



CURRENT TRENDS AND OPPORTUNITIES IN NUTRACEUTICAL

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ABSTRACT

The rising awareness of consumers toward the health benefits of foods and their nutritional benefits for potential disease prevention and health enhancement is the driving force of the global functional food and nutraceutical market. Functional foods are the medicinal foods that provide health benefits beyond energy and essential nutrients. Many studies, including several European Commission (EC) funded projects, have led to the understanding of the potential mechanisms of biologically active components in food, which could improve health and probably reduce the risk of disease while enhancing our overall well-being. Functional foods and nutraceutical products are helping to improve health, reducing the healthcare costs, and supporting the economic development in rural areas. Growing demand for functional foods is also helping the producers to diversify their agriculture and marine-based crops and promoting research and innovation. There is growing demand for functional foods, especially in developed economies due to increasing awareness toward health benefits of functional foods and an increase in disposable income. The USA is the world's largest market for functional foods and is expected to witness 21 % growth in the coming years owing to the growing demand for functional foods and expected to reach the value of USD 8.62 billion by 2015. This growth is mainly driven by the continuously growing demand for energy drinks and fortified dairy products. Meanwhile, country-specific regulations and health claim substantiation are some of the challenges the functional food and nutraceutical market continues to face.

INTRODUCTION

Consumers are deeply concerned about how their health care is managed, administered and priced. They are frustrated with the expensive, high-tech, disease-treatment approach predominant in modern medicine; the consumer is seeking complementary or alternative beneficial products and the red tape of managed care makes nutraceuticals particularly appealing. Nutraceuticals (often referred to as phytochemicals or functional foods) are natural bioactive, chemical compounds that have health promoting, disease preventing or medicinal properties. Nutraceuticals are found in a mosaic of products emerging from (a) the food industry, (b) the herbal and dietary supplement market, (c) pharmaceutical industry, and (d) the newly merged pharmaceutical/ agribusiness/ nutrition conglomerates. The term ‘nutraceuticals’ was coined in 1979 by Stephen DeFelice, founder and chairman of the Foundation for Innovation in Medicine located in Cranford, New Jersey[15]. It was defined as ‘a food or part of food that 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 "designer" foods and processed products such as cereals, soups and beverages. Doubtlessly, many of these products possess pertinent physiological functions and valuable biological activities.[2]

With the passage of the Dietary Supplement Health and Education Act of 1994, the definition of nutraceuticals 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 and subsequently increased the use of nutraceuticals dramatically.[3]

Nutraceuticals In India - Growth And Opportunities

Along with the growing healthcare industry in India there is an emerging trend in ‘Fast Moving Healthcare Goods (FMHG)’ in India; worldwide known as Nutraceuticals, which are by definition, ingredients with human health benefits beyond basic nutrition. Nutraceuticals and functional food ingredients are ingredients with human health benefits beyond basic nutrition. Nutraceuticals market in 2009 was INR27 billion and expected to grow at 20% CAGR to achieve a market size of INR40.1 billion in 2011. Global nutraceuticals market was estimated USD128.4 billion in 2008 growing at 7% (CAGR). The US has been the major market for nutraceuticals with India and China becoming fastest growing markets. Nutraceuticals are gaining acceptance for their ability to address several diseases[17]. Large global food companies, which are always on the lookout for ways to diversify their product line and still turn a profit, have set up functional food or nutraceuticals divisions. Pharmaceutical companies are now adopting the nutraceuticals and the recent trend is convergence of food manufacturing companies with pharmaceuticals to implement the research necessary for drug discovery; the move into the less expensive and time consuming nutraceuticals research process. It is thus becoming a logical progression for many food companies to enter into nutraceuticals market.[4]

Nutraceuticals which have a general health care purpose stands a great opportunity in Indian markets as they have the requisite knowledge and long-tradition which can be transformed into global outsourcing business. Growing interest in the health benefits of food is a worldwide trend that presents opportunities for nutraceuticals business[16]. The proposed study is aimed at understanding the current trends and opportunities for nutraceuticals in Indian market. The study will evaluate factors that will drive the future demand for nutraceuticals in Indian market. Information regarding the perception of nutraceuticals (protein supplements) among the doctors as well as direct consumers mind would enable a company to identify the need and hence to establish market awareness for nutraceuticals with reference to protein supplements. Such vital information of nutraceuticals (protein supplements) collected helps in launching a new product (protein supplement) and in developing new strategies for the marketing force

OBJECTIVES

Our study is aimed at achieving the following objectives:

PRIMARY OBJECTIVES

1. Understand the current trends and opportunities in nutraceuticals with reference to protein supplements in Indian market.
- 2.To make suitable suggestions and recommendations based on the findings of the studyto improve the market awareness.

