amounts, confer a health effect on the host. They are friendly bacteria that promote healthy digestion and absorption of some nutrients. They act to crowd out pathogens, such as yeasts, other bacteria and viruses that may otherwise cause disease and develop a mutually advantageous symbiosis with the human gastrointestinal tract. They have an antimicrobial effect through modifying the microflora, preventing adhesion of pathogens to the intestinal epithelium, competing for

nutrients necessary for pathogen survival, producing an antitoxin effect and reversing some of the consequences of infection on the intestinal epithelium, such as secretory changes and neutrophil migration. Probiotics can cure lactose intolerance by the production of the specific enzyme (ß-galactosidase) that can hydrolyze the offending lactose into its component sugars (Singh and Sinha, 2012).

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 (Ried, 2016).

Ried K. Garlic lowers blood pressure in hypertensive individuals, regulates serum cholesterol, and stimulates immunity: an updated meta-analysis and review. The Journal of nutrition. 2016 Feb 1;146(2):389S-96S.

Fortified nutraceuticals

They are enriched with vitamins, minerals, usually at a range up to 100 percent of the Dietary Reference Intake for that nutrient. Fortified nutraceuticals are the food with agricultural breeding or with added nutrients. Some of the examples of fortified nutraceuticals are Orange juice with calcium, cereals with added vitamins or minerals, flour with added folic acid, and milk with cholecalciferol (Jeroen *et al*., 2002).

Recombinant nutraceuticals

Production of probiotics and the extraction of bioactive components by enzyme/fermentation technologies as well as genetic engineering technology are achieved through biotechnology. Energy-providing foods, such as bread, alcohol, fermented starch, yogurt, cheese, vinegar, and others are produced with the help of biotechnology (Jeroen *et al*., 2002).

Medicinal food

Medicinal food a food which is formulated to be consumed or administered internally under the supervision of a physician and which is intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on recognized scientific principles, are established by medical evaluation also without any components that promote disease condition or contain a specific nutrient that the body cannot normally produce due to specific disease condition. It is prescribed by physicians for various health conditions that lead to impaired ingestion, digestion, absorption, or metabolism of traditional foods like phenylketonuria, coeliac disease and lactose intolerance (Borkar *et al*., 2015).

Functional foods

Functional foods, according to their generally accepted definition, are "any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains. Functional foods are designed to allow consumers to eat enriched foods close to their natural state, rather than

by taking dietary supplements manufactured in liquid or capsule form. Functional foods have been either enriched or fortified, a process called nutrification. This practice restores the nutrient content in a food back to similar levels from before the food was processed. Sometimes, additional complementary nutrients are added, such as vitamin D to milk. Health Canada defines functional foods as "ordinary food that has components or ingredients added to give it a specific medical or physiological benefit, other than a purely nutritional effect. In Japan, all functional foods must meet three established requirements: foods should be.

(1) Present in their naturally occurring form, rather than a capsule, tablet, or powder.

(2) Consumed in the diet as often as daily; and.

(3) Should regulate a biological process in hopes of preventing or controlling disease (McClements *et al*., 2015).

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[16] 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 (Brower *et al*., 1998).

Anti-Oxidant

Damage to cells caused by free radicals is believed to play a central role in the aging process and in disease progression. Antioxidants are our first line of defense against free radical damage, and are critical for maintaining optimum health and wellbeing. Oxygen is a highly reactive atom that is capable of becoming part of potentially damaging molecules commonly called free radicals. Free radicals are capable of attacking the healthy cells of the body, causing them to lose their structure and function. Antioxidants are capable of stabilizing, or deactivating, free radicals before they attack cells. Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being. Humans have evolved a highly sophisticated and complex antioxidant protection system. It involves a variety of components, both endogenous and exogenous in origin, that function interactively and synergistically to neutralize free radicals (Rajam *et al*., 2019).

Advantages and Disadvantages of Nutraceuticals

Nutraceuticals have various advantages on multiple aspects of our health when consumed in appropriate quantities. Commonly known advantages include improved immune function from vitamin C, prevention of cardiovascular disorders from fatty acids, anti-inflammatory properties from

carotenoids, risk reduction of neurological disorders from phytochemicals, and many more. As studies showing the advantages of nutraceuticals have increased, as well as their advertisement from the nutrition and health industries, the intake of nutraceuticals through a regular diet or in supplement form has become very popular.

