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Nutraceuticals impact on health care

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Abstract

A people are quite concerned about their health in the contemporary environment since lifestyles have changed significantly as a result of longer work hours and numerous psychological stressors, which has raised the frequency of various life-threatening diseases. Various associated nutraceutical products are promoted as remedies for issues such as hair thinning, diminished self-esteem, unsatisfactory skin appearance, varicose veins, alcohol dependence, depression, and fatigue. This chapter endeavors to categorize the different types of nutraceuticals, providing examples along with their respective applications. Additionally, the chapter discusses the design and development of dosage forms aimed at enhancing the delivery mechanisms of nutraceuticals, while also highlighting the significance and challenges involved in this process. Challenges persist despite the promising potential of nutraceuticals, such as inconsistent regulatory standards, insufficient clinical validation, and variability in product quality. The absence of comprehensive, large-scale trials frequently hinders their acceptance in conventional medical practice. This abstract highlight the transformative capacity of nutraceuticals in altering health care paradigms, while emphasizing the need for enhanced scientific validation, improved regulatory frameworks, and increased public awareness to optimize their advantages and ensure safety.

Keywords: Nutraceuticals; Lifestyle: Life Trephining Diseases; Therapeutic Outcome; Traditional nutraceuticals

1. Introduction

It is as define any substance that may be consider as a food or part of the food which provides And medical health Benefits including the prevention and treatment of diseases. The Name Nutraceuticals was coined by Stephen DeFelice founder and chairman of the foundation for Innovation machine in 1989. The turn and nutraceutical comprise the world Nutrient (Nourishing food or food component) and pharmaceutical (A medical drugs)(1)

Nutraceuticals are classified as phytocomplexes when they originate from plant-based foods, And as pools of secondary metabolites when derived from animal-based foods, provided they Are concentrated and delivered in the most appropriate pharmaceutical form. For instance, the Recent European Regulation EU 2015/2283 concerning novel foods does not acknowledge the Term nutraceutical, categorizing them instead as food supplements. It is important to note that The beneficial effects of nutraceuticals on health conditions must be substantiated by clinical Studies to demonstrate their capability in providing health benefits, including disease Prevention and treatment.

The fascination with and exploration of Specific components derived from plants, animals, minerals, and microorganisms that Contribute positively to human health has led to the creation of the term "Nutraceuticals." The Concept of Nutraceuticals has evolved from the understanding of the relationship between Nutrition and health.(2)

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Figure 1 Nutraceuticals 3

2. Classification

- Traditional Nutraceuticals / Conventional Nutraceuticals
- Non-Traditional Nutraceuticals / Non-Conventional Nutraceuticals

2.1. Traditional Nutraceuticals

This category primarily consists of substances sourced directly from nature, remaining in their Unaltered state. Phytochemicals derived from plants are incorporated into diets, offering health Benefits such as serving as substrates for biochemical reactions and acting as cofactors for Enzymatic processes. Traditional nutraceuticals are food products that retain their natural Composition, with all components being inherently natural and capable of delivering health Benefits. Numerous natural ingredients, including lycopene in tomatoes, omega-3 fattyacids, respectively. These substances are typically obtained in their original form, without any alterations. Various components, including lycopene from tomatoes, Omega-3 fatty acids from salmon, and saponins from soy, are consumed for their diverse health Advantages.(4)

3. Traditional nutraceuticals encompass a range of elements, including

- Chemical Constituents
- Nutrients
- herbal Products
- Phytochemical
- Probiotic Microorganisms
- Nutraceutical Enzymes
- Non- conventional neutraceuticals
- Recombinant nutraceuticals

3.1. Chemical constituents

3.1.1. Nutrients

Primary metabolites, including amino acids, various vitamins, and fatty acids, play crucial Role in numerous metabolic pathways. Products derived from plants and animals, along with Vitamins, Offer significant health benefits and assist in the treatment of diseases affecting the Heart, kidneys, Lungs, and more. Nutrients can be effective in managing

conditions such as Strokes, cataracts, Osteoporosis, diabetes, heart disease, and cancer. Minerals obtained from Plant, animal, and dairy Sources are advantageous in addressing osteoporosis and anemia. Omega-3 polyunsaturated fattyAcids (PUFAs), present in flaxseed and salmon, serve as Powerful regulators of inflammation, Support brain function, and help reduce cholesterol Accumulation.

3.1.2. *Herbals products*

Nutraceuticals, in conjunction with herbs, have demonstrated significant efficacy in the Prevention of various chronic diseases, thereby enhancing quality of life. Herbs, often referred To as botanical foods, have been utilized since the dawn of human civilization and offer a vast Array of remedies for both acute and chronic health conditions. Numerous nutraceuticals Derived from medicinal herbs serve as essential components, creating a comprehensive Repository of treatments for serious and long-lasting ailments.

