

**NUTRACEUTICALS STRIDE IN MEDICINAL ARENA**

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**\*Corresponding author e-mail:** [bindiya.2691@gmail.com](mailto:bindiya.2691@gmail.com)**ABSTRACT**

Nutraceutical is term coined to describe substances which are *not* traditionally recognized nutrients but which have positive physiological effects on the human body. The concept of nutraceuticals was started from the survey in U.K., Germany and France which concluded that diet is rated more highly by consumers than exercise or hereditary factors for achieving good health. Nutraceuticals are food product that provides health as well as medical benefits including the prevention and treatment of disease without any risk of toxicity or adverse effects. Such products range from dietary supplements to genetically engineered foods, herbal products and processed foods. The main aim of this article is to explore and discuss the role of nutraceuticals in the prevention or treatment of underlying causes of disease.

**Keywords :** Nutraceutical, herbal products, food, dietary supplement, vitamins.**INTRODUCTION**

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. It was defined as “a food or part of food”, that provides medical or health benefits including the prevention and treatment of disease.<sup>[1]</sup> They are frustrated with the expensive, high tech, disease treatment approach prominent in modern medicine, the consumer is seeking complementary or alternative beneficial products and the red tape of managed care makes nutraceuticals particularly appealing.<sup>[2]</sup> Over the last few decades, detailed knowledge of the influence of diet on human health has increased greatly and populations across the world have become conscious of the need for a so called “Healthy diet”.<sup>[3]</sup> Growing concerns about the diet’s impact on health reflects the rising economic and social costs associated with the diet related disease, such as cancer, diabetes and cardio vascular disease.<sup>[4]</sup> When the consumers have doubts about their eating habits, they are encouraged by the media to seek dietary supplements in the form of pills, capsules or drinks. 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.

Most popular amongst these supplements are :

(a) Nutraceuticals, which are defined by Schaafsma and Ford as supplements containing essential nutrient like vitamins and minerals whose bioactivity is not in doubt.

(b) Nutraceuticals whose activities in the human body still need to be unequivocally demonstrated.<sup>[5,6,7]</sup>

Doubtlessly, many of these products possess pertinent physiological functions and valuable biological activities.<sup>[8]</sup> 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 substances for use by humans to supplement the diet by increasing the use of nutraceuticals dramatically.<sup>[9,10]</sup>

Among the nutraceuticals, the importance of  $\alpha$ -3 fatty acids like  $\alpha$ -linolenic acids has been widely published because they are precursors of important long chain fatty acids, such as eicosapentaenoic acid (EPA), which cannot be synthesized in the human

body. Yet they are vital for the normal functioning and development of the brain, and are believed to reduce the plaque formation in the arteries.<sup>[11]</sup> Vegetables oil or fatty fish like herrings or sardines are good sources of  $\alpha$ -3 fatty acids, but not all communities have ready access to these foods. More recently, however, attention has focused on functional food and nutraceuticals that are demonstrated to affect beneficially one or more target functions in the body beyond adequate nutritional effects, in a way that is relevant to either improved state of health and well being and or reduction of risk of disease".<sup>[13]</sup> However, the functional food concepts is different from the nutraceuticals and can be defined as food products to be taken as part of the useful diet in order to have beneficial effects that go beyond what are known as traditional nutritional effects.<sup>[14]</sup> The goal of achieving an optimal or maximal state of nutrition and health is becoming an increasing challenge with the introduction of many nutraceuticals.<sup>[15]</sup>

