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Review Article

Emerging evidence on the role of secondary metabolites as nutraceutical

Saumya Das[1*] and Manas Kumar Das[2]

[1]Department of Pharmaceutical Technology, Noida Institute of Engineering and Technology, Greater Noida, Uttar Pradesh, India.
[2]Department of Pharmacy, IEC-CET, Greater Noida, Uttar Pradesh, India.

***Corresponding Author**
Saumya Das
Department of Pharmacology,
N.I.E.T. Greater Noida, Uttar Pradesh, India.
E-mail: awasthi.saumya22@gmail.com

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Abstract

Nutraceuticals have time-honored considerable interest because of their reputed safety, nutritional and therapeutic potential effects. Pharmaceutical and nutritional industries are conscious of the monetary success taking advantage of the more health-seeking consumers. Natural products such as cereals are likely to form the basis of nutraceutical as its revolution represents an enormous opportunity for growth and expansion. Wheat, rice, millets, barley, oat, buckwheat, corn, sorghum, flaxseed psyllium, brown rice, and products are notify the most common cereal based functional foods and nutraceuticals. The nutrients in the cereals have identified prospective for reducing the risk of coronary heart disease, diabetes, tumor incidence, cancer risk, blood pressure, reduces the rate of cholesterol and fat absorption, delaying gastrointestinal emptying and providing gastrointestinal health. Thus, the regular insertion of cereals and their processed products can make a payment to health endorsement and disease avoidance.

1. Introduction

Nutraceuticals (often referred to as phytochemicals or functional foods) are natural bioactive, chemical compounds that have health promoting, disease preventing or medicinal properties. The term 'nutraceutical' was coined in 1979 by Stephen DeFelice, founder and chairman of the Foundation for Innovation in Medicine located in Cranford, New Jersey. It is defined as 'a food or part of food, which provides medical or health benefits, including the prevention and treatment of disease'[1]. Nutraceuticals may range from isolated nutrients, herbal products, dietary supplements and diets to genetically engineered foods and processed products such as cereals, soups and beverages[2]. With the passage of the Dietary Supplement Health and Education Act of 1994, the definition of nutraceutical has been expanded to include vitamins, minerals, herbs and other botanicals, amino acids and any dietary substance for use by humans to supplement the diet by increasing total dietary intake[3]. The concepts of nutraceuticals, functional or medical foods, or dietary supplements are confusing and most often they can be used interchangeably. These concepts may be distinguished by their description from different points of view, e.g. functional food is a more general term to emphasize foods with specific or strong purposes[4]. Dietary supplements have more defined health roles such as vitamins, minerals, herbs or other botanicals, amino acids, and other dietary substances intended to supplement the diet by increasing the total dietary intake of these ingredients[5]. Many fruits, vegetables, grains, fish, dairy and meat products contain several natural components that deliver benefits beyond basic nutrition, such as lycopene in tomatoes, omega-3 fatty acids in salmon or saponins in soy. Even tea and chocolate have been noted in some studies to contain health-benefiting attributes (north corolina association 2007). Dietary supplements are not intended to treat or cure disease, whereas nutraceuticals more emphasize the expected results of these products, such as prevention or treatment of diseases[4].

2. Nutraceutical Categories

Due to minimal international regulations different types of products fall under the nutraceutical category. Because of this some of them have overlapping definitions. The most usual are herbals, dietary supplements, functional food and products labeled "nutraceutical". These can be grouped into the following three broad categories:-

Nutrients

Substances with established nutritional functions, such as vitamins, minerals, amino acids and fatty acids.

Herbals

Herbs or botanical products as concentrates and extracts.

Dietary supplements

Reagents derived from other sources (e.g. pyruvate, chondroitin sulphate, steroid hormone precursors) serving specific functions, such as sports nutrition, weight-loss supplements and meal replacement.

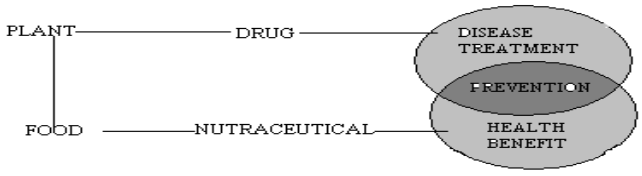

Figure 1: Nutraceutical inhabit grey area between the food and drug

3. Pharmacological Aspects of nutraceuticals

Numerous nutraceuticals currently are on the market. Table 1 represents a sample of available nutraceuticals, their components and their potential human health benefits (north corolina association, 2007).