For instance, Parsley (*Petroselinum crispum*) acts as a diuretic, carminative, and antipyretic, Containing flavonoids such as apiol and psoralen. Willow bark (*Salix nigra*) is rich in salicin, Which possesses anti-inflammatory, analgesic, antipyretic, astringent, and antiarthritic Properties. Additionally, Lavender (*Lavandula angustifolia*) contains tannins that are Beneficial in alleviating symptoms of depression and anxiety.

3.1.3. *Phytochemical*

Phytochemical are defined as non-nutritive compounds derived from plants that possess Protective properties against diseases. These compounds, while not essential for basic Nutrition, play a significant role in plant defense mechanisms. They function as inhibitors and Intestinal enzyme absorbents, effectively binding to and eliminating undesirable substances, While also enhancing the absorption and stability of vital nutrients by neutralizing reactive or Harmful molecules.

3.2. Probiotic Microorganisms

The concept of “probiotic” was first introduced by Metchnikoff. Its significance in modern medicine has notably grown due to its ability to improve intestinal health, thereby aiding in processes such as nutrient absorption and metabolism. Probiotics are live microorganisms administered to the host in sufficient quantities to provide health benefits. They are available in various formats, including powders, liquids, gels, pastes, granules, and capsules, and are commonly used in the treatment of gastrointestinal issues, such as lactose intolerance, acute diarrhea, and the adverse effects of antibiotics. The most frequently utilized probiotics are from the *Lactobacillus* and *Bifidobacterium* genera; however, yeasts like *S. cerevisiae*, along with specific strains of *E. coli* and *Bacillus*, are also employed. Lactic acid bacteria, particularly those from the *Lactobacillus* genus, play a significant role in this context. species, have been employed for thousands of years for their Beneficial properties. The process of food preservation via fermentation can fulfill two roles: it functions as a means Of food fermentation while also possessing the potential to enhance health benefits. Probiotic Interventions offer numerous significant advantages, such as promoting gut health through the Regulation of microbiota, enhancing immune function, increasing the bioavailability of Nutrients, alleviating the adverse effects of lactose intolerance, and lowering the risk of Various diseases.

3.3. Nutraceuticals Enzyme

Enzymes are essential for maintaining life; their absence can result in considerable dysfunction within the body. Individuals suffering from digestive issues such as hypoglycemia, irregular blood sugar levels, or obesity may benefit from the inclusion of enzyme supplements sourced from microbial, plant, and animal origins in their diets. Enzymes are protein-based molecules synthesized by cells, acting as biocatalysts that enhance metabolic rates and expedite various biological processes. Medical conditions primarily affecting the gastrointestinal system, such as gastroesophageal reflux disease (GERD), constipation, diarrhea, and ulcerative colitis, may be effectively managed through enzyme supplementation. Furthermore, enzymes could provide a valuable alternative for patients with diabetes.

3.4. Non-conventional Nutraceuticals

Non-traditional nutraceuticals originate from advancements in agriculture that focus on the enhancement of nutrients and ingredients. Examples include calcium-fortified orange juice, cereals enriched with vitamins and minerals, and flour that has been supplemented with folic acid. Agricultural experts have successfully employed techniques to improve the nutritional profile of various crops. These enhanced foods either contain additional supplements or result from biotechnological innovations designed to elevate nutrient levels; for example, rice and broccoli are recognized for their significant amounts of β -carotene and vitamins, respectively. This category can be further divided into recombinant and fortified nutraceuticals.

3.5. Recombinant nutraceuticals

Biotechnology methods have been effectively utilized in fermentation processes to isolate Enzymes that deliver essential nutrients at optimal levels in various food products, including Cheese and bread. This field of science contributes to the creation of energy-rich foods such as Bread, wine, fermented starch, yogurt, cheese, vinegar, and more. Additionally, biotechnology.

