NUTRACEUTICAL AS FUNCTIONAL FOODS

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ABSTRACT

Nutraceuticals are a diverse product category with various synonyms used internationally. Nutraceutical is recognized as a linguistic combination of “nutrient” and “pharmaceutical” and is accepted as “Any substance that may be considered a food or part of a food and provides medical or health benefits, including the prevention and treatment of disease.” Nutraceuticals have received considerable interest because of their presumed safety and potential nutritional and therapeutic effects. By using nutraceuticals, it may be possible to reduce or eliminate the need for conventional medications, reducing the chances of any adverse effect. Nutraceuticals often possess unique chemical actions that are unavailable in pharmaceuticals. Nutrients, herbals and dietary supplements are major constituents of nutraceutical which make them instrumental in maintaining health, act against various disease conditions and thus promote the quality of life. Nutraceuticals are a diverse product category with various synonyms that are used internationally. Nutraceuticals create an open environment for new products that promise novel solutions to health-related issues. Nutraceuticals will play important role in future therapeutic developments. This current review article is to examine the impact of Nutraceuticals as an alternative treatment for different types of disease. In these scenario natural products (nutraceutical) play vital role which is plant based. The term of Nutraceuticals was coined by Dr. Stephen Defelice in 1989. This article briefly discusses about the basic information about the nutraceutical and its importance.

KEYWORDS: Nutraceuticals, Functional foods, Used in the treatment of different diseases.
INTRODUCTION
The term “nutraceutical” combines the word “nutrient” (a nourishing food or food component) with “pharmaceutical” (a medical drug). Nutraceuticals may contain substances that are “natural” expressed intent of treatment or prevention of disease but may not be generally recognized as safe.\textsuperscript{[1]} The role of dietary active compounds in human nutrition is one of the most important areas of investigation with the findings having wide-ranging implications for consumers, health care providers, regulators, food producers, processors and distributors.\textsuperscript{[2,3]}

Thus, the concept of ‘adequate nutrition’ is beginning to be replaced by ‘optimal nutrition’ with consumer belief increasing at an unprecedented pace.\textsuperscript{[4,5]} Scientists and food manufacturers have coined several terms to describe these physiologically active components and health benefits of these foods. None have clear and generally accepted definitions.\textsuperscript{[6,7]}

Nutraceuticals are a diverse product category with various synonyms used internationally. The term "nutraceutical" was coined by Stephen DeFelice, founder and chairman of the Foundation for Innovation in Medicine. This term has been part of the industry lexicon for almost a decade. Unfortunately, it still seems to be held up in a scrambled web of complementary definitions, regulatory watchdogs and consumer confusion.\textsuperscript{[8]} “Functional foods,” “nutraceuticals,” “pharmaconutrients,” and “dietary integrators” are all terms used incorrectly and indiscriminately for nutrients or nutrient-enriched foods that can prevent or treat diseases.\textsuperscript{[7]}

Plants are one of the most important resources of human foods and medicines. Rapidly increasing knowledge on nutrition, medicine and plant biotechnology has dramatically changed the concepts about food, health and agriculture, and brought in a revolution on them. With recent advances in medical and nutrition sciences, natural products and healthpromoting foods have received extensive attention from both health professionals and the public. New concepts have appeared with this trend, such as nutraceuticals, nutritional therapy, phytonutrients, and phytotherapy.\textsuperscript{[9-11]} These functional or medicinal foods and phytonutrients or phytomedicines play positive roles in enhancing health and improving immune function to prevent specific diseases and also hold great promise to reduce side effects and health care cost.\textsuperscript{[12]}

Modern nutritional science is providing even more information on the functions and mechanisms of specific food components in health promotion and/or disease prevention.
Current nutritional approaches are beginning to reflect a fundamental change in our understanding of health. Today, foods are intended to deliver a health benefit beyond providing sustenance and nutrition.\[13\]

