



# Food as a source of Nutraceuticals: A Review

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## Abstract

Nutraceuticals are bioactive substances that are used to treat and prevent a wide range of diseases as well as to improve effects that support health. They play a major role in managing and averting chronic illnesses such as diabetes, cancer, heart disease, lung disease, gastrointestinal, and neurological conditions. As a result, the nutraceutical market is growing quickly. Depending on the health concerns of the patient, a licensed healthcare provider may prescribe nutraceuticals, or they may be used over-the-counter. Nutraceuticals are generally beneficial to health and have many benefits, such as anti-inflammatory, anti-cancer, and antioxidant properties. The present article focuses on the food source of nutraceuticals and the need for consuming appropriate diets.

**Keywords:** Nutraceuticals, Phytochemicals, Health benefits, Therapeutics, Disease, Infection.

## Introduction

The industrial revolution has resulted in a multitude of environmental issues, including pollution of air and water, soil and food contamination due to the widespread use of various chemicals, heavy metals, electromagnetic waves, and other potentially harmful man-made items. These issues have led to an increase in the incidence of diabetes, obesity, various cancers and vascular diseases, physiological issues, as well as other degenerative diseases[1]. Since the cost of medical care has skyrocketed due to the increased demand for health care, people have attempted to improve their quality of life by consuming more fruits, vegetables, and other plant-based foods, taking dietary supplements or nutraceuticals, or substituting nutritional therapy or radiotherapy for chemotherapy or radiation therapy[2].

One of the most significant sources of food and medication for humans is the plant kingdom. The ideas around food, health, and agriculture have undergone a radical transformation as a result of the rapidly expanding body of knowledge in the fields of plant biotechnology,

nutrition, and medicine. Health experts and the general public have paid close attention to natural products and foods that promote health as a result of recent advancements in the medical and nutrition sciences[5].

With economic development has come improvements in living standards with regard to income, expenditures, and way of life. But it has also presented a significant obstacle in the shape of "lifestyle diseases." Food habits have been the first casualty of this new way of living. Junk food consumption has skyrocketed, which has resulted in a host of illnesses linked to dietary deficiencies. The use of nutraceuticals can be very helpful in managing them. It makes sense that the number of people using nutraceuticals is rising[3].

The well-known proverbial statement from the Greek physician Hippocrates, which dates back almost 2,500 years, is still relevant today: "Let food be thy medicine and medicine be thy food." The term "any substance that may be considered a food or part of a food and provides medical and health benefits including the prevention and treatment of disease" is used to describe functional foods, dietary supplements, and nutraceuticals. "Nutraceuticals" is arguably the most apt term to describe these partially food, partially drug products. Stephen DeFelice, the founder and chairman of the Cranford, New Jersey-based Foundation for Innovation in Medicine, came up with this name[4].