Often, people self-prescribe various nutraceuticals in the hopes of gaining these health benefits alone or in conjunction with other prescribed medications. As such, people may unintentionally misuse or overuse nutraceuticals, which can have harmful side effects. The same components that have health benefits are also toxic when consumed in excess. Due to the general population shifting towards nutraceuticals as alternative health options, the advantages and disadvantages of commonly used nutraceuticals need to be thoroughly and comprehensively analyzed (Rajalakshmi *et al*., 2023).

Marketed preparation of nutritional supplements

In world market various nutritional product are present some are given in table 1. (Nelson, 1999)-

Table 1: Marketed preparation of nutritional supplements

Marketed preparation of nutritional supplements	Product Category	Contents
Coral calcium	Calcium supplements	Calcium and trace minerals
Weight smart	Nutritional supplements	Vitamins and trace elements
Omega women	Immune supplements	Antioxidants, vitamins and phytochemicals (eg. Lycopene)
Appetite Intercept	Appetite suppresents	Caffeine, tyrosine and phenylalanine
Chaser	Hangover supplements	Activated calcium carbonate and vegetable carbon
Rox	Energy drink	Taurine, caffeine and glucuronolactone
Mushroom optimizer	Immune supplement	Mushroom, polysaccharides and folic acid

Applications

Diabetes

Herbal dietary supplements containing nutraceuticals have proven to offer therapeutic benefit on type 2 diabetes. Universal antioxidants like lipoic acid and catechins, the spices like fenugreek and cinnamon are used to treat diabetic neuropathy, nephropathy and retinopathy. Magnesium, chromium, calcium, vitamin D promotes insulin sensitivity, improve glycemic control etc. Caffeic acid reduces elevated plasma glucose in insulin resistant patients. Green tea and epicatechin 3

gallate reduces fasting and postprandial glucose and improves insulin resistance. Bitter melon, pomegranates are good for diabetes which regulates metabolism and transports glucose from the blood into cells (Stephen, 2012).

Cardiovascular diseases:

Universal, the burdens of chronic diseases like cardiovascular diseases, cancers, diabetes and obesity is quickly increasing. In 2001, chronic diseases contributed approximately 59% of the 56.5 million total reported deaths in the world and 46%of the global burden of disease. Cardiovascular diseases (CVD) is the name for the group of disorders of the heart and blood vessels and consist of hypertension (high blood pressure), coronary heart disease (heart attack), cerebrovascular disease (stroke), heart failure, peripheral vascular disease, etc. In 1999 CVD only contributed to a third of global deaths and by 2010 it would be the leading cause of death in developing countries. Majority of the CVD are preventable and controllable. It was reported that low intake of fruits and vegetables is related with a high mortality in cardiovascular disease (Lokhande, 2018).

Parkinson's disease

Parkinson's disease is a brain disorder that results from nerve damage in certain regions of the brain causing muscle rigidity, shaking, and difficult walking, usually occurring in mid to late adult life. Canadian researchers indicated that vitamin E in food may be protective against Parkinson's disease. Creatine appeared to modify Parkinson's disease features as measured by a decline in the clinical signs. Researchers have also studied glutathione to determine its effect on nerve and its power as an antioxidant. The appropriate long-term dosing, side-effects and the most effective method of administration are not yet clear. Nutritional supplements have shown some promising results in preliminary studies, it is important to remember that there is not sufficient scientific data to recommend them for Parkinson's disease at present. The patients should be cautioned that over-the-counter medications do have sideeffects and interactions with other drugs and are also expensive (Rajasekaran *et al*., 2008).

Obesity

Obesity is a global public health problem and is defined as accumulation of unhealthy amount of body fat. It is a well-established risk factor for many disorders like angina pectoris, congestive heart failure (CHF), hypertension, hyperlipidemia, respiratory disorders, renal vein thrombosis, osteoarthritis, cancer and reduced fertility (Caterson and Gill, 2002).