The pharmaceutical companies favor the terms medical foods, nutraceuticals, and functional foods, whereas the food companies prefer functional foods and nutritional foods. While the food industry’s approach is based on a nutritional concept, the pharmaceutical industry’s approach is based on a medicine concept.\[14\] The role of dietary active compounds in human nutrition is one of the most important areas of investigation with the findings having wide-ranging implications for consumers, healthcare providers, regulators and industry.\[11\] Foods and nutrients play a vital role in the normal functioning of the body. They help to maintain the health of the individual and to reduce the risk of various diseases. Worldwide Acceptance of this fact formed a recognition link between "nutrition" and "health", and thus the concept of "nutraceuticals" evolved.\[12\] Risk of toxicity or adverse effects of medical drugs led to consider safer nutraceutical and functional food based approaches for health management. This resulted in a world-wide nutraceutical revolution.\[15\]

Nutrigenetics is a nascent area that is developing quickly and riding on the wave of “personalized medicine” providing opportunities in nutraceutical product development.\[16\] Nutraceuticals are considered as pharmaceutical forms (tablets, capsules, powders, etc.) containing bioactive food compounds as active principles.\[17\] The word “nutraceutical” has often been used to describe a broad list of products sold under the premise of being food components, but with the expressed intent of treatment or prevention of disease.\[18\]

The term 'nutraceutical' has been part of the industry lexicon for almost a decade. Unfortunately, it still seems held up in a scrambled web of complementary definitions, regulatory watchdogs and consumer confusion.\[19\]

“Functional foods,” “nutraceuticals,” “pharmconutrients,” and “dietary integrators” are all terms used incorrectly and indiscriminately for nutrients or nutrient-enriched foods that can prevent or treat diseases19. While several terms have been used with similar meanings to the term nutraceutical, one of most frequently used terms is functional food.\[20\]

The scope of nutraceuticals is significantly different from functional food for several reasons. These include: (i) Prevention and treatment of disease (i.e., medical claims) are relevant to
nutraceuticals, but only reduction of disease, not the prevention and treatment of disease, is involved with functional foods. (ii) Nutraceuticals include dietary supplements sold in forms that are similar to drugs: pills, extracts, tablets, etc as well as other type of foods, functional foods must be in the form of ordinary food.\textsuperscript{[14, 17]} Since there is no distinct regulatory framework for “functional foods” or “nutraceuticals”, they are both often regulated as foods.\textsuperscript{[21]} The pharmaceutical industry is known for the high costs of research and development associated with drug development and the use of patents to protect the discoveries from this research; therefore, the industry is associated with high product margins. The food industry is noted for its low margins and the commoditization of its inputs and in some cases its products.\textsuperscript{[22]} Nutraceutical products represent an excellent growth opportunity but, companies must take appropriate actions to develop, preserve and protect their intellectual property rights in order to stay competitive.\textsuperscript{[23]} The rational use of nutraceuticals is based on objective evaluation of the clinical evidence as well as subjective evaluation of the risks, benefits, economic costs and potential drug interactions.\textsuperscript{[24]}

\textbf{Nutraceutical Categories}

\textbf{I) Dietary Supplements including botanicals}
A product that contains one or more of the following dietary ingredients: vitamin, mineral, herb or other botanical, amino acid (protein) and also includes the diet as concentrates, constituents, extracts or metabolites of these compound EG: Vitamins, co-enzymes, minerals, carnitine.

\textbf{II) Functional Foods}
\begin{itemize}
  \item a. Oats, bran, Psyllium and lignin's for heart disease and colon cancer
  \item b. Prebiotics - Oligofructose for control of intestinal flora
  \item c. Omega-3 milk in prevention of heart disease
  \item d. Canola oil with lowered triglycerides for cholesterol reduction
  \item e. Stanols (Benecol) in reduction of cholesterol adsorption
\end{itemize}

\textbf{III) Medicinal Foods}
\begin{itemize}
  \item a. Transgenic cows and lactoferrin for immune enhancement
  \item b. Transgenic plants for oral vaccination against infectious diseases
  \item c. Health bars with added medications.
IV) Inorganic mineral supplements
Large number of element control variety of physiological and biochemical function of human body. Most of