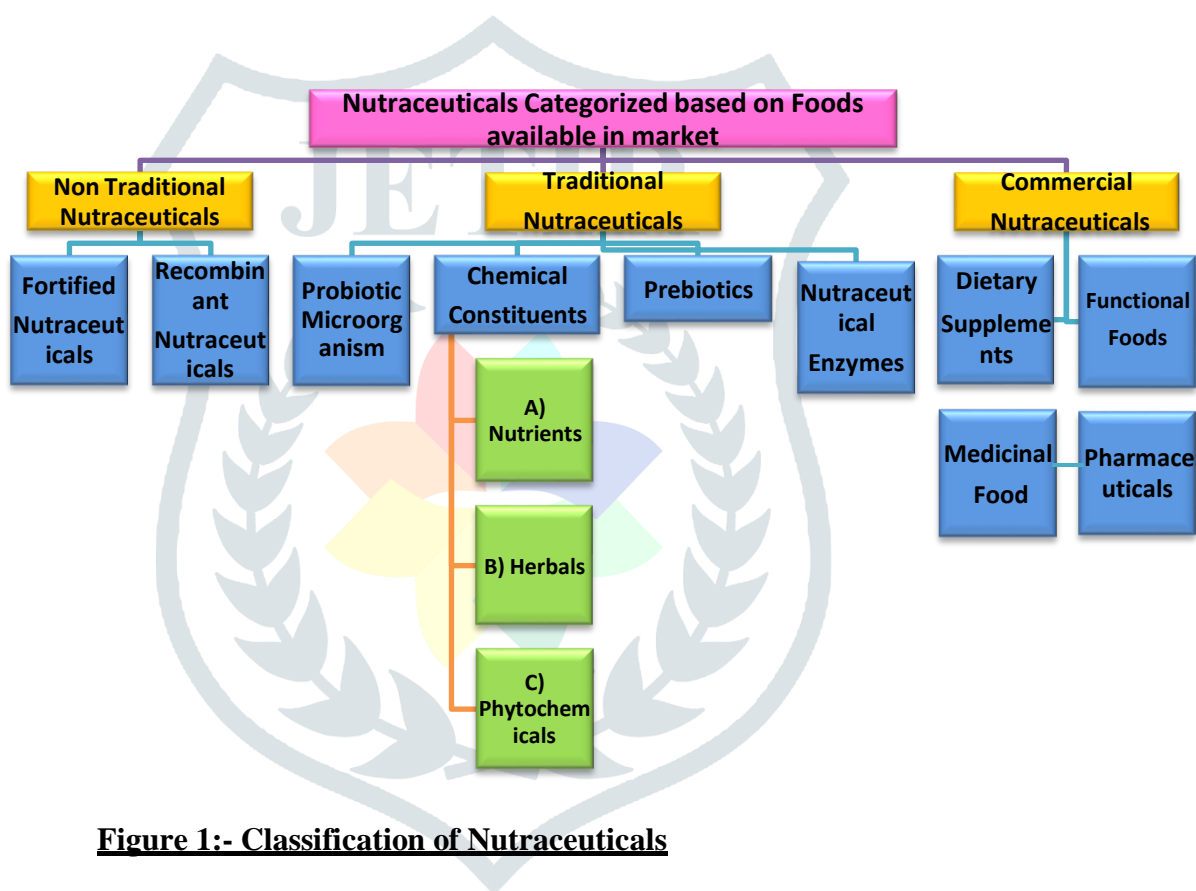
### **ADVANTAGES**

1. Nutraceuticals aid in illness prevention.
2. Assist customers in getting their recommended daily intake of vitamins and minerals.
3. These are less harmful than traditional medications.
4. They are affordable and widely accessible.
5. Anti-oxidant effects
6. Anti-inflammatory effects
7. Anti-aging effect
8. Improves metabolism
9. Holistic approach
10. Keep diseases and infections at bay
11. Avoid chronic healthcare issues
12. Works at the cellular level
13. Helps improve the immune function
14. Increases energy levels and body functioning.

## DISADVANTAGES

1. Headache
2. Dizziness
3. Elevated blood pressure
4. Digestive problems
5. An expensive process
6. Process loss of material was high
7. Unsuitable for moisture sensitive, thermo-labile.

## Classification of Nutraceuticals



**Figure 1:- Classification of Nutraceuticals**

### NON-TRADITIONAL NUTRACEUTICALS

These are synthetic meals made possible by biotechnology. Bioactive ingredients found in food samples are designed to create goods that promote human health.

They are divided into two categories:

A. Fortified nutraceuticals.

B. Recombinant nutraceuticals.

### **A. Fortified nutraceuticals**

They are supplemented with vitamins and minerals, typically up to 100% of the recommended daily intake for those particular nutrients. Foods with agricultural breeding or additional nutrients are known as fortified nutraceuticals. For example, orange juice fortified with calcium, cereals fortified with vitamins or minerals, flour fortified with folic acid, and milk fortified with cholecalciferol are examples of fortified nutraceuticals[6].

### **B. Recombinant nutraceuticals**

Biotechnology enables the production of probiotics, the extraction of bioactive components through enzyme/fermentation technologies, and genetic engineering. Biotechnology is used to produce foods that provide energy, including bread, alcohol, fermented starches, yogurt, cheese, vinegar, and others[6].

## **II. TRADITIONAL NUTRACEUTICALS**

Conventional nutraceuticals don't alter the food; they are just natural. Food contains a number of naturally occurring substances, such as saponins in soy, omega-3 fatty acids in salmon, and lycopene in tomatoes, that provide health benefits beyond simple sustenance.

