

Current concepts and prospects of herbal nutraceutical: A review

Baby Chauhan, Gopal Kumar,
Nazia Kalam, Shahid H. Ansari

Department of Pharmacognosy and
Phytochemistry, Faculty of Pharmacy,
Jamia Hamdard, New Delhi, India

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ABSTRACT

Nutraceuticals are food or part of food that provides medical or health benefits including the prevention and/or treatment of a disease. Nutraceutical has advantage over the medicine because they avoid side effect, have naturally dietary supplement, etc. Nutraceutical; on the basis of their natural source, chemical grouping, categories into three key terms –nutrients, herbals, dietary supplements, dietary fiber, etc. The most rapidly growing segments of the industry were dietary supplements (19.5 percent per year) and natural/herbal products (11.6 percent per year). Global nutraceutical market is estimated as USD 117 billion. FDA regulated dietary supplements as foods to ensure that they were safe. In 2006, the Indian government passed Food Safety and Standard Act to regulate the nutraceutical industry. Herbal nutraceutical is used as a powerful instrument in maintaining health and to act against nutritionally induced acute and chronic diseases, thereby promoting optimal health, longevity, and quality of life.

Key words: Dietary supplement, global market, nutraceutical, regulation

INTRODUCTION

The term nutraceuticals was coined from “nutrition” and “pharmaceutical” by Stephen Defelice MD, founder and chairman of the foundation for innovation in medicine (FIM) Cranford, New Jersey, in 1989.^[1] According to Defelice “nutraceuticals are food or part of a food that provides medical or health benefits including the prevention and/or treatment of a disease.”^[2] Greek physician HIPPOCRATES (known as father of medicines) said “let food be your medicine” The philosophy behind is “focus on prevention” Other words used in the context are Dietary supplements, functional food, multi-functional food, etc. Functional foods are ordinary foods that have

components, ingredients that incorporated into give them a specific medicinal or health benefit moreover nutritional effect.^[3]

According to dietary supplement, health and education act (DSHEA) dietary supplements are products intended to supplement the diet that bears or contains one or more of the following dietary ingredients: a vitamin, a mineral, an herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing the total daily intake, or a concentrate, metabolite, constituent, extract, or combinations of these ingredients.^[4] It may be taken in the form of pill capsule, tablet, or liquid form. It is not represented for use as a conventional food or as the sole item of a meal or diet. It is labeled as a “dietary supplement.”^[5] Under the DSHEA (1994), the manufacturer of a dietary supplement is responsible for ensuring that the dietary supplement is safe before it is marketed.^[6]

Simply, Nutraceuticals means, NUTRITIVE + PHARMACEUTICAL: A food stuff (as a fortified food or dietary supplement) that provides health benefits.

The functional food concept can be defined as “Food products to be taken as part of the usual diet in order to have beneficial effects that go beyond basic nutritional function” [Tables 1-4].

Address for correspondence:

Prof. S.H. Ansari,
Department of Pharmacognosy and Phytochemistry,
Faculty of Pharmacy, Jamia Hamdard, New Delhi-110062, India.
E-mail: shansari189@rediffmail.com

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HEALTH BENEFITS

- Avoid the side effect.
- May increase the health beneficial effect.
- May have naturally dietary supplement, so do not have unpleasant side effect.
- May increase the health value, our diet and improve medical condition of human.
- May easily be available and economically affordable.

Nutritional therapy is a healing system using dietary therapeutics or nutraceuticals as a complementary therapy. This therapy is based on the belief that foods can not only be sources of nutrients and energy but could also provide medicinal benefits.

According to nutraceutical and nutritional therapy theory, it achieves this goal by using efficacy of such nutraceuticals in detoxifying the body, avoiding vitamin and mineral deficiencies, and restoring healthy digestion and dietary habit. Phytonutrients basically is plant nutrients with particular biological activities in supporting human health.^[7]

Table 1: As per chemical classification^[9]

Class	Example
Inorganic mineral supplements	Minerals
Vitamin supplements	Vitamins
Digestive enzymes	Enzymes
Probiotics	<i>Lactobacillus acidophilus</i>
Prebiotics	Digestive enzymes
Dietary fibers	Fibers
Cereals and grains	Fibers
Health drinks	Fruits juice
Antioxidants	Vitamin c
Phytochemicals	Carotenoids
Herbs as a functional foods	Soya proteins