Today most studies have focused on consumer awareness and acceptance of functional foods and nutraceuticals,<sup>[16]</sup> evaluation of functional food consumers perception of these products and their efficacy,<sup>[17]</sup> characterization of functional food consumers and regulations of functional food and health claims.<sup>[18]</sup> Other groups have focused on functional food consumption and health risks, factors motivating consumptions of functional food. Broadly these studies highlight the predominant role of consumer perceptions of the efficacy of such products and find significant variations in usage protensity across individuals. The ascribed introduction of many nutraceuticals is legion. Various products are claimed not only to reduce the risk of cancer and heart disease but also to prevent or treat hypertension, high cholesterol, excessive weight, osteoporosis, diabetes, arthritis, macular degenerations (leading to irreversible blindness). Cataracts, menopausal symptoms, insomnia, diminished memory and concentrations, digestive upsets and constipation and not to mention headaches.<sup>[19]</sup> Nutraceuticals are marketed in concentrated forms as pills, capsules, powders and tinctures wither as a single substances or as combination preparations.<sup>[20]</sup> Nutraceuticals are non-specific biological therapies used to promote wellness, prevent malignant processes and control symptoms. These can be grouped into the following three broad categories.<sup>[21]</sup>

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

2. Herbs or botanical products as concentrates and extract- Herbals.

3. Reagents derived from other sources e.g Pyruvate, Chondroitin sulphate, steroid hormones, precursors) serving specific functions such as sports nutrition-dietary supplements.

The relationship between nutraceuticals and health benefits include the importance of calcium in preventing osteoporosis for late in the prevention of neutral tube defects in infants and the role of decreasing dietary fat and increasing fiber in the prevention of colon cancer. Phytochemicals and antioxidant are two specific types of nutraceuticals. Phytochemicals is a term that means plant chemicals. The word comes from the Greek root, "Phyto" meaning plant. There are over 900 phytochemicals found in foods, and one serving of a fruit or vegetables may have as many as 100 different phytochemicals. Fruits and vegetables that are bright in colour – yellow, red, green, blue and purple- usually have the most phytochemicals and nutrients. Antioxidants are compounds in fruits and vegetables that may be helpful in avoiding chronic disease. They act as a defense systems against oxidative damage in our bodies and may be useful in avoiding chronic disease and the effects of aging 22. The most commonly used Nutrients are antioxidants, water and fat soluble vitamins. Many potentials benefits have been attributed to antioxidant use in the form of dietary intake or supplementations. Antioxidant in general may be useful in the prevention of cancer and cerebrovascular disease.<sup>[23-27]</sup>

### NEED FOR NUTRACEUTICALS

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 and are therefore seeking for complementary or alternative beneficial products.<sup>[28]</sup>

### MARKET SCENARIO OF NUTRACEUTICALS

There is a growing demand for plant based medicines, health products, pharmaceuticals, food supplement, cosmetics etc, in the national and international market. Global demand for nutraceuticals will goes on increasing. Nutraceuticals is one huge business opportunity awaiting the Indian pharmaceutical industry in the coming years. Many of these are just food supplement with no specific curative values. The explosive growth, research development, lack of standard, marketing zeal, quality assurance and regulation will play a vital role in its success or failure. Nutrient, herbals and dietary supplement are major constituents of nutraceuticals which make them instrumental in maintaining health,

act against various disease conditions and thus promote the quality of life.<sup>[28]</sup>