A. probiotic micro-organism

B. prebiotics

C. chemical constituents

D. nutraceutical enzymes[7]

### **A. Probiotic Micro-organisms**

They work to drive out pathogens—such as viruses, bacteria, and yeasts—that could otherwise lead to illness and form a mutually beneficial symbiosis with the human digestive system. By altering the microbiota, inhibiting pathogen adhesion to the intestinal epithelium,

competing with pathogens for nutrients required for survival, generating an antitoxin effect, and reversing some of the effects of infection on the intestinal epithelium, such as secretory changes and neutrophil migration, they have an antimicrobial effect. By producing the particular enzyme ( $\beta$ -galactosidase), which can hydrolyze the offending lactose into its component sugars, probiotics can treat lactose intolerance. As an illustration, One of the best places to find probiotics—friendly bacteria that can enhance your health—is in yogurt. A fermented probiotic milk beverage is called kefir.

## B. Prebiotics

More recently added to our lexicon are "prebiotics," which are substances that our bodies do not digest when they are consumed. Rather, they serve as a source of nutrients for the beneficial probiotic bacteria. This lowers the possibility that dangerous microorganisms will begin to grow in our digestive tract by promoting the probiotic bacteria to grow in a favorable environment. For instance: One common prebiotic found in processed foods is inulin. It is basically a kind of fiber that can be found in the roots of plants like dandelions, chicory, and Jerusalem artichokes[56].

## C. Chemical Constituents

With the aid of herbals, nutraceuticals hold great promise for enhancing health and preventing chronic disease. Aloe Vera gel is one example. dilates capillaries and has emollient, anti-inflammatory, and wound-healing qualities. Ephedra: lowers bronchial edema, acts as a vasoconstrictor and bronchodilator. Garlic: Hypotensive, anti-inflammatory, antibacterial, antifungal, and antithrombotic Liquorice: a secretolytic, expectorant, and peptic ulcer remedy. Garlic: cholagogue, antiemetic, carminative, and positive inotropic[8].

## PHYTOCHEMICALS

Essentially, phytochemicals are plant nutrients with specific biological properties that promote human health and combat a variety of dangerous diseases. As an illustration, Fruits, vegetables, and egg yolks contain isoprenoids called carotenoids, which have anti- carcinogenic properties, increase natural killer cells, and shield the cornea from UV rays. Non-carotenoids, found in grains, legumes (such as chickpeas and soybeans), and palm oil, lower cholesterol and prevent cancer. Onions and garlic contain sulfurides, which may boost immunity. Apples, apricots, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, garlic, legumes, onions, red peppers, soybeans, sweet potatoes, and tomatoes are foods high in phytochemicals[9].

## D. Nutraceutical Enzymes

Our bodies could not survive without enzymes, which are vital components of life. Individuals with medical conditions like hypoglycemia, blood sugar disorders, obesity, and digestive issues can reduce their symptoms

by adding enzyme supplements to their diet. These enzymes come from sources that are plant, animal, and microbiological. A few examples are the enzyme xylanase, which comes from *Trichoderma* sp. Advantages: High molecular weight arabinoxylans are broken down by xylanase, which is also useful for breaking down the endosperm cell walls of feed grains and vegetable proteins. Numerous issues pertaining to arabinoxylans can be resolved by supplementing feed with Xylanase. In the nutraceuticals sector, papain enzyme is frequently utilized as a protease enzyme to aid in the digestion of proteins. They produce tiny peptides by breaking apart protein chains[10,11].

### III. COMMERCIAL NUTRACEUTICALS

$\beta$ -D-galactose and  $\alpha$ -D glucose are produced by the lactase enzyme, which is obtained from *Aspergillus* sp. lactose (4-O- $\beta$ -D galactopyranosyl-Dglucose). Advantages: Lactase usage improves digestive capacity. Since lactase functions best in an acidic environment, it is useful in the circumstances found in the human digestive system[12,13].

- A. Dietary supplements,
- B. Functional food,
- C. Medicinal food.
- D. Pharmaceuticals.