The phytochemical work by following way:

1. Substrate for biochemical reactions.
2. Cofactors of enzymatic reactions.
3. Inhibitors of enzymatic reactions.
4. Absorbents that bind to and eliminate undesirable constituent in the intestine.
5. Enhance the absorption and/or stability of essential nutrients.
6. Selective growth factor for beneficial bacteria.
7. Fermentation substrate for beneficial bacteria.
8. Selective inhibitors of deleterious intestinal bacteria.
9. Scavengers of reactive or toxic chemicals.
10. Ligands that agonize or antagonize cell surface or intracellular receptors.^[8]

CLASSIFICATION

Nutraceuticals or functional foods can be classified on the basis of their natural sources, pharmacological conditions, or as per chemical constitution of the products.

1. On the basis of natural source, it can be classified as the products obtained from plants, animals, minerals, or microbial sources.
2. Nutraceuticals as per the chemical groupings.

Category of Nutraceutical

- Substances with established nutritional functions, such as vitamins, minerals, amino acids, and fatty acids–Nutrients.
- Herbs or botanical products as concentrates or extracts–Herbals.
- Reagents derived from other sources (e.g., pyruvate, chondroitin sulfate, steroid hormone precursors) serving specific functions, such as sports nutrition, weight-loss supplements, fortified conventional foods, and meal replacements–Dietary supplements.

Table 2: Various vitamins and their health benefits

Name of vitamin	Source	Health benefits
Vitamin A ₁	Fish liver oil, liver	Antioxidants maintenance of healthy skin, vision and mucous membrane
Vitamin A ₂	Cheese, butter carrots, spinach, pumpkins, papaya	
Vitamin D	Fish liver oil, wheat germ oil, egg yolk, milk, butter	Essential for formation of bones and teeth, helps the body absorb and use calcium
Vitamin E	Wheat germ oil, cotton seed oil, peanut oil	Antioxidant, helps form blood cells, muscles, lung and nerve tissue, boosts the immune system
Vitamin K	Cabbage, cauliflower, tomatoes.	Essential for blood clotting
Vitamin B ₁	Cereals, pulses	Essential in neurologic
Vitamin B ₂	Nuts, yeast	Helps in energy production
Vitamin B ₃ (pantothenic)	Liver, meat, yeast	Helps to convert food in to energy and maintain proper brain function
Folic acid	Green vegetables	Essential in pregnancy, helps in RBC formation
Nicotinic acid (B ₃)	Yeast, egg, milk	Required for various nervous system function
Pyridoxine (B ₆)	Banana, tomato juice	Helps to produce essential proteins and convert protein in to energy
Biotin (Vitamin H)	Swiss chard	Required for various metabolic functions

