

# Use, Importance, Present and Future of Nutraceuticals in the Emerging Food Industry

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**Abstract**— In recent years, important events that directly affect health and nutrition, such as war, famine, rapid population growth, air pollution, economic depression and epidemics, have led to a decrease in food resources, insufficient nutritional value of existing foods and difficult access to safe food. All these events have led to the appreciation of the nutraceutical and functional food markets, the increase in the importance of R&D studies in this field, and the creation of a portal built on healthy and safe foods with high nutritional and physiological values. Nutraceuticals, which are expressed as "more than food but less than drugs", are a compound of rising value in the targeted food portal because they have similar properties to both nutrients and pharmaceuticals. The term "Nutraceutical", which brings "nutrition" and "pharmacy" under the same roof, ensures that products that will contribute to the protection of our health are made ready without the need for medical consultation. Known for their valuable biological activities and beneficial effects on health, nutraceuticals are bioactive or chemical compounds that promote natural healing of the body, prevention of possible diseases and treatment of existing diseases. This review focuses on the food and health aspects of nutraceuticals, the uses of nutraceuticals in the food industry, their effects on health and the future of nutraceuticals are mentioned.

**Index Terms**—Food Safety, Functional Food, Nutraceutical, Nutraceutical and Health, Nutraceutical Supplement, Types of Nutraceuticals

## 1 INTRODUCTION

Since ancient times, people have benefited from various plants, plant extracts and spices in addition to traditional medicine methods in order to protect their current health, prevent and treat diseases. In India, an ancient form of treatment called "Ayurveda", which is heavily based on herbal medicine, has been used for centuries. Ayurveda is seen and practiced in many countries around the world, especially in India, as a part of the holistic approach necessary to achieve health and wellness. The famous Greek Doctor Hippocrates' saying "Let food be your medicine and your medicine your food" also supports that modern medicine and Ayurvedic system agree and that food can be used as medicine. Mankind has used many plants and plant extracts for therapeutic purposes since its creation; benefited from the healing effects of many natural sources such as ginger, cinnamon, saffron, onion, garlic, thyme, mint, honey [9, 10, 32, 43, 65, 68, 69].

The concept of nutraceutical is a definition that includes the process of using both pharmaceuticals and nutritional food, which expresses the food with pharmaceutical properties, in order to prevent and treat diseases. It was first introduced in 1989 by Dr. Although the term Nutraceuticals used by Stephen

is a concept that was originally used to prevent and treat diseases, it includes plant extracts that are not toxic to humans and have scientifically accepted benefits for health. This definition was later expanded with the enactment of the Health and Education Act in 1994 to include vitamins, minerals, amino acids, herbs, extra-botanicals, and dietary substances developed by humans for use as nutritional supplements. In recent years, with the development of more conscious societies that take care of their health and nutrition, the interest in nutraceuticals has increased considerably [18, 27, 32, 43, 46, 69, 73, 74, 77].

Today, nutraceuticals, the use of which is increasing rapidly due to its completely natural ingredients and positive effects on health, can be widely used in the prevention and treatment of various diseases and pathological conditions, although they cannot completely replace pharmaceuticals. The basic principle of nutraceutical therapy is the use of nutrients used to provide energy and nutrients, but also for therapeutic purposes. Nutraceuticals, which can be obtained from plant and animal sources, can be used in the prevention and treatment of various pain and inflammatory diseases, many serious health problems including stroke, diabetes, cardiovascular diseases even cancer. In this sense, the use of nutraceuticals is an important trigger and challenging tool for the prevention-treatment of diseases from a medical point of view [2, 21, 36, 43, 47, 50, 51, 60, 63, 64, 65, 66].