#### A. Dietary supplements

Dietary supplements are liquid or capsule-based products that are concentrated sources of nutrients from food products. Most dietary supplements, including the vitamin B supplement, are offered for sale as pills. A dietary supplement is defined as a product taken by mouth that contains a "dietary ingredient" meant to supplement the diet in the United States by the Dietary Supplement Health and Education Act (DSHEA) of 1994. These products' "dietary ingredients" could consist of vitamins, minerals, botanicals or herbs, amino acids, and materials like organ tissues, glandulars, metabolites, and enzymes. Dietary supplements come in a variety of forms, including tablets, capsules, soft gels, gel caps, liquids, and powders. They can also be extracts or concentrates[12,13]. The Food and Drug Administration in the United States does not require dietary supplements to be approved before being marketed; however, businesses are required to register their manufacturing facilities with the FDA. With a few specific exceptions, dietary supplements can only be sold to promote the body's structure or function; they cannot be used to treat illnesses or ailments, and a disclaimer stating that the Food and Drug Administration has not reviewed the claims made on the label must be included[14]. This product uses the effectiveness of such nutraceuticals in detoxifying the body, preventing vitamin and mineral deficiencies, and restoring healthy digestion and dietary habits to achieve its stated goal of



"not diagnosing, treating, curing, or preventing any disease." There are many different types of dietary supplements, such as drinks, energy bars, gummies, pills, and powders. Vitamins D and B12, minerals like calcium and iron, herbs like garlic and echinacea, and goods like glucosamine, probiotics, and fish oils are among the commonly used supplements[15].

## B. Functional foods

"Any food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains" is the widely accepted definition of functional foods. Functional foods are made to enable people to consume enriched foods in a state that is close to their natural state instead of ingesting liquid or pill-form dietary supplements. Nutrification is the process of enriching or fortifying functional foods.

Three requirements are set forth for all functional foods in Japan:

- they must be present in their natural form, as opposed to being in the form of a capsule, tablet, or powder.
- Should be included in the diet on a daily basis
- Aims to control or prevent disease by regulating a biological process.

Foods that are functional include Fruits include oranges, bananas, pears, peaches, apples, kiwis, and berries. veggies: spinach, kale, broccoli, cauliflower, and zucchini. Nuts: Brazil nuts, macadamia nuts, pistachios, cashews, and almonds. Pumpkin, hemp, flax, and chia seeds are among the seeds[12,13].

## C. Medicinal food

The primary distinction is that while functional or medicinal foods are taken as part of a regular eating pattern, nutraceuticals can be consumed in a nonfood matrix form as pills, capsules, or tablets. Doctors prescribe it for a variety of illnesses like phenylketonuria, coeliac disease, and lactose intolerance that result in poor ingestion, digestion, absorption, or metabolism of traditional foods[17,18]. Thus, a medicinal food can be thought of as existing in what is known as the "Pharma-nutrition interface," which is the space between conventional foods and pharmaceuticals. "Let medicine be your food and food be your medicine." Spices, for instance, which are typically added to food to improve its flavor or taste, were referred to as "influencers of body metabolism." Curcumin, the active ingredient in turmeric (*Curcuma longa*), has been used traditionally in Indian cooking. It is thought to have anti-inflammatory, anti-carcinogenic, and antioxidant qualities. Allicin is found in garlic (*Allium sativum*), which is edible both raw and cooked[20]. It has been shown to have antihypertensive, HDL-raising, and circulation-improving benefits while lowering LDL cholesterol. Because peppermint (*Mentha piperita*) has a smooth muscle relaxant effect, it has long been used to treat digestive issues such as bloating, abdominal distension, and difficulty evacuation. Ancient Egyptians used

thyme (*Thymus vulgaris*) and sage (*Salvia officinalis*), both members of the Lamiaceae family, as a vermifuge and to treat spasmodic gastric- intestinal complaints, cough, bronchitis, laryngitis, and tonsillitis[19].

## D. Pharmaceuticals

Drugs, or pharmaceuticals, are specifically designed and developed to treat, cure, or prevent diseases that do not normally occur in our physiology. In addition, pharmacological products are more potent or biologically active than phytochemicals, which are typically consumed in trace amounts through diet and only start to have physiological effects after prolonged use[11].