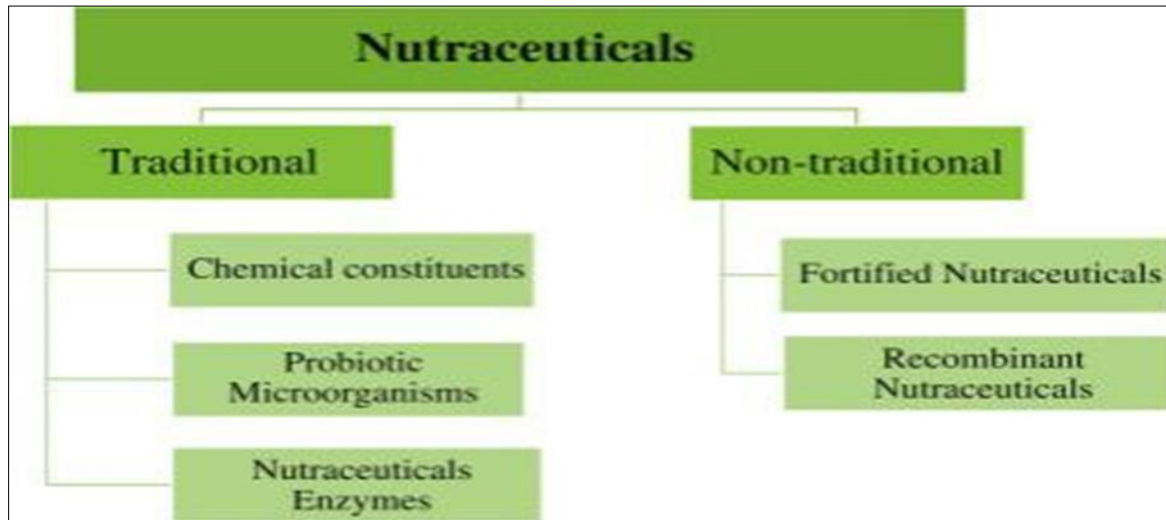


Figure 2 Nutraceuticals classification Based on Source (5)

The production of probiotics and the extraction of bioactive compounds are supported by enzyme and fermentation technologies, along with genetic engineering. Fortified nutraceuticals are developed by enriching dietary components with micronutrients, including trace elements or vitamins, in the final product. This process, referred to as fortification, is designed to enhance the nutritional value and effectiveness of food. In Cases of children suffering from diarrhea, respiratory infections, and severe illnesses,

Consumption of prebiotics and probiotics, along with preserved milk containing Bifidobacterium consumption of prebiotics and probiotics, along with preserved milk Containing bifidobacterium lactic HNO19, is recommended. Additionally, persistent bananas May be developed as effective solutions to address iron deficiency resulting from malnutrition These nutraceuticals can involve agricultural breeding practices or the incorporation of Compatible nutrients into primaringredients. Examples include the addition of minerals to Cereals, the fortification of flour with calcium, iron, and folic acid, and the enrichment of milk With cholecalciferol, which is commonly utilized to combat vitamin D deficiency.(6)

3.6. Classification According to Mechanism of Action

In order to identify and assess their functions and roles, nutraceuticals have been categorized Into groups based on their therapeutic properties, including antibacterial, antifungal, Antioxidant, anti-inflammatory, and anti-obesity classifications.(7)

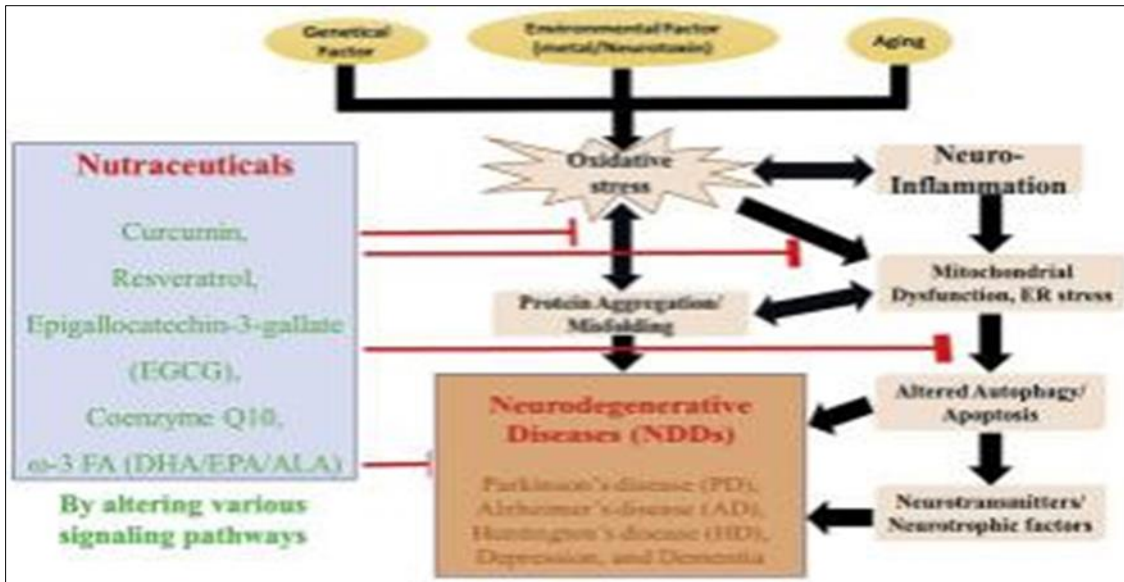


Figure 3 Classification of Nutraceuticals mode of action (8)

4. Components of nutraceuticals

Nutraceuticals are products obtained from food sources that provide health advantages that extend beyond fundamental nutrition. They may be utilized for the prevention and treatment of diseases and typically encompass a variety of components. Below are the primary components of nutraceuticals.

