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Nutraceuticals

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Abstract
The term "Nutraceutical" is a combination of "Nutrition" and "Pharmaceutical." Nutraceuticals, broadly speaking, are foods or components of foods that significantly alter and maintain the normal physiological function that supports healthy human beings. The Foundation for Innovation in Medicine (New York, US) first used the term "nutraceutical" in 1989 to describe this quickly expanding field of biomedical research. Dietary fiber, prebiotics, probiotics, polyunsaturated fatty acids, antioxidants, and other diverse kinds of herbal/natural foods are some of the food products used as nutraceuticals. Risk of drug toxicity or side effects prompted us to seek functional food-based and safer nutraceutical alternatives for the management of health. Overall, the term "nutraceutical" has ushered in a new era of medicine and health, one in which the food industry has evolved into a research-focused enterprise. The goal of the current review is an overview of nutraceuticals and also their comparison with Pharmaceuticals.

Keywords: nutraceutical, prebiotics, antioxidants, probiotics, polyunsaturated fatty acids, nutrition, pharmaceutical

Introduction

Over the past few years, a growing variety of dietary supplements have become accessible in supermarkets, health food stores, and even pharmacies.

These foods that have therapeutic or nutritional benefits are known as "nutraceuticals." Nutraceuticals include everyday items like "bio" yogurts and fortified breakfast cereals, as well as vitamins, herbal remedies, and even genetically/living modified foods and supplements. They have also been referred to as designer foods, functional foods, medical foods, functional foods, phytochemicals, and nutritional supplements. Confusion can result from the numerous phrases and definitions that are employed in various nations. A broad word known as "nutraceuticals" is used to describe any food-derived product that provides additional health advantages over and beyond its fundamental nutritional content. They might be regarded as non-specific biological therapies designed to enhance overall health, halt cancerous processes, and manage symptoms. Nutraceuticals are typically defined as "foods or dietary components that provide health advantages, including the prevention and treatment of disease [1]."

Today's growing market for nutraceuticals—food-derived bioactive substances with health-promoting and disease-preventing properties—is the result of increased public awareness of health-related problems and concerns. Because of their benefits, nutraceuticals are a growing segment of the food and pharmaceutical industries.[2]Additionally, more patents based on nutraceuticals have been filed, emphasizing the critical importance of global nutraceuticals [3].

In addition to enhancing health and immune function to avoid diseases, these therapeutic or active foods and phytonutrients also promise to reduce side effects and preserve optimal health [4].

“Let food be thy medicine and medicine be thy food” These goods fall within the categories of functional foods, dietary supplements, and nutraceuticals, which are defined as "any substance that may be considered a food or a component of a food and that provides health and medical advantages, including the prevention and treatment of disease." "Nutraceuticals" is arguably the most apt name to describe this group. This title was created by Stephen DeFelice, the founder and chairman of the Medicine Innovation Foundation in Cranford, New Jersey [5].

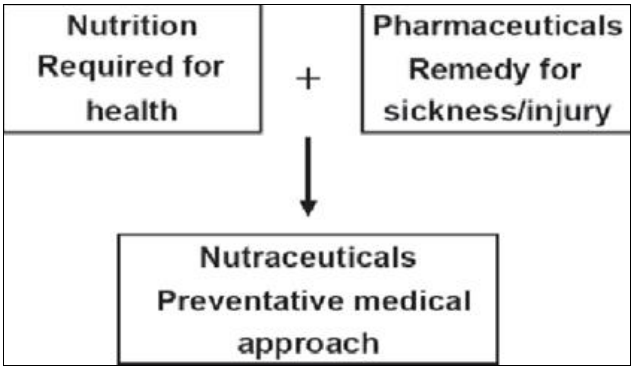

Fig 1: Defination of nutraceuticals

Nutraceuticals

Contrary to typical diets, foods (or parts of foods) that combine nutritional and pharmacological effects (i.e., provide medical or health advantages, including the prevention and/or treatment of a disease) have been referred to as nutraceuticals. Therefore, nutraceuticals encompass any substance of natural origin with a nutritional value and a good impact on human [6]. health. Nutraceuticals are commonly found in the most popular functional foods. It has been suggested that certain chemical groupings, These goods' macronutrients and micronutrients are in charge of the positive effects seen in the host include terpenoids, polyphenols, and alkaloids. Vitamins A, B6, B12, C, D, E, folate, unsaturated fatty acids, and a few trace minerals, like as magnesium, copper, zinc, iron, selenium, and magnesium [7]. We might also mention polyunsaturated fatty acids (PUFAs) and antioxidants (such -carotenoids and lycopene),