### 1.1. CLASSIFICATION OF NUTRACEOTICS

Many different classifications of nutraceuticals have been made since 1994, when the term nutraceutical first appeared. It is divided into many subclasses such as traditional-non-traditional nutraceuticals, functional foods, dietary supplements, phytochemicals, recombinants, fortified nutraceuticals, probiotic-prebiotics, herbal-based. Each nutraceutical class has different contents and, due to their nature, they have various

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uses and applications. However, all these nutraceutical classes may be similar in nature, and therefore they may overlap due to their health functions. According to the Institute of Food Technologists (IFT), our traditional foods, dietary supplements, and all fortified foods are included in nutraceuticals because they are "food and food ingredients that provide benefits for our health beyond being essential nutrients." When we examine all nutraceutical classes, it is seen that basically nutraceuticals can be divided into 2 groups as traditional nutraceuticals and non-traditional nutraceuticals [25, 37, 46, 70].

## 1.2. TRADITIONAL NUTRACEUTICALS AND THEIR EFFECTS ON HEALTH

Natural foods such as fruits, vegetables, meat, fish, milk, cereal products that we consume daily and have positive effects on our health are classified as traditional nutraceuticals [11, 15, 24, 39, 45, 69].

### 1.2.1. FUNCTIONAL FOOD PRODUCTS

Foods that provide not only the nutritional function we need daily, but also the benefits of preventing and treating diseases are included in the class of traditional nutraceuticals. These products are meat and meat products, milk and dairy products, fish, wheat, rice, lentils, beans, chickpeas, fruits, vegetables, nuts, peanuts, chocolate, etc. such products. Functional foods are offered for daily consumption in places where we do our routine food shopping such as markets, greengrocers [4, 70].

#### Effects on Health:

Functional food products contain ingredients that increase antioxidant and anti-inflammatory activities with proven beneficial effects in preventing two of the most important health problems of our age, such as type-2 diabetes and cancer. In addition, according to the nature of foodstuffs, it has beneficial effects on many health problems such as cardiovascular health, bone, skin, eye, joint and oral health, gynecological diseases, respiratory system problems. On the other hand, these foods also provide vitamin, mineral, diet and sports support to people [4, 45, 70].

### 1.2.2. DIETARY FIBERS

Dietary fibers, which have been very popular in recent years, are natural foods that provide a feeling of satiety for a long time due to their difficulty in digestion, as well as have serious health benefits, especially due to their supporting effects on intestinal flora. They are abundant in fruits, vegetables, oats, wheat bran [42, 54, 59].

#### Effects on Health:

Dietary fibers are divided into 2 as soluble and insoluble fibers according to their water solubility and water retention properties. Water-soluble fibers delay the gastric emptying time of the intestines; Due to these properties, it can be used as a diarrhea reducer, especially for patients with diarrhea problems.

Non-water-soluble dietary fibers, on the other hand, help relieve constipation and accelerate gastric emptying time. In addition, diets rich in fiber contribute positively to the improvement of intestinal flora, recovery of inflammatory bowel diseases, healthy weight loss, and reduction of health risks such as Crohn's and ulcerative colitis [28, 41, 46].

### 1.2.3. CAROTENOIDS

Carotenoids are natural sources of pigmentation found in abundance in plants and other photosynthetic microorganisms, giving color to fruits, vegetables, and many other foods. There are about 600 carotenoid compounds in nature. Only about 20 of these can be measured in human blood. As a result of the measurements, it was determined that the most important carotenoids in human nutrition are  $\alpha/\beta$  carotenes,  $\beta$ -cryptoxanthin, zeaxanthin, fucoxanthin, astaxanthin, lycopene, lutein and crocetin [8, 16, 35, 44, 71].