### **NUTRACEUTICALS FOODS**

Vegetables, fruits, whole grains, herbs, nuts and seed contains abundance of phenolic compounds, terpenoids, sulphur compounds, pigments and other natural antioxidant that have been associated with protection from and or treatment of conditions. Such as cardio vascular disease and cancer. The foods and herbs with the highest anticancer activity include, garlic, soy bean, cabbage, ginger, licorice root and umbelliferous vegetables. Citrus in addition to providing an ample supply of vitamin C, folic acid, potassium and soluble fiber contains a host of active phytochemicals.<sup>[29]</sup> Epidemiological and experimental studies suggest that dietary phytosterols may offer protection from the most of the common cancers in western societies such as colon, breast and prostate cancer.<sup>[30]</sup> The possible mechanism by which phytosterols offer this protection include the effect of the membrane structure and function of the tumor and host tissue, signal transduction pathways that regulate tumor growth and apoptosis, immune functions of the host and cholesterol metabolism by the host. Garlic is found to be superior to placebo in reducing the total cholesterol levels.<sup>[31]</sup> The possible protective effect of aqueous garlic extract against the oxidative organ damage distant from the original burn wound was determined. Burn injury caused a significant decrease in glutathione level and significant increase in malondialdehyde and protein oxidation levels and myeloperoxidase activity at post burn 2 and 24 hours. Since garlic extract reversed these oxidant responses it seems likely that garlic extract protect tissues against oxidative damages.<sup>[32]</sup> Garlic is reported to decrease LDL by controlling the aortic stiffness and to increase HDL. It is also inhibit inducible nitric oxide synthesis by reducing the protein and m RNA and thus promote vasodilatation. It has strong immunopotentiating capacity enhances the natural killer (NK) activity and proliferation of T-Lymphocytes by delaying the hypersensitivity reaction. Aged garlic extract is found to be a promising immune modifier with homeostasis balance and particularly in case of controlled sarcoma- 180 and lung carcinoma. It inhibits platelet aggregation. Both the oil and water soluble components have shown health benefits specially it reduces dementia. It prevents blood coagulation even in diabetes while water extracts are effective on cell cycle and viability of Hep G2 hepatoma cells. The spices and nuts both play distinct role in human nutrient and are countered as potent nutraceuticals, clove, curcumin seeds, turmeric, onion, garlic, fennel, fenugreek nutmeg and mace have shown effective

healing property. The cereals are rich source of  $\beta$ -Glucan which have strong colloidal properties and are considered as good nutraceuticals food and are used for replacing in food. Oats are especially rich in  $\beta$ - Glucan, the soluble dietary fibers which have gained special attention for its many health benefits such as lowering serum cholesterol. B- Glucan present in cereal bran is attributed to the good water retention capacity, gelling ability and hydro colloidal forming properties that have triggered their use as substitutes of fat. Inulin has successfully replaced fat in dairy products. B-Glucan a family of diversified structure found in the cell wall of yeast, fungi, bacteria and cereal bran modulate immune system by enhancing leucocytes activity this is responsible for enhancing body defense mechanism. Mushroom's polysaccharide has focused for their antitumor activity and its chemical diversity of these glycans ranges from homopolymers to highly complex heteropolymers. Variety of sugars are involved in the formation of such polysaccharides such as glucose, galactose, mannose Xylose, arbinose, sucrose ribose, glucouronic acid etc. some of the glycans forms conjugates with protein and peptides that show higher potent antitumor activity.<sup>[33]</sup> Active components in tomato, such as kaempferol and chlorogenic acid, have antimutagenic activities and lycopene is the most active oxygen quencher with potential chemo preventive activities. This suggests that tomato suspension have a protective effect on colon carcinogenesis which is mediated by modulation of different biological pathway during carcinogenesis.<sup>[34]</sup> Honey has proven antimicrobial activity. Green tea enhances humoral and cell mediated immunity while decreasing the risk of certain cancers and risk of cardio vascular disease. Ginseng enhances production of macrophages, band T cells, natural killer cells and colony forming activity of bone marrow. Nutraceuticals like soya bean, garlic, ginger and green tea which have been suggested in epidemiological studies, to reduce the incidence of cancer may do so by inducing programmed cell death. Soybean extract has been shown to prevent development of polycystic kidneys.<sup>[35]</sup> Turmeric is the most potent nutraceuticals against skin tumors.<sup>[36]</sup> Scientific evaluations of herbal products are the most commonly consumed health yet the herbal products are the most commonly consumed health care products. Because of the known pharmacological effects and potential interactions of many of these components with therapeutic drugs, a history of herbal intake should be considered as part of the routine medical history and should be evaluated before any changes in prescription drugs and before medical procedures.<sup>[37]</sup>

### CATEGORIES OF NUTRACEUTICALS

Nutraceuticals are non-specific biological therapies used to promote wellness, prevent malignant processes and control symptoms. These can be grouped into the following three broad categories.

**1) nutrients:** substances with established nutritional functions such as vitamins, mineral, amino acids and fatty acids.