which have also been discovered in nutraceuticals, as functional foods [8, 9]. Note that this definition of nutraceuticals and the regulation proposal put forth by Zeisel *et al*. both state that: If probiotics and prebiotics are found as pills rather than in a food matrix, they would also be considered nutraceuticals [10]. For the sake of practicality, we are going to offer them separately here. Probiotics and other food-derived microorganisms release active substances that are by-short-chain fatty acids, critical vitamins, and antioxidants are byproducts of their metabolism. fatty acids (SCFAs), which directly affect the health of the host [11, 12]. The World Health Organization (WHO) has defined it since 2011; nonetheless, the idea was reevaluated in 2013 to come to terms with "living microbes that, when confer a health effect on the host when administered in sufficient doses"[13, 14]. It has been demonstrated that a variety of bacterial species, largely originating from human diet [15, 16].

History

Nutraceuticals have a history dating back more than 3,000 years. Let food be thy medicine, said Hippocrates (460–377 B.C.), and let medicine be thy food. Early in the 20th century, American food makers began iodizing salt in modest amounts to avoid goiter. Stephen DeFelice, the Chairman and Founder of the Foundation for Innovation in Medicine, Cranford, New Jersey, first used the phrase "nutraceuticals" in 1989 [17]. A food (or component of a food) that offers medical or health benefits, such as the prevention and/or treatment of a disease, is referred to as a nutraceutical, according to DeFelice. However, there is no regulatory meaning for the term "nutraceutical" as it is frequently used in marketing [18]. Nutraceuticals are already influencing diets in England, Japan, and other nations. Germany, France, and O. K. Nwosu and K. I. Ubaoji 15 the United Kingdom were the first countries to view diet as being more essential than exercise or inherited factors in achieving good health. They were classified as products of foods in Canada but were "sold in tablets, powders, (potions), and other therapeutic forms not generally associated with food." Nutraceuticals are viewed as dietary ingredients in India that are created from herbal or botanical raw materials and are used to prevent or treat many sorts of chronic and acute illnesses [19]. Nutraceuticals are currently one of the industry's fastest-growing segments, with an anticipated compound annual growth rate (CAGR) of 7.5%. According to estimates, the global market for dietary supplements will grow from $241 billion in 2019 to $373 billion in 2025. Nutraceuticals have been used with certainty to provide desired therapeutic results with fewer negative effects. Herbal nutraceuticals are effective tools for maintaining health and operate in opposition to acute and chronic diseases brought on by poor dietary choices by fostering optimum health, longevity, and quality of life [20].

Scope

Nutraceuticals are based on a philosophy that emphasizes prevention. It is frequently applicable to dietary supplements and/or functional foods [21].

a. Dietary supplements: These products are intended to supplement diets and accept or contain one or more of the following dietary ingredients: minerals, vitamins, amino acids, herbs, other botanicals, constituents, dietary substances for use by humans to supplement diets by increasing daily intake, or concentrates, extracts, or combinations of these ingredients [18]. While nutraceuticals place more emphasis on the expected outcomes of these goods, such as the prevention or treatment of diseases, dietary supplements do not aim to treat or remedy disease.
b. Functional Food: According to the Food and Nutrition Board of the American Institute of Medicine, functional food is any food or food ingredient that "may provide a health benefit in addition to the traditional nutrients it contains." "Food products should be used as part of the regular diet in order to have beneficial benefits that go beyond basic nutritional function" is the definition of functional food. Physiologically active ingredients can come from either plant or animal sources in functional foods [22].

Classification

Based on their sources, nutraceuticals or functional foods can be divided into two categories: natural or conventional and unnatural or unconventional.

a. Products derived from plants, animals, minerals, or microorganisms fall within the category of natural sources. Traditional Nutraceuticals is the name for this category.
b. Biotechnologically produced nutritional supplements, also known as non-traditional nutraceuticals.

1. Traditional Nutraceuticals

They are all-natural products that don't alter the food in any way. They contain a variety of organic elements that offer advantages beyond merely providing sustenance, such as the omega-3 fatty acids in salmon, saponins in soy, and lycopene in tomatoes, among others. the customary nutritional supplements can be divided according to:

a. Chemical Constituents.
1. Nutrients.
2. Herbals.
3. Phytochemicals.
b. Nutraceutical Enzymes.
1. Chemical Constituents.
c. Probiotic Microorganisms.