Table 1: Pharmacological Aspects of nutraceuticals

Class/Components	Source	Potential Benefit
Carotenoids: Beta-carotene	Carrots, various fruits	Neutrlizes free radicals, which may damage cells; bolsters cellular antioxidant defenses.
Lycopene	Tomatoes processed products	Antioxidant defenses
Dietary Fiber: Insoluble Fiber	Wheat bran	Maintenance of a healthy digestive tract.
Fatty Acids: Monosodium Fatty acids	Tree nuts	May reduce risk of coronary heart disease.
Flavonoids: Flavonols	Onions, apples tea, broccoli	Neutralizer free radicals, which may damage cells; bolster cellular antioxidant defences.
Isothiocyanates: Sulforaphane	Cauliflower, broccoli, cabbage, kale	May enhance detoxification activity and bolster cellular antioxidants defenses.
Phenols: Caffeic acid, ferulic acid	Apples, Pears, Citrus fruits and Vegetables	Bolster cellular antioxidants to maintenance of vision and heart health.
Plant Stanols/Sterols	Stanol Ester dietary supplements	May reduce risk of coronary heart disease.
Stanol/Sterol esters	Dietary Supplements	May reduce risk of coronary heart disease.
Polyols: (Suger alcohols (xylitol, sorbitol, manitol)	Some chewing gums and other food applications	May reduce risk of dental cavites.
Prebiotics/Probiotics: Lactobacilli, bifidobacteria	Yogurt, other dairy and nondairy applications	May improve gastrointestinal health and systematic immunity.
Phytoestrogens: Isoflavones(daidzein, genistein)	Soybeans and Soybased foods	Maintence of bone health, healthy brain and immunity.
Soy Protein	Soybeans and Soybased foods	May reduce risk of coronary heart disease.
Sulfides/Thiols: Diothiolthiones	Cruciferous vegatables	May Contribute to maintenance of healthy immune function.

4. Market Interest of Nutraceuticals

The nutraceutical market is becoming more competitive with the entry of pharmaceutical and major food companies into the nutraceutical arena. Also, many food companies have established their nutraceutical divisions with a view toward a diversified product line. Pharmaceutical companies have also joined the race by acquiring dietary supplement producers. Recent years have marked the entry of major food and pharmaceutical companies into the nutraceutical marketplace, including Kellogg, Heinz, M&M, Quaker Oats, Unilever, Cargill, Hormel, Glaxo- SmithKline, Warner-Lambert, Johnson & Johnson and Wyeth. The 2004 global nutraceuticals market at the retail level is estimated at approximately $106 billion and is poised to grow at a compounded annual growth rate of 6.0% during 2004–2009 to exceed $140 billion in 2009.

5. Current & future Developments

Although nutraceuticals have significant promise in the promotion of human health and disease prevention, health professionals and regulatory toxicologists also could strategically work together to plan appropriate regulations to provide the ultimate therapeutic benefits to mankind [6]. For manufacturing processes of nutraceuticals, quality controls such as the composition and contents of active constituents in natural plants, and maintenance are critically important. To establish product safety and efficacy, extensive safety studies including acute, subacute, subchronic, chronic and long-term toxicity studies as well as supplementation studies in animals and clinical trials in humans are necessary[7]. The DNA microarraytechnology may be used to examine the safety and efficacy of drugs, chemicals, food supplements and nutraceuticals[8]. In summary, agricultural, food, and biomedical biotechnology continue growing as a nonstop to change our life, the potential is high that one day our foods will also serve a medicines.

Nutraceuticals are of great importance in present system of Medical and Healthcare. The lack of quality control is a major area of concern for nutraceuticals. The quality of plant material and manufacturing processes used for nutraceuticals are regulated by food laws, which lack the specificity required for botanical drugs. This can have serious consequences. Nutraceutical professionals and regulatory bodies need to play a major role for safety maintenance and advances of nutraceuticals.

Herbal compounds are considered as better treatment options for a variety of physiological conditions due to their fewer side effects. According to World Health Organization, 80% of the world population use herbal medicines.

6. Conclusion

Nutraceuticals are currently receiving recognition as being beneficial in coronary heart disease, obesity, diabetes, cancer, osteoporosis and other chronic and degenerative diseases such as Parkinson's and Alzheimer's diseases. Evidences indicate that the mechanistic actions of natural compounds involve a wide array of biological processes, including activation of antioxidant defenses, signal transduction pathways, cell survival-associated gene expression, cell proliferation and differentiation and preservation of mitochondrial integrity. In order to gain more scientific knowledge about the nutraceuticals, we aimed our review to establish the various secondary plant metabolites as a potent nutraceutical agent with the rapidly increasing interest in the nutraceutical revolution.

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