**2) herbals:** herbs or botanical products such as concentrates and extracts

**3) dietary supplement:** Reagents derived from other sources( Pyruvate, Chondroitin sulphate, steroid hormone precursor) serving specific function such as sports, nutrients, weight loss supplements and meal replacement)

### NUTRIENT

The most commonly known nutrient is antioxidant, water and fat soluble vitamins. Many potential benefits have been attributed to antioxidant use in the form of dietary intake or supplementation. Antioxidant in general may be useful in the prevention of cancer and cerebrovascular disease. High dietary intake of vitamin E may prevent Parkinsonism's disease. The oxidized form of vitamin C, dehydro ascorbic acid readily crosses the blood brain barrier. These findings have implication for increasing the uptake of antioxidant in the central nervous system thus some feel that this has potential for improving the treatment of Alzheimer's disease. Vitamin E, C and Beta carotene has been useful in reducing low density lipoprotein oxidation and subsequent atherosclerosis. Vitamin supplement is associated with increased antibody titer response to both hepatitis B and tetanus vaccines as a result of macrophage and T cell stimulation.<sup>[13]</sup>

Those genetically predisposed to pancreatic cancer have low serum level of selenium thus it is assumed that supplementation with selenium may help to prevent this conditions.<sup>[14, 15]</sup> Zinc is an essential components of more than hundred enzymes involving digestion, metabolism and wound healing. L-Arginine is a semi essential amino acids that is a substrate for nitric oxide production. The human defensive mechanism is based on the immune response which is composed of various cells and is a highly organized complex and prompts system to perform molecular disintegration of any of the invading organisms. It needs a constant supply of active components (Nutrients) or phytochemicals through diet for its survival and its functioning. The immune suppression caused by the inflammatory response against foreign attack is an integral act of immune function. The diet therapy is essential for recovery from suppression.<sup>[38]</sup> Cholesterol and fatty acids located at the cell membrane regulate micro

viscosity at membrane level that governs many reaction including enzymatic conversions such as those by the phospholipases and cyclo oxygenases. Clinical nutrition has identified many diet ingredients as immune nutrient cocktail such as n-s PUPA (polyunsaturated fatty acids) glutamine, arginine, sulphur containing amino acids and nucleotides<sup>15</sup>. Nutritional support also includes other phytochemicals such as carotenoids, flavonoids, catechines, curcuminoids, tannins and fibers. The variety of functional food is getting popularity which has motivated their commercialization in the developed part of the world although natural resources are abundant in under developed countries.

### HERBALS

Herbals are as old as human civilization and they are provided a complete store house of remedies to cure acute and chronic disease. 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 component. Phenolic compounds constitute one of the main classes of secondary metabolites. They display a large range of structures and they are responsible for the major organoleptic characteristic of plant derived foods and beverages particularly colour and taste properties and they also contribute to the nutritional qualities of fruits and vegetables. The most important natural pigment is carotenoids which are tetrapyrrole derivatives of naturally occurring Phenolic compounds ubiquitously distributed in plant kingdom. Among these components, flavonoids constitute one of the most ubiquitous groups of all plant Phenolic. The major active nutraceuticals ingredients in plants are flavonoids. As is typical for Phenolic compounds they can also been recognized to possess anti inflammatory, anti allergic, hepatoprotective, antithrombotic, anti viral and anti carcinogenic activity.<sup>[39]</sup>

### DIETARY SUPPLEMENT

Buckwheat proteins have unique amino acids composition with special biological activities of cholesterol- lowering effects, anti hypertension effects and improving constipation and obesity by acting similar to dietary fiber and interrupting the in vivo metabolism. The Trypsin inhibitor isolated from the buckwheat seeds may also contain some allergenic proteins which induces allergy. Buckwheat flour can improve diabetes, obesity, hypertension, hypercholesterolemia and constipation.<sup>[40]</sup> Calcium caseinate when protein isolate films and found that these films may be used for wrapping or coating to enhance the nutrition