SECONDARY OBJECTIVES

- 1.To evaluate factors that will drive the future demand for nutraceuticals with reference toprotein supplements in Indian market.
- 2.To determine fast moving protein supplements brands currently available in the market.

Review Of Literature

➤ A variety of terms have appeared world-wide such as nutraceuticals, medifoods, vitafoods, functional foods and the more traditional dietary supplements and fortified foods. However, the term “Functional Foods” have become the predominant one even though several organizations have attempted to differentiate this emerging food category. The term “Functional Foods” was first introduced in Japan in the mid-1980s and refers to processed foods containing ingredients that aid specific body functions, in addition to being nutritious. Presently, there is no universally accepted term for functional foods.

➤ The term nutraceutical was coined from nutrition and pharmaceutical in 1989 by Stephen DeFelice, MD, founder and chairman of the ‘Foundation for Innovation in Medicine’ (FIM), Cranford, NJ. According to DeFelice, nutraceutical can be defined as, a food (or part of a food) that provides medical or health benefits, including the prevention and/or treatment of a disease. With the passage of the Dietary Supplement Health and Education Act of 1994, the definition of nutraceuticals 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 and this subsequently increased the use of nutraceuticals.

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CLASSIFICATION

Based upon the products

Nutraceuticals are defined as non-specific biological therapies used to promote wellness, prevent malignant processes and control symptoms they can be broadly categorized as given below:

1. Antioxidant
2. Vitamins
3. Minerals
4. Herbals/Botanicals
5. Non-Herbals
6. Proteins
7. Fibers

Antioxidants

Antioxidants are substance which retard or prevent deterioration, damage, or destruction caused by oxidation. Antioxidants are substances that may protect our body cells against the effects of free radicals. Free radicals are molecules produced when our body breaks down food, or by environmental exposures like tobacco smoke and radiation. Free

radicals can damage cells, and may play a role in heart disease, cancer and other diseases.[9]

Some antioxidants are vitamins, such as vitamin A (and beta-carotene), vitamin C, vitamin E, others are minerals, such as selenium, zinc, and molybdenum. Additional nutrients, such as L- Glutathione, N-acetyl cysteine and co-enzyme Q10 all display antioxidant activity, other nutrients not strictly essential to the body[6], nevertheless show excellent activity, include compounds such as Anthocyanidins, Bioflavonoids and Lycopene. Many herbs also contain excellent ranges of antioxidants and are now being included in the list.

Vitamins

In humans, there are thirteen vitamins, divided into two groups, the four fat-soluble vitamins(A, D, E and K) and the nine water-soluble vitamins (vitamins B and vitamin C).

Common vitamins nutrients and their associated health	
Benefits	
Nutrients	Health benefits
Fat Soluble Vitamins	
Vitamin A	Antioxidant, essential, for growth and development, maintains healthy vision, skin and mucous membranes, may aid in the prevention and treatment of certain cancers and in the treatment of certain skin disorders.
Vitamin D	Essential for formation of bones and teeth, helps the body absorb and use calcium

Vitamin E	Antioxidant, helps form blood cells, muscles, lung and nerve tissue, boosts the immune system
Vitamin K	Essential for blood clotting

Water Soluble Vitamins

Vitamin C	Antioxidant, necessary for healthy bones, gums, teeth and skin, helps in wound healing, may prevent common cold and attenuate its symptoms
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Vitamin A (Beta Carotene)

Vitamin A has a number of functions in the body. It plays an essential role in the function of the retina. It is necessary for the growth and differentiation of epithelial tissue and is required for the growth of bones, reproduction and embryonic development. Together with certain carotenoids, vitamin A enhances immune function, reduces the consequences of certain infectious diseases and may protect against the development of certain malignancies[7]

Vitamin C (Ascorbic acid)

Ascorbic acid is one of the strongest reductants and radical scavengers and reduces stable oxygen, nitrogen and thiol radical and acts as a primary defence against radicals in the blood.