Nutrient

The nutrients include vitamins, minerals, amino acids, and fatty acids, all of which have known nutritional purposes. The majority of meals contain vitamins that help treat conditions like heart disease, cataracts, osteoporosis, and stroke. Minerals from plants, animals, and dairy products can help with anemia, osteoporosis, and the development of healthy bones, muscles, and nerve impulses as well as heart rhythm. Foods with fatty acids, such as omega-3 PUFAs, are effective anti-inflammatory agents that also maintain brain health and lower cholesterol accumulation [23].

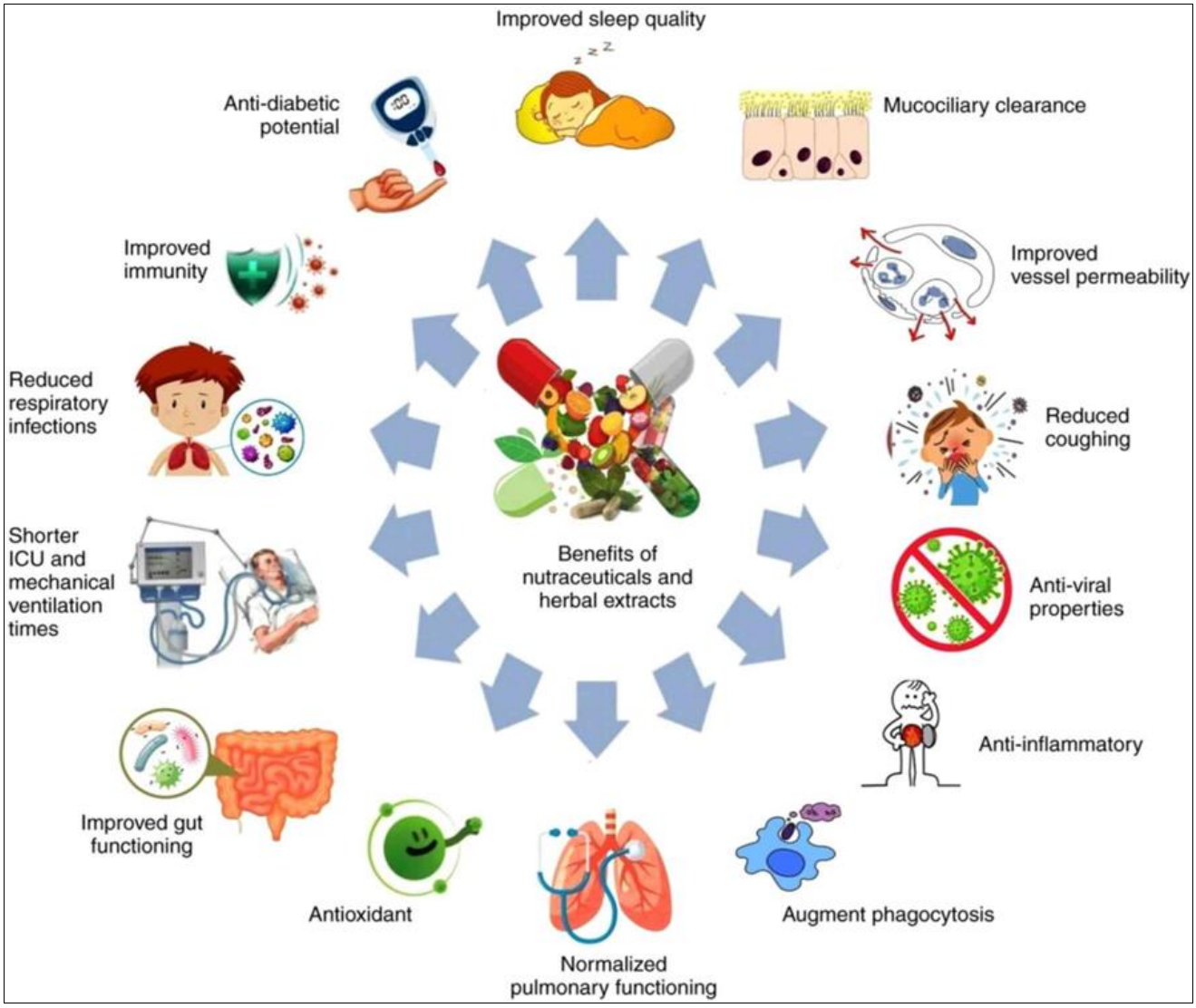

Fig 2: Scope of Nutraceuticals

Herbals

Herbal nutraceuticals contribute to better health and the prevention of chronic diseases. These mostly have analgesic, anti-inflammatory, astringent, antipyretic, and antiarthritic properties. Some herbal remedies have flavonoids like apiol and psoralen, which have diuretic, carminative, and antipyretic properties. Menthol, an active ingredient found in peppermint (Mentha Piperita), aids in the treatment of colds and flu [24]. While proanthocyanidin, which is included in some herbal remedies, is good in the management of cancer, ulcers, stress, cough, hypertension, and asthma, some plants contain tannin that is allegedly helpful in the management of depression, colds, stress, hypertension, and asthma [23].

Phytochemicals

Plant compounds known as phytochemicals have specific biological effects that are beneficial to human health. They go by the name phytonutrients as well. They function by acting as a substrate for biochemical reactions, cofactors or inhibitors of enzymatic reactions, absorbents that attach to and remove undesirable components in the intestine, and/or improving the stability and/or absorption of essential nutrients, among other things [25].

Nutraceutical Enzymes

Bioactive Enzymes These enzymes come from microbial, animal, and plant origins. Without enzymes, our bodies wouldn't be able to work as well as they should. Enzyme supplements in the diet can alleviate the symptoms of medical diseases such blood sugar imbalances, digestive issues, and obesity [21].

Probiotic Microorganisms

For life, probiotics stand for. They are characterized as living microorganisms that have an impact on the host's health when ingested in moderation [26]. These microbes are adaptable bacteria that support wholesome digestion and some nutrient uptake. Most importantly, they work to eliminate pathogens like yeasts, other bacteria, and viruses that could cause disease and form a mutually beneficial relationship with the human digestive system [27]. Through changing the