value of food. The two nutraceuticals namely glucosamine sulfate and Chondroitin sulfate are effective and safer to alleviate symptoms of osteoarthritis.<sup>[41]</sup> Immune milk products are promising examples of health promoting nutraceuticals. Numerous casein and whey protein derived angiotensin -1- converting enzyme inhibitory peptides/ hydrolysate have been identified. These peptides/ hydrolysate may be classified as nutraceuticals due to their ability to provide health benefits. Buck wheat has been used and will be better used as an important raw material for the functional food production. Phenolic compounds constitute one of the main classes of secondary metabolites. They display a large range of structures and they are responsible for the major organoleptic characteristic of the plant derived foods and beverages particularly colour and taste properties that they also contribute to the nutritional qualities of fruits and vegetables. The most important natural pigments are carotenoids which are tetrapyrrole derivatives of naturally occurring Phenolic compounds. Ubiquitously distributed in plant kingdom. Among these compounds, flavonoids constitute one of the most ubiquitous groups of all plant phenolic. So, far 6000 varieties of flavonoids have been identified. But it was widely known for centuries that compound of plant origin possesses a broad spectrum of biological activities. Flavonoids drew greater attention.<sup>[42]</sup>

#### AREAS COVERED BY NUTRACEUTICALS

All therapeutic areas such as,

1. Anti- Arthritic (Rheumatoid Arthritis)
2. Sleeping disorders
3. Digestion problems
4. Prevention of certain cancers (Colorectal cancer)
5. Osteoporosis
6. Blood pressure
7. Cholesterol lowering (garlic)
8. Neurological disorders (Autism)
9. Diabetes etc..

#### EFFECTIVENESS AND SAFETY-REGULATION

Nutraceutical products also required same level of scrutiny and regulation as "dietary supplements". Companies which involved in nutraceuticals production invest more on scientific research to substantiate their manufacturing standards, products by keeping the view in mind consumer benefits and differentiate their products from "dietary supplements". Now a day many international companies move within the industry, professional organizations, academia, and health regulatory agencies to add specific legal and scientific criterion to the definition and standards for nutraceuticals.<sup>[43,44]</sup>

#### BIOAVAILABILITY

Bioavailability is "absorption rate" of a supplement product. In development of effective nutraceutical products bioavailability play important role. The bioavailability of substance which is in natural state will be more as comparison manufactured product.

#### SAFETY AND EFFICACY

Nutraceuticals hold great potential, as an alternative to substance obtained by plant. Yet, some time they also cause harmful effect as seen with ephedrine, a widely used botanical ingredient in weight-loss products. Now a days peoples are more conscious about there health and these products offer the promised health benefits. But danger is associated with some product due to lack of solid information about interaction and side effect.<sup>[45,46]</sup>

#### LABELING AND HEALTH CLAIMS

Proper labeling and health claims are very important for nutraceutical products because they alert consumers. Food and food substances can qualify for health claims only if they meet FDA requirements. The following are the FDA-approved health claims showing a positive relationship between a certain compound and reduced risk of specific disease(s).<sup>[48]</sup>

#### CONCLUSION

Nutraceutical is growing health care industry in India. Nutraceuticals is playing important role in developments of future therapeutics but it depends on control of purity, efficacy and safety. Nutraceutical products are used in prevention of disease not in cure of disease. Nutraceutical Products is collaborative research effort of pharma, food and chemistry. As healthcare industry is growing in India, growth of nutraceutical is also increase because people want treat their disease by improving their health with the help of Fast Moving Healthcare Goods. India is significant Player because it has extensive markets and facilities like rich bio-diversity, world-class R & D facilities, resources, qualified human, and varied raw materials - aspects that provides edge our country. Now "nutraceutical a day may keep the doctor away" replace the old proverb "an apple a day will keep the doctor away" Consumers are turning massively to food supplements to improve well being where pharmaceuticals fail. The future of nutraceuticals food is bright for developing countries to achieve the optimal productivity from their natural resources. The future of nutraceuticals foods is bright for developing countries as they have rich sources of raw materials, economically available human resources and the large local consumption. "Let Food be Your Medicine".

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