## **FOOD AS A SOURCE OF NUTRACEUTICALS**

Nutraceuticals can be found in food in a variety of forms. The most sought-after and frequently consumed nutraceuticals are those that support immune system, digestive system, and cardiovascular system functions as well as physical performance[20]. Because of the qualities of nutraceuticals, one can mention the following food groups:

1. Enhancing the digestive system's performance: yogurt and probiotic drinks; bread; pro- and prebiotic-containing breakfast cereals.
2. decreasing overweight and obesity-lower sugar and fat foods, herbs as an appetite suppressant (e.g., hydroxycitric acid, HCA acid), dietary fiber, boosting fat burning (e.g., L- carnitine), and enhancing the metabolism of carbohydrates (e.g., chrome).
3. lowering the chance of cardiovascular illnesses (e.g., dietary fiber, n-3 fatty acids, vegetable oils, olive oil, yogurt, cheese, juices, bread, chocolate, and soy; a source of flavonoids and polyphenols, peptides, gamma-linolenic acid, and gamma-aminobutyric acid [GABA]).
4. foods and beverages (sources of calcium, magnesium, and prebiotics) such as soy, bakery and confectionery goods, desserts, and drinks.
5. lowering the risk of cancer: green tea (source of catechins), muesli bars (source of dietary fiber and isoflavones), whole-grain bread, and flour products.
6. Citrus fruits have anticancer properties because they contain limonoids, which are biologically active compounds, as well as vitamin C, folates, and fiber.
7. Juices, fruit drinks, herbal infusions, and other non-alcoholic (energizing and isotonic) beverages are among the items that can improve psychophysical efficiency.
8. Currently, the majority of drugs in the group known as statins are used to treat and prevent diseases caused



by hypercholesterolemia; however, the use of plant sterols and stanols increases the efficacy of blood cholesterol-lowering diets (rapeseed oil, sunflower, corn oil, linseed, and soy) and statin therapy.

9. as a source of precursors of enterodiols and enterolactone lignans, which are useful in preventing cancer; in the prevention of estrogen-dependent cancers.

10. lutein and zeaxanthin, along with natural antioxidants (vitamins C, E, and beta-carotenes), are important in the prevention of age-related macular degeneration (AMD) and cataracts.

11. containing caffeine, taurine, glucuronolactone, sugars, a complex of vitamins and minerals, and caffeine.

### **The Top 10 Nutraceutical Items**

This business is only going to get bigger as more and more health-conscious consumers search for ways to maintain their physical fitness. Here, we've examined the top 10 nutraceutical products available right now in more detail.

1. Prenatal Liquid Vitamins Liquids are now in high demand in the nutraceutical sector. Prenatal vitamins are still among the top ten products in the nutraceutical category. They not only provide the body with enough energy, but they also keep it that way before, during, and after pregnancy.

2. The development and maintenance of strong bones and teeth, as well as overall health, depend on vitamin D3. According to certain research, vitamin D3 can also strengthen your immune system and improve your mood. An osteoporosis-prone diet, frequent exercise, and calcium supplementation can all help lower the risk of osteoporosis.

3. Garcinia Cambogia: In the health and fitness sector, weight loss is a popular product. It has consequently propelled Garcinia Cambogia to the top of the list of nutraceutical products. You can burn more calories by increasing your metabolic rate with the aid of garcinia cambogia. It can also improve your mood and lessen food cravings.

4. Raspberry Ketones: Another type of dietary supplement, raspberry ketones has great fat-blocking and thermogenic properties.

5. Green Tea Supplements: The market for green tea supplements is hugely popular. In the nutraceuticals sector, green tea supplements have actually exceeded \$135 million in sales. Known for being a potent antioxidant, it's a fantastic substitute for coffee if you want a caffeine rush.

6. Echinacea: this herb is used to treat a variety of infections, such as syphilis, herpes, UTIs, and bloodstream

infections. Additionally, it is used to treat skin conditions like psoriasis, eczema, sunburned skin, and bee stings.

7. Probiotics: They can support the health of your body's beneficial bacteria. Probiotics can help food pass through your gut when added to a nutritious diet.

8. Omega 3 Fatty Acids: Although the body is unable to produce them, these vital fatty acids are required for human health. In addition to reducing inflammation, omega-3 fatty acids may also help minimize the chance of developing chronic illnesses like cancer, arthritis, and heart disease.

9. Alpha-lipoic Acid: This naturally occurring fatty acid has been utilized in complementary medicine to help treat rheumatoid arthritis, lower blood sugar, heal wounds, treat diabetic nerve pain, and help people lose weight.

10. Vitamin B12: Studies have indicated that this vitamin can boost energy levels and aid in metabolism.

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