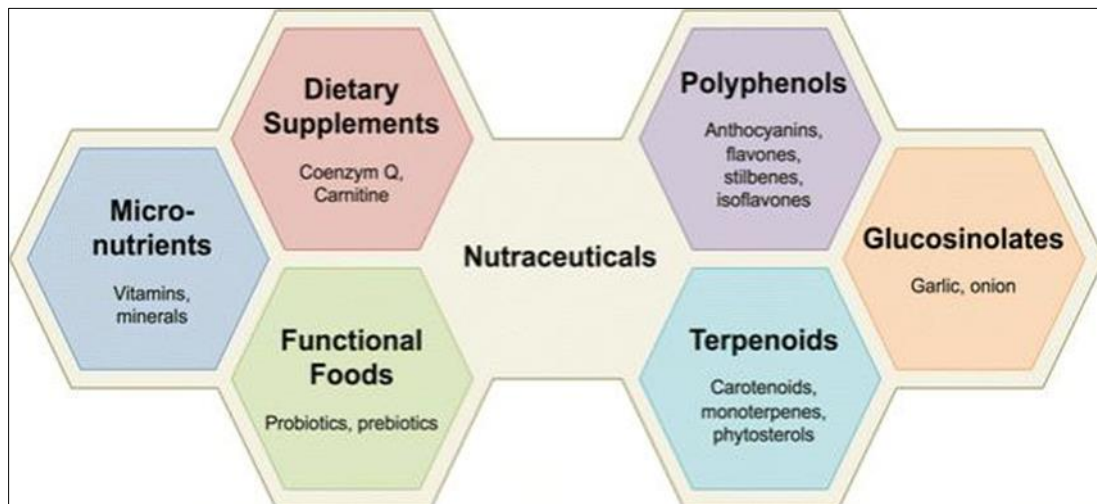


Figure 4 Components of Nutraceuticals (9)

- **Vitamins and Minerals:** These vital micronutrients are essential for numerous physiological functions within the body. Notable examples include vitamin C, vitamin D, calcium, and magnesium.
- **Herbal Extracts:** Sourced from various plants, these extracts possess potential therapeutic benefits. Examples encompass ginseng, garlic, and turmeric.
- **Amino Acids:** Serving as the fundamental components of proteins, amino acids contribute to muscle development, repair, and overall well-being. Notable examples include L-arginine and L-glutamine.
- **Fatty Acids:** Omega-3 and omega-6 fatty acids play a vital role in supporting cardiovascular health and reducing inflammation. Typical sources of these essential fatty acids are fish oil and flaxseed oil.
- **Probiotics:** These beneficial microorganisms support gut health and enhance digestive and immune functions.
- **Prebiotics:** These non-digestible food components foster the growth of advantageous gut bacteria. Examples include inulin and fructooligosaccharides (FOS).

- **Polyphenols:** These antioxidant-rich compounds, found in fruits, vegetables, tea, and red wine, help safeguard cells against oxidative stress.
- **Fiber:** Essential for digestive health, fiber aids in regulating blood sugar levels and cholesterol. Sources include whole grains, fruits, and vegetables.
- **Antioxidants:** These compounds defend cells from damage inflicted by free radicals. Common antioxidants include vitamin E, vitamin C, and selenium.(10)

5. Marketed growth

In India, the consumption of functional foods is projected to rise over the next five years, leading to a larger market share for functional foods and beverages compared to dietary supplements. The total Indian Nutraceuticals market is anticipated to reach approximately US \$5 billion by 2015. This segment, however, presents significant opportunities for Nutraceutical Product manufacturers to customize their offerings by incorporating natural and herbal ingredients. The success of the chyawanprash supplements market exemplifies this potential. The global increase in life expectancy has resulted in a higher prevalence of lifestyle-related diseases, such as diabetes, Hypertension, elevated cholesterol levels, and obesity have led to a significant increase in mortality rates associated with these conditions worldwide..