Ascorbic acid acts as a synergist with tocopherol for the reduction of lipid peroxy

radical within the lipid compartment by reacting with tocoperoxy radical and regenerating active tocopherol. Ascorbate appears to belong to the first line of antioxidant defence. Ascorbate should prove very helpful in degenerative processes caused by oxidative stress[8]

Vitamin E (Tocopherol)

Tocopherols belong to a class of phenolics antioxidants which can inhibit autooxidation by scavenging free radicals and by reacting with singlet oxygen. Vitamin E is well accepted as nature's most effective lipid – soluble, chain – breaking antioxidant, which protects cell membranes from peroxidative damage. Vitamin E has a significant role in preventing or minimizing peroxidation damage in biological systems.[18]

Minerals

Minerals are natural inorganic compounds. Humans need small amounts of about 14 minerals to maintain normal body function and good health. There are two types of minerals:

- 1) Macro minerals
- 2) Trace minerals

Minerals	Health benefits
Calcium	Essential for building bones and teeth and maintaining bone strength, important in nerve, muscle and glandular functions
Iron	Helps in energy production, helps to carry and transfer oxygen to tissues
Magnesium	Essential for healthy nerve and muscle function and bone formation, may help prevent premenstrual syndrome (PMS)
Phosphorous	Essential for building strong bones and teeth, helps in formation of genetic material, energy production and storage
Chromium	With insulin helps to convert carbohydrates and fats into energy
Cobalt	Essential component of vitamin B12, but ingested cobalt is metabolized in vivo to form the B12 coenzymes
Selenium	Essential for healthy functioning of the heart muscle
Zinc	Essential for cell reproduction, normal growth and development in children, wound healing, production of sperm and testosterone

Herbals/Botanicals

Herbals are as old as human civilization and they have provided a complete storehouse of remedies to cure acute and chronic diseases. The knowledge of herbals has accumulated over thousands of years so that today we possess many effective means of ensuring health care. Numerous nutraceuticals are present in medicinal herbs as key components. A list of commonly known herbal and phytochemicals is given below[10]

Herbals/Botanicals	
Compound	Therapeutic activity
Aloe vera gel <i>(Aloe vera L. N.L. Burm.)</i>	Dilates capillaries, anti-inflammatory, emollient, wound healing properties
Echinacea <i>(Echinacea purpurea L.)</i>	Immunostimulant, treatment of cold and flu symptoms
Evening primrose oil <i>(Oenothera biennis L.)</i>	Dietary supplement of linoleic acid, treatment of atopic Eczema
Garlic <i>(Allium sativum L.)</i>	Antibacterial, antifungal, antithrombotic, hypotensive, fibrinolytic, antihyperlipidemic, anti-inflammatory
Ginger <i>(Zingiber officinale Rosc.)</i>	Carminative, antiemetic, cholagogue, positive inotropic, treatment of dizziness

Non herbals

Non herbal category includes chondroitin, glucosamine and coenzyme Q10 as well as dietary supplements which have been developed to manage a variety of diseases[19]. The prepackaged nutritionally balanced meals influence multiple risk factors for patients with cardiovascular disease.

Protein Processing: Digestion, Absorption, and Metabolism

Protein digestion begins when the food reaches the stomach and stimulates the release of hydrochloric acid (HCl) by the parietal cells located in the gastric mucosa of the GI (gastrointestinal) tract. Hydrochloric acid provides for a very acidic environment, which helps the protein digestion process in two ways:

- (1) Through an acid-catalyzed hydrolysis reaction of breaking peptide bonds (the chemical process of breaking peptide bonds is referred to as a hydrolysis reaction because water is used to break the bonds).[13]
- (2) Through conversion of the gastric enzyme pepsinogen (an inactive precursor) to pepsin (the active form). Pepsinogen is stored and secreted by the "chief cells" that line the stomach wall. Once converted into the active form, pepsin attacks the peptide bonds that link amino acids together, breaking the long polypeptide chain into shorter segments of amino acids known as dipeptides and tripeptides. These protein fragments are then further broken down in the duodenum of the small intestine. The brush borders enzymes which work on the surface of epithelial cells of the small intestines, hydrolyze the protein fragments into amino acids.[14]