Cancer

Cancer has emerged as a major public health problem in developing countries, matching the industrialized nations. Approximately 20-30% of Americans consume multivitamin supplements daily, indicating high public interest in the prevention of cancer and other chronic diseases through a nutrition-based approach. Because epidemiologic studies generally evaluate foods rather than specific bioactive food components, a systematic approach to determining how combinations of vitamins and minerals may interact to ameliorate cancer risk is necessary to further our understanding of the potential

benefits and risks of supplement use. Increasing consumption of vegetables and fruits elevates the levels of antioxidative components, for example, selenium, vitamin E, vitamin C, lycopene, cysteine-glutat hione and various phytochemicals. These detrimental processes of heme catalysis of oxidative damage hypothesized here are not well recognized. More investigative studies in this field to be done Large scale clinical trials suggest that some agents such as selenium, lycopene, soy, green tea, vitamins D and E, anti-inflammatory and inhibitors of 5a-reductase are effective in preventing prostate cancer (Vishvakarma *et al.,* 2023).

Nutrivigilance and its importance

Due to our limited knowledge of nutraceuticals and herbal products, we often end up misusing them. Irrational use of such products is common in our country. There is a rampant use of nutraceuticals, herbal products, and health supplements with no clear pathway to report the associated adverse events. It poses a major challenge of identifying such adverse events and taking the corrective actions for the same. FSSAI needs to adopt proactive role for nutrivigilance. Stricter regulations are needed for the approval of nutraceuticals and health supplements. There must be a plan to monitor the long-term effect of these products. The lack of robust clinical studies with such products is a major limitation in a current regulatory scenario. Healthcare professionals can play an important role in nutrivigilance by proactively identifying the use of such products and any adverse events. It is essential to impart education at the primary care level about the rational use of nutraceuticals and the possible limitations associated with the products. Special populations need to use such products carefully; for example, sport persons and athletes should be careful about the ingredients of health supplements or sport drinks they are taking to avoid inadvertent doping. The use of digital tools to educate the general population about the possible impacts of irrational use of nutraceuticals should be initiated by FSSAI. The time has come to specify the indications for complex nutraceutical products as it is specified for pharmaceutical products. It is also essential to curb unsubstantiated and false claims and their advertisement at the mass level. Need to strictly regulate the promotional materials for nutraceuticals (Malve and Bhalerao, 2023).

Challenges in the Formulation of Nutraceuticals

While formulating nutraceuticals, the poor aqueous solubility, high melting point of nutraceuticals and chemical instability of active constituents pose difficulties. For example, omega-3 fatty acids, carotenoids, oil soluble vitamins, curcumin possess high nutritional value but are poorly soluble. Therefore, the possible approach is to formulate these as novel delivery systems. These novel delivery systems make them costly. Thus, efforts are needed to make these formulations cost effective. Another challenge in formulating nutraceuticals is their high melting point. For example, phytosterols, fatty alcohols and carotenoids all have high melting points that may cause instability to formulation. Therefore, the possible approach is to prepare solid dispersion/dissolve in suitable grade solvent and introduce in food as suspended nanocrystals. However, the

challenge is again that it leads to deteriorated stability and shelf life, disagreeable appearance, and obnoxious odor and mouthfeel, which affect market value and customer demand. Therefore, there is need to develop cost-effective technologies.

Chemical instability is another challenge. For example, omega-3 fatty acid rich oils, such as fish oils, flaxseed oil, cod liver oils; carotenoids; lycopene or curcumin all have stability issues. Finally, there is a challenge in the formulation of nutraceuticals and dietary supplement dosage forms that are suitable for different groups of the aging population, especially older adults and children. This is because this group of people has limitations in solid dosage from (tablets or capsules) swallowing (dysphagia). Therefore, advanced dosage forms such as orodispersible tablets, fast dissolving films and easy-swallowing gels, which are normally used in pharmaceutical applications, have to be considered in nutraceutical and dietary supplement administration (Puri *et al*., 2022).

CONCLUSION

Health supplements in nutraceuticals offer valuable contributions to preventive healthcare and the management of various health conditions through their provision of essential nutrients and bioactive compounds. Advances in nutraceutical research highlight the potential of these supplements to enhance health outcomes and support chronic disease management. However, challenges such as ensuring product efficacy, addressing safety concerns, and navigating regulatory frameworks remain significant. Continued research and development in the field are crucial for optimizing the benefits of health supplements and overcoming existing limitations. As the nutraceutical sector evolves, a focus on evidence-based practices and regulatory adherence will be key to maximizing the positive impact of health supplements on public health.