Market Size: The global nutraceuticals market was valued at approximately USD 382 billion in 2022 and is projected to grow at a compound annual growth rate (CAGR) of around 8-10% from 2023 to 2030(11)

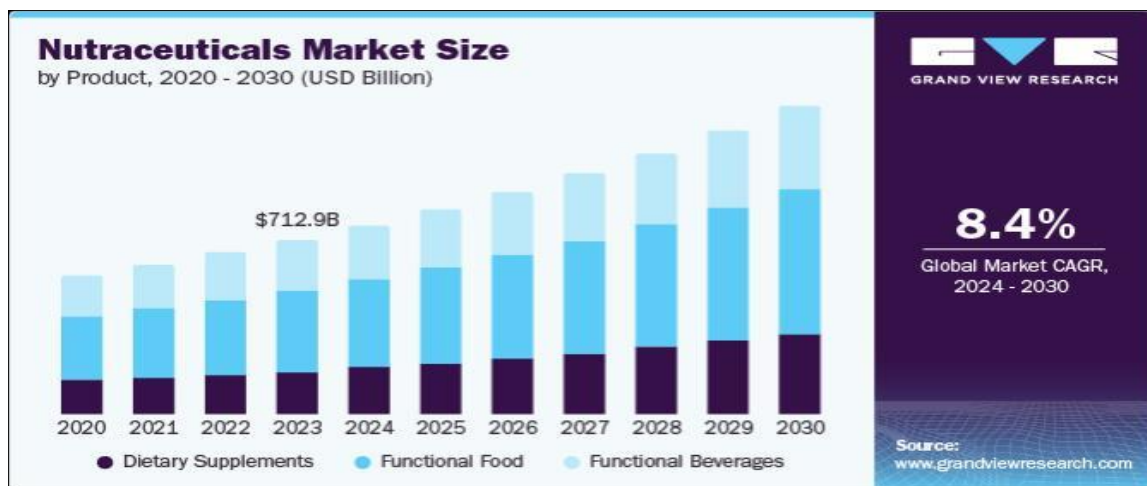


Figure 5 Nutraceuticals of Markets Growth(12)

5.1. Indian regulatory accept of nutraceuticals

The regulatory landscape governing nutraceuticals in India requires significant enhancement from the appropriate authorities. Unlike many countries where regulatory bodies adapt to the evolving demands of consumers by revising existing legislation, India continues to operate under outdated laws such as the Prevention of Food Adulteration Act of 1954, which governs packaged food products. Manufacturers are also burdened by a multitude of other complex regulations, including:

- --The Standards of Weights and Measures Act of 1976, along with the Standards of Weights and Measures (Packaged Commodities) Rules of 1977.
- The regulation of the production, supply, and distribution of infant milk substitutes, feeding bottles, and infant foods. and Distribution) Act of 1992, along with its 1993 Rules.
- -The Edible Oils Packaging (Regulations) Order of 1998.
- -The Fruit Products Order of 1955.
- -The Meat Products Order of 1973.
- -The Milk and Milk Products Order of 1992.
- -The Vegetable Oils Products (Regulation) Order of 1998.
- -The Atomic Energy Act of 1962 and the Atomic Energy (Control or Irradiation of Food) Rules of 1996.
- -The Consumer Protection Act of 1986, along with the Consumer Protection (Amendment) Act of 2002 and its 1987 Rules.(13)

6. Conclusion

Nutraceuticals have a rich history in disease treatment, and their application is expected to Persist in contemporary and future medical practices. To ensure the safety of these products, it Is essential to enhance their quality, purity, and efficacy, as well as to understand better the Various processes involved in their development. Continued research is necessary to address These aspects. Caution is paramount when consuming supplements, highlighting the Importance of foundational research and dialogue regarding their benefits, recommended Daily dosages, and possible adverse effects. Consequently, we might consider replacing the Saying “an apple a day keeps the doctor away” with “nutraceuticals a day may keep the doctor Away.

A considerable body of evidence supports the application of nutraceuticals in the treatment of various health conditions, highlighting their importance in both current and future medical practices. Nevertheless, further investigation is imperative to ascertain the safety, Improved quality, purity, efficacy, health benefits, and disease-preventing properties of these Products, alongside a deeper understanding of the diverse homethodologies involved in their Development. Caution is paramount when consuming supplements. Consequently, there is a Pressing need for fundamental discussions and research concerning the advantages, Recommended daily intake, and possible adverse effects associated with supplement usage. In Light of this, we might consider updating the traditional saying “an apple a day keeps the Doctor away” to “a nutraceutical a day may keep the doctor away.

Compliance with ethical standards

Disclosure of conflict of interest

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