The cells of the small intestine actively absorb the amino acids through a process that requires energy. The amino acids travel through the hepatic portal vein to the liver, where the nutrients are processed into glucose or fat (or released into the bloodstream).[11]

The tissues in the body take up the amino acids rapidly for glucose production, growth and maintenance, and other vital cellular functioning. For the most part, the body does not store protein, as the metabolism of amino acids occurs within a few hours. Amino acids are metabolized in the liver into useful forms that are used as building blocks of protein in tissues[20]. The body may utilize the amino acids for either anabolic or catabolic reactions. Anabolism refers to the chemical process through which digested and absorbed products are used to effectively build or repair bodily tissues, or to restore vital substances broken down through metabolism. Catabolism, on the other hand, is the

process that results in the release of energy through the breakdown of nutrients, stored materials, and cellular substances. Anabolic and catabolic reactions work hand-in-hand, and the energy produced in catabolic processes is used to fuel essential anabolic processes. The vital biochemical reaction of glycolysis (in which glucose is oxidized to produce carbon dioxide, water, and cellular energy) in the form of adenosine triphosphate, or ATP, is a prime example of a catabolic reaction. The energy released, as ATP, from such a reaction is used to fuel important anabolic processes, such as protein synthesis. The metabolism of amino acids can be understood from the dynamic catabolic and anabolic processes. In the process referred to as deamination, the nitrogen- containing amino group (NH_2) is cleaved from the amino acid unit. In this reaction, which requires vitamin B6 as a cofactor, the amino group is transferred to an acceptor keto-acid, which can form a new amino acid. Through this process, the body is able to make the nonessential amino acids not provided by one's diet.

Methodology

Materials and methods:

Sources of data:

a) Primary data:

Through questionnaire method primary data was obtained from doctors and chemists.

b) Secondary source:

The related information was obtained from:

- Text books
- Nutraceuticals journals
- Pharma biz
- Pharma pulse
- Internet

Survey areas:

The survey was carried out in two cities – Bangalore and Delhi

Sample size:

The sample size consisted of 100 doctors and 50 chemists.

- 50 doctors and 25 chemists from Bangalore.
- 50 doctors and 25 chemists from Delhi

The doctors' sample from both the cities consisted of GPs, physicians and gynecologist.

Methods of data collection:

- Preliminary communication with doctors and chemists to obtain their consent to participate in the survey.
- Structured, undisguised questionnaires were prepared to collect information from doctors and chemists separately. They were qualified by conducting a pilot survey amongst 10 doctors and 10 chemists in Bangalore and Delhi each. Necessary changes were incorporated in the questionnaires after the survey.
- The qualified questionnaires were then administrated to the remaining doctors and chemists.
- All the details obtained were segregated into qualitative variables and evaluated.

Data Analysis Method:

The data obtained was tabulated using Microsoft excel and various aspects were analyzed and compared.

CONCLUSION

In the last few years, a new perception has been shaped in the general public regarding the incorporation of natural products and functional foods into everyday life. Thus, the market of nutraceuticals greatly expanded due to their acknowledged health benefits against several pathologies and their increased therapeutic efficacy compared to known conventional formulations. Rapid progress in the field of natural compound databases and chemoinformatics tools facilitates the design and development of novel nutraceuticals with enhanced bioactivities by applying in silico screening methodologies. Furthermore, the combination of in silico techniques with modern nanonization strategies is the key driver in all the innovations related to nutraceuticals. Therefore, nanonutraceuticals are considered the next generation nutraceuticals since they present improved properties, such as enhanced stability and solubility and improved absorption and bioavailability, and thus, more targeted delivery and upgraded therapeutic efficacy. Nonetheless, further investigation and clinical data are required to draw safe conclusions regarding the toxicity and safety of these nanoformulations. Finally, it is important to stress that both the research community as well as international and local authorities should establish shared legislation and common protocols to ensure the safety of consumers

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