REFERENCES

- AlAli, M., Alqubaisy, M., Aljaafari, M.N., AlAli, A.O., Baqais, L., Molouki, A., Abushelaibi, A., Lai, K.S. & Lim, S.E. (2021) Nutraceuticals: Transformation of conventional foods into health promoters/disease preventers and safety considerations. *Molecules*, 26, 2540.
- Borkar, N., Saurabh, S.S., Rathore, K.S., Pandit, A. & Khandelwal, K.R. (2015) An insight on nutraceuticals; Pharma tutor, 3, 13–23.
- Brower, V. (1998) Nutraceuticals: Poised for a healthy slice of the healthcare market? *Nature Biotechnology*, 16, 728–731.
- Caterson, I.D. & Gill, T.P. (2002) Obesity: Epidemiology and possible prevention. *Best Practice & Research. Clinical Endocrinology & Metabolism*, 16, 595–610.
- Hugenholtz, J., Sybesma, W., Groot, M.N., Wisselink, W., Ladero, V., Burgess, K., van Sinderen, D., Piard, J.C., Eggink, G., Smid, E.J., Savoy, G., Sesma, F., Jansen, T., Hols, P. & Kleerebezem, M. (2002) Metabolic engineering of lactic acid bacteria for the production of nutraceuticals.

Antonie van Leeuwenhoek, 82, 217–235.

- Kumar, G.P. & Khanum, F. (2012) Neuroprotective potential of phytochemicals. *Pharmacognosy Reviews*, 6, 81–90.
- Malve, H. & Bhalerao, P. (2023) Past, present, and likely future of nutraceuticals in India: Evolving role of pharmaceutical physicians. *Journal of Pharmacy and Bioallied Sciences*, 15, 68–74.
- Maurya, S., Sharma, N., Tiwari, M., Singh, A., Singh, S. & Yadav, K. (2022). *A Review Article on Nutraceuticals. Int Res J Modernizat Eng Technol Sci*.
- McClements, D.J., Zou, L., Zhang, R., Salvia-Trujillo, L., Kumosani, T. & Xiao, H. (2015) Enhancing nutraceutical performance using excipient foods: Designing food structures and compositions to increase bioavailability. *Comprehensive Reviews in Food Science and Food Safety*, 14, 824–847.
- Misra, L.N. (2013) Traditional phytomedicinal systems, scientific validations and current popularity as nutraceuticals. Int J Trad Nat Med., 2, 27–75.
- Nelson, N.J. (1999) Purple carrots, margarine laced with wood pulp? Nutraceuticals move into the supermarket. *Journal of the National Cancer Institute*, 91, 755–757.
- Puri, V., Nagpal, M., Singh, I., Singh, M., Dhingra, G.A., Huanbutta, K., Dheer, D., Sharma, A. & Sangnim, T. (2022) A comprehensive review on nutraceuticals: Therapy support and formulation challenges. *Nutrients*, 14, 4637.
- Rajalakshmi, R., Melians, M.A., Pon, F.F., Cosio, D.S., Buvarahamurthy, V., Jayakumar, A.R. & Paidas, M.J. (2023) Advantages and disadvantages of nutraceuticals. In: *Nutraceuticals for Alzheimer's Disease*, pp. 245–286.
- Rajam, R.P., Murugesan, K., Kumar, K.V. & Meenatchisundaram, V. (2019) Nutraceuticals – A review – World. *Journal of Pharmaceutical Research SJIF*, 8, 1354–1374.
- Rajasekaran, A., Sivagnanam, G. & Xavier, R. (2008) Nutraceuticals as therapeutic agents: A review. *Research Journal of Pharmacy and Technology*, 1, 328–340.
- Ruby, D.S., Prakash, S., Kumar, V.P., Kumar, T.P. & Prathab, S. (2021) A comprehensive review on nutraceuticals. *International Journal of Pharmaceutical Sciences Review and Research*, 68, 136–148, Article no. 21.
- Singh, J. & Sinha, S. (2012) Classification, regulatory acts and applications of nutraceuticals for health, IJPBS. *International Journal of Pharmacy and Biological Sciences* (EISSN: 2230-7605) Int J Pharm Bio Sci., 2, 177–187.

- Stephen, D. (2012) A report of national nutraceutical centre. *Nutraceuticals India*, pp. 1–22. Lokhande, S.S. (2018) Role of nutraceuticals in various diseases: A comprehensive review. *Asian Journal of Pharmaceutical Research*, 8, 236–240.
- Vishvakarma, P., Mandal, S. & Verma, A. (2023) A review on current aspects of nutraceuticals and dietary supplements. *International Journal of Pharma Professional's Research*, 14, 78–91.