Table 3: Common herbals as nutraceuticals

Common name	Biological name	Constituent	Health benefits
Garlic	Dried bulbs of <i>Allium sativum</i> (Liliaceae).	Alliin and allicin	Anti-inflammatory, antibacterial, antigout, nerve tonic
Maiden hair tree	Leaves of <i>Ginkgo biloba</i> (<i>Ginkgoaceae</i>).	Ginkgolide and bilobalide	PAF antagonist, memory enhancer, antioxidant
Ginger	Rhizomes of <i>Zingiber officinale</i> (<i>Zingiberaceae</i> .)	Zingiberene and gingerols	Stimulant, chronic bronchitis, hyperglycemia and throat ache
Echinacea	Dried herb of <i>Echinacea purpurea</i> (<i>Asteraceae</i>)	Alkylamide and echinacoside	Anti-inflammatory, immunomodulator, antiviral
Ginseng	Dried root of <i>Panax ginseng</i> (<i>Araliaceae</i>)	Ginsenosides and Panaxosides	Stimulating immune and nervous system and adaptogenic properties
Liquorice	Dried root of <i>Glycyrrhiza glabra</i> (<i>leguminosae</i>)	Glycyrrhizin and liquirtin	Anti-inflammatory and Anti-Allergic, Expectorant
St. John's wort	Dried aerial part of <i>Hypericum perforatum</i> (<i>Hypericaceae</i>)	Hypericin and hyperforin	Antidepressant, against HIV and hepatitis-c virus ^[18]
Turmeric	Rhizome of <i>Curcuma Longa</i> (<i>Zingiberaceae</i>)	Curcumin	Anti-inflammatory, antiarthritic, anticancer and antiseptic
Onion	Dried bulb of <i>Allium cepa</i> Linn. (Liliaceae)	Allicin and alliin	Hypoglycemic activity, Antibiotic and anti-atherosclerosis
Valeriana	Dried root of <i>Valeriana officinalis</i> Linn. (<i>Valerianaceae</i>)	Valerenic acid and valerate	Tranquillizer, migraine and menstrual pain, intestinal cramps, bronchial spasm.
Aloes	Dried juice of leaves <i>Aloe barbadensis</i> Mill. (Liliaceae)	Aloins and aloesin	Dilates capillaries, anti-inflammatory, emollient, wound healing properties
Goldenseal	Dried root of <i>Hydrastis Canadensis</i> . (<i>Ranunculaceae</i>)	Hydrastine and berberine	Antimicrobial, astringent, antihemorrhagic, treatment of mucosal inflammation
Senna	Dried leaves of <i>Cassia angustifolia</i> (<i>Leguminosae</i>)	Sennosides	Purgative,
Asafoetida	Oleo gum resin of <i>Ferula assafoetida</i> L. (<i>Umbelliferae</i>)	Ferulic acid and umbellic acid	Stimulant, carminative, expectorant
Bael	Unripe fruits of <i>Aegle marmelos</i> Corr. (<i>Rutaceae</i>)	Marmelosin	Digestive, appetizer, treatment of diarrhea and dysentery
Brahmi	Herbs of <i>Centella asiatica</i> (<i>Umbelliferae</i>)	Asiaticoside and madecassoside	Nervine tonic, spasmolytic, anti-anxiety

Table 4: List of marketed nutraceutical products

Product	Category	Contents	Manufacturer
Calciorol D-3	Calcium supplement	Calcium and vitamins	Cadilla healthcare limited, Ahmedabad, India
GRD ^[23-25]	Nutritional supplement	Proteins, vitamins, minerals and carbohydrates	Zydus Cadila Ltd. Ahmedabad, India
Proteinex [®]	Protein supplement	Predigested proteins, vitamins, minerals and carbohydrates	Pfizer Ltd., Mumbai, India
Coral calcium	Calcium supplement	Calcium and trace minerals	Nature's answer, Hauppauge, NY, USA
Chyawanprash	Immune booster	Amla, ashwagandha, pippali	Daburindia Ltd.
Omega woman	Immune supplement	Antioxidants, vitamins and phytochemicals (e.g. Lycopene and resveratrol)	Wassen, Surrey, U.K.
Celestial Healthtone	Immune booster	Dry fruit extract	Celestial Biolabs Limited
Amiriprash (Gold)	Good immunomodulator	Chyawanprash Avaleha, Swarnabhasma and RasSindur	UapPharma Pvt. Ltd.

Dietary supplements are not intended to treat or cure disease,^[10] whereas nutraceuticals more emphasize the expected results of these products, such as prevention or treatment of diseases.^[11]

Some of the most common ways of classifying nutraceuticals

can be based on food sources, mechanism of action, chemical nature, etc. The food sources used as nutraceuticals are all natural and can be categorized as

1. Dietary Fiber.
2. Probiotics.
3. Prebiotics.

4. Polyunsaturated fatty acids.
5. Antioxidant vitamins.
6. Polyphenols.
7. Spices^[12]

Nutraceutical can be broadly classified into the following 2 groups:

- i) Potential nutraceuticals.
- ii) Established nutraceuticals.

A potential nutraceutical could become an established one only after efficient clinical data of its health and medical benefits are obtained.^[13,14]

GLOBAL DEMAND OF NUTRACEUTICAL

The nutraceutical industry lies under three main segments which include functional foods, dietary supplements, and herbal/natural products.^[15] Global nutraceutical market is estimated as USD 117 billion (INR 5148 billion).^[16] In 2007, nutraceuticals sale is projected to reach \$74.7 billion at an AAGR of 9.9%. This assumes a world economic recovery in 2003 and an end to price competition [Figure 1].^[17]

According to a recent report, the total market for nutraceuticals in India is growing at 21 percent per annum. It is currently valued at INR 44bn (€621 m), but could be worth more than INR 95bn in four years.^[19]

As a concept, “Nutraceuticals” is still in its stage of infancy in India. But it has been growing much faster than global rates at CAGR of 18% for the last 3 years driven by functional food and beverages categories.^[20] The most rapidly growing segments of the industry were dietary supplements (19.5 percent per year) and natural/herbal products (11.6 percent per year).