#### Effects on Health:

Physiologically, biochemically and pharmacologically, carotenoids have different effects on humans than they do on plants and photosynthetic microorganisms. Antioxidant due to its chemical structure consisting of a series of conjugated C=C bonds; Carotenoids, which are known to act as anti-inflammatory due to their inflammatory properties that inhibit the production of reactive oxygen species, have many beneficial properties on health in a wide range. Especially in recent years, many scientific studies have shown that consumption of food sources rich in carotenoids can be beneficial for the formation of cataracts, prostate enlargement, protection of cardiovascular health and prevention of diseases, strengthening immunity, maintaining a healthy functioning of our respiratory system, and treatment of serious health problems such as Alzheimer's, Parkinson's and cancer. shows that it has very important functions [4, 5, 19, 30, 34, 35].

### 1.2.4. FATTY ACIDS

One of the basic building blocks used by living things to maintain their lives and meet their necessary energy needs is fat. Oils, which have the highest energy value in terms of unit weight, are also very suitable for energy storage. Fats are composed of glycerol and fatty acids. In general, the physical, chemical and physiological properties of oils depend on the type and amount of fatty acids in their structure. Animal and vegetable fatty acids are generally derived from triglycerides, and most of them can be synthesized in the body, with the exception of essential fatty acids. Fatty acids are basically divided into two as saturated fatty acids and unsaturated fatty acids. Saturated and unsaturated fatty acids are determined by the double bonds made by the "C" atoms in their structure. Fatty acids are abundant in fish oil supplements, seeds, animal fats, coconut oil and olive oil [4, 16, 20, 33, 46, 52, 57, 67].

#### Effects on Health:

In various scientific studies, it has been determined that fatty acids have the ability to act as anti-inflammatory and immunomodulatory as well as energy storage and balancing the

lipid level in the blood. Fatty acids have important effects on the health of many organs and organs, especially joint health. Today, fatty acids are used in the treatment of rheumatoid arthritis and in the improvement of cardiovascular disease risk factors. In addition, the positive effects of fatty acids have been found in the prevention of heart attack, depression, migraine-type headaches, joint rheumatism, diabetes, some allergic diseases, high cholesterol and blood pressure [4, 20, 29, 45, 67, 82].

### 1.2.5. PROBIOTICS AND PREBIOTICS

Probiotics are microbes that are beneficial to health and are abundant in foods, especially milk and dairy products, with health benefits such as facilitating digestion, providing immunological support, and improving intestinal flora. Prebiotics, on the other hand, are components that consist of short-chain carbohydrates and increase the activity of these health-beneficial microorganisms. Since 1989, prebiotics and probiotics are nutraceuticals used in the food industry as an adjunct and/or preservative. There are many probiotic microorganisms in nature. The most common probiotic microorganism that can survive in the human intestine is the *Lactobacillus* genus, which has many species [16, 31, 38, 48, 56].

#### Effects on Health:

Probiotics, which have been used as food by people for centuries, have gained popularity, especially in recent years, with the effects of preventing and treating diseases. The use of probiotics is very common, especially in the treatment of diarrhea caused by changes in the intestinal flora. There are many scientific studies on probiotics and prebiotics. In the light of these studies, it has been revealed that the use of prebiotics and probiotics can be used in the prevention and treatment of various intestinal diseases, especially diarrhea, atopic diseases and skin diseases. In addition, it has been determined by many studies that the use of these products supports the diet and provides healthy weight loss [21, 70, 76].

### 1.3. UNCONVENTIONAL NUTRACEUTICALS AND THEIR HEALTH EFFECTS

Unconventional nutraceuticals are artificially produced food and food products that are far from natural. In non-traditional nutraceuticals, they are divided into recombinant and fortified nutraceuticals according to their production characteristics [21, 70, 76].

#### 1.3.1. RECOMBINANT NUTRACEUTICALS

Foods that are produced by using biotechnological methods and recombinant DNA technology, which are one of the greatest inventions of our age, and that have preventive and curative effects are called recombinant nutraceuticals. Golden rice, iron rice, golden kiwi, golden mustard, multivitamin and mineral drinks, corn are the most well-known recombinant nutraceutical products [37, 61].