microflora, preventing pathogen adhesion to the intestinal epithelium, competing for nutrients required for pathogen survival, producing an antitoxin effect, and regressing some of the effects of infection on the intestinal epithelium, such as secretory changes and neutrophil migration, they have an antimicrobial effect. Probiotics, By increasing the synthesis of a particular enzyme (ß-galactosidase), for example, probiotics can treat lactose intolerance by hydrolyzing the offending lactose into its component sugars [28].

2. Non-Traditional Nutraceuticals

These are the biotechnologically created artificial foods. Food samples contain bioactive ingredients that have been developed to create goods for human wellness. They can be divided into recombinant and fortified nutraceuticals.

Fortified Nutraceuticals

These are agrarian-bred nutraceuticals or supplements with additional nutrients and/or additives. Examples include cereals with added vitamins or minerals, milk fortified with cholecalciferol to treat vitamin D deficiency, flour fortified with folic acid, milk fortified with prebiotics and probiotics to treat diarrhea, respiratory infections, and severe illnesses in children[29], and orange juice fortified with calcium.

Recombinant Nutraceuticals

Probiotic production, bioactive component extraction via enzyme/fermentation technologies, and genetic engineering are all examples of recombinant nutraceuticals. Additionally, current biotechnology is used to manufacture foods that provide energy, like bread, wine, fermented starches, yogurt, cheese, vinegar, and others. For instance, recombinant human lactoferrin (rhLf) is used to treat lactoferrin insufficiency in cows that have been genetically modified [30].

Benefits of Nutraceuticals

From the perspective of the consumer, functional foods and nutraceuticals may provide a number advantages: [31]

- May have naturally dietary supplements, thus don't have unpleasant side effects.
- May increase the health, our diet and improve the medical condition of humans.
- May simply be obtainable and economically cheap. organic process medical care could be a healing system using dietary therapeutics or nutraceuticals as a complementary medical care. This medical care is predicated on the idea that foods can't only be sources of nutrients and energy however may additionally give healthful advantages.
- Might improve the nutritional value of our diet.
- Might prolong our lives.
- Might enable us to prevent specific medical issues
- us to prevent specific medical issues.
- Could be viewed as more "natural" than conventional therapy and a lower likelihood of producing unfavorable side effects [32].