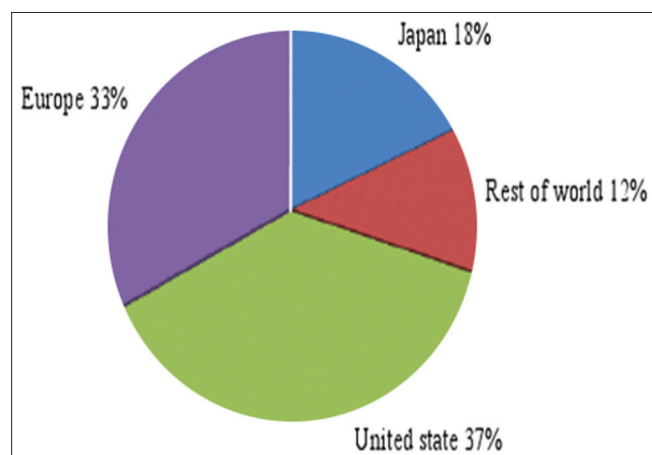


Figure 1: Nutraceutical market in different countries

REGULATIONS

A food stuff (as a fortified food or a dietary supplement) that provides health benefits, if indeed a claim was made that implied medicinal benefit regarding a nutraceutical product, the product would be required to comply with the regulatory requirements for medicinal products, in respect of safety, efficacy, and quality testing and marketing authorization procedures.^[14] For decades, FDA regulated dietary supplements as foods to ensure that they were safe and wholesome and that their labeling was truthful and not misleading. In 2006, the Indian government passed Food Safety and Standard Act to integrate and streamline the many regulations covering nutraceuticals, foods, and dietary supplements. The act calls for the creation of the Food Safety and Standards Authority (FSSA).^[21]

BENEFITS OF IMPLEMENTATION OF FSSA ACTS

- Unification of eight laws, i.e. steps to Harmonization.
- Alignment of international regulations.
- Science-based standards.
- Clarity and uniformity on novel food areas.
- Help curb corruptions.

Unlike the US, where the DSHEA is in place to regulate these products, in India the Government is in the process of drafting a law to regulate manufacturing, importing, and marketing of health foods, dietary supplements, and other nutraceuticals^[22] and finally Indian food safety standard bill 2005 signed into law, promising a major impact on Indian food processing industry. The Indian Food Safety and Standard Act came into enforcement in 2006 with the following two main objectives:

- To introduce a single statute relating to food, and
- To provide for scientific development of the food processing 2009 industry.^[21]

GOVERNMENT REGULATIONS – NLEA 1990

Nutrition Labeling and Education Act of 1990 (NLEA) defines how food is labeled, including nutrition labeling, in accordance with definitions established by FDA, and providing for the use of claims about the relationship between nutrients and diseases or health-related condition.

Benefits of Regulation

- Allows greater legal security and more predicable environment.
- Supports innovation (food and drink products).
- Prevents unfair competition from manufactures using false or misleading claims.

- If positive claims cannot be made, the regulation does not oblige anyone to make negative claims about the product.^[26]

CONCLUSION

Nutraceuticals have proven health benefits and their consumption (within their acceptable Recommended Dietary Intakes) will keep diseases at bay and allow humans to maintain an overall good health. Although nutraceuticals have significant promise in the promotion of human health and disease prevention, health professional, nutritionists, and regulatory toxicologist should strategically work together to plan appropriate regulation to provide the ultimate health and therapeutic benefit to mankind. That is why implementation of regulatory body is necessary to standardize the nutraceutical industry. It is also necessary to review this topic because the nutraceutical industry is growing at a rate far exceeding expansion in the food and pharmaceutical industries. Herbal nutraceutical is a powerful instrument in maintaining health and to act against nutritionally induced acute and chronic diseases, thereby promoting optimal health, longevity, and quality of life.

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