#### Effects on Health:

Supporting foods in terms of multivitamin, mineral, nutritional elements, antioxidant, anti-inflammatory properties by using recombinant and biotechnological methods strengthens the content of the product and can have positive effects in terms of health [7, 53, 78].

#### 1.3.1. FORTIFIED NUTRACEUTICALS

Nutraceuticals produced as a result of adding vitamins, minerals and micronutrients to the content in order to increase the value of foodstuffs and strengthen their beneficial effects on health are called fortified nutraceuticals [37, 64, 70].

#### Effects on Health:

Fortified nutraceuticals can provide positive contributions to health according to the properties of vitamins, minerals and micronutrients added to the foodstuff. For example, beverages fortified in terms of vitamins, minerals and antioxidants can have many beneficial effects on bone, cartilage, skin, intestine and cardiovascular health [21, 26, 79].

### 1.4. FUTURE OF NUTRACEUTICALS

Nutraceuticals are in the category of products that have a very good market share today and are expected to grow and develop sectorally in the next twenty years. In recent years, the nutraceutical sector has made rapid development with the emergence of conscious consumers who pay attention to what they eat and drink and give importance to their health, diet and nutrition. With these developments, phytochemical products and food extracts have been enriched; current market [13,

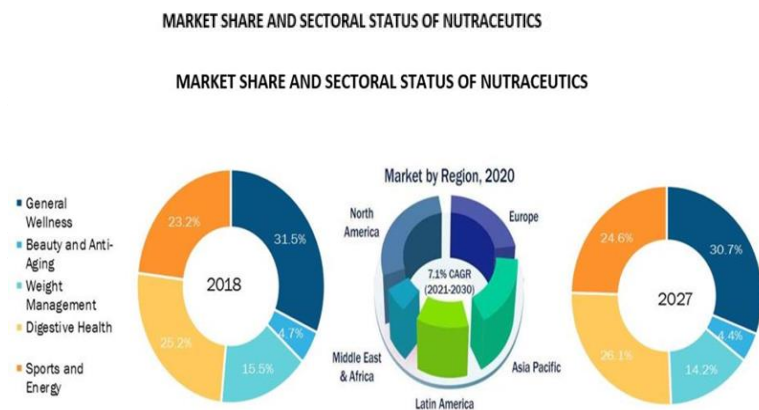


Fig. 1. Past, present and future of nutraceuticals; market share and sectoral distribution. Nutraceuticals Market to 2027 - Global Analysis and Forecasts by Type (Functional Food, Functional Beverages, Dietary Supplements, Personal Care and Pharmaceuticals); Application (General Wellness, Beauty and Anti-Aging, Weight Management, Digestive Health, Sports and Energy) Publication Month: Dec 2019 | Report Code: TIPRE00005504 | No. of Pages: 142 | Category: Food and Beverages | Status: Published

## 2 CONCLUSION

For thousands of years, plants have been used both as food and as preventive-therapeutic agents for diseases. In recent years, the importance of plants has increased due to their health benefits, reliability and economic status, and this has caused the nutraceutical industry to gain value. Many researchers have realized that proper nutrition and dietary supplements can prevent and even cure chronic diseases. These products, in addition to being used as food, have also started to be used in the prevention and treatment of various diseases. These foodstuffs, which we call nutraceuticals, have positive effects on health and their effectiveness in many diseases, including cancer, rheumatism, diabetes and other chronic diseases, has been proven by scientific studies. In addition, nutraceuticals, cheaper, more reliable, natural structure compared to pharmaceuticals and risk-benefit assessments compared to other traditional pharmaceuticals, the absence of side effects and drug interactions have increased the orientation towards nutraceuticals.

The fact that nutraceuticals are important substances in terms of health, and especially with the emergence of more conscious consumers recently, the increase in this field makes studies in this field valuable both in terms of academia and pharmaceutical/food industries. In this review, it provides comprehensive information about the definition, classification, health effects and future of nutraceuticals.

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