Comparison Studies of Nutraceuticals and Pharmaceuticals

- The words "nutrition" and "pharmaceutics" are the roots of the term "nutraceutic." The word is used to describe goods that are isolated from herbal products, dietary supplements (nutrients), certain diets, and processed meals like cereals, soups, and drinks that are also utilized as medicine in addition to providing nutrition [33].
- Contrary to pharmaceuticals, nutraceuticals are compounds that often do not have patent protection. While both pharmaceutical and nutraceutical substances may be used to treat or prevent diseases, only pharmaceutical substances are approved by the government [34].
- A contrast between medications and nutraceuticals. Nutraceuticals can be ingested through regular food, as naturally high-content foods, or as enriched elements in a food matrix. Pharmaceuticals, on the other hand, are goods created for a particular medical use.
- Nutraceuticals are used for prevention of diseases. Whereas Pharmaceuticals are used for treatment of diseases.

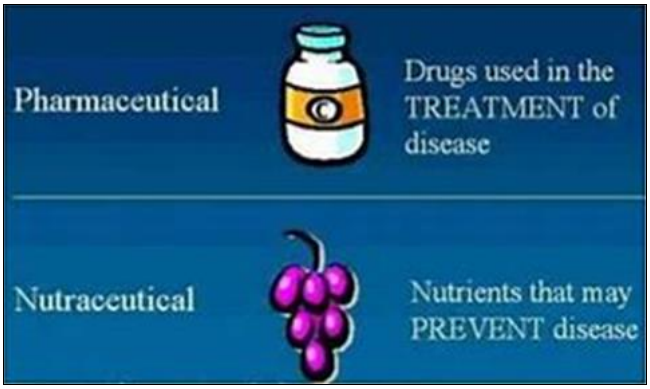

Fig 3: comparison of Nutraceutical and Pharmaceutical

Table 1: Comparison of Nutraceuticals with Pharmaceuticals.

Nutraceuticals	Pharmaceuticals
Low Potency	High Potency
Weak interactions with targets	Strong interaction with targets
Works on the root cause and take longer time for recovery	Relatively more instant in effect
No prescription needed for buying	Sold only on prescription except OTC
Long term application/effect	Short term application /effect
Focuses on prevention and wellness	Focuses on illness and treatment
Do not have side effects	For severe illnesses have side effects
Needs no approval of FDA	Needs approval of FDA

Disadvantages of Nutraceuticals

1. Digestive problems, such as gas and bloating, may result from ingesting them in larger doses, but they are often short.
2. Stomach or intestinal discomfort.
3. Allergy.
4. Not tested and regulated in the same ways as pharmaceuticals.
5. In the USA, the FDA does not regulate the majority of products.
6. Businesses that produce unlicensed goods to boost their profit margins.
7. Nutrient bioavailability is decreased.
8. There is no legal definition.

Marketed Products of Nutraceuticals

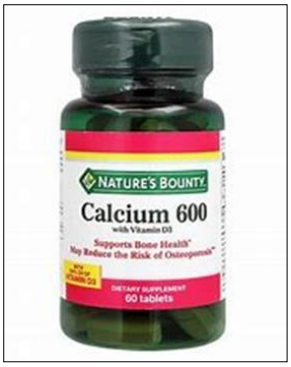

Fig 4

Fig 5

Conclusion

There has been a shift in public opinion over the past several years about the use of natural goods and functional foods in daily living. As a result of their accepted health benefits against a number of illnesses and their higher therapeutic efficacy compared to well-known conventional formulations, the market for nutraceuticals has significantly developed. Nutraceuticals are a unique class of healthcare treatments that fall between dietary supplements and pharmaceuticals. Nutraceutical products have similar effects to medications even if they are not approved by the health authorities. The manufacturer determines similarity and dependability. We can therefore conclude that nutraceuticals are crucial to our daily lives and that they offer greater health advantages than medications while having fewer adverse effects but, they also have some disadvantages over pharmaceuticals in means of effect, regulation and approval from FDA. Although there is still much to learn about the positive impacts of nutraceuticals on human health as well as any potential negative side effects, between food and medications, this category of health items presents difficulties for governmental regulating authorities as well. In order to deliver the most possible health and therapeutic benefit to humanity, health experts, nutritionists, and regulatory toxicologists should strategically collaborate to plan the proper regulation.

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Conflict of Interest

We declare that we have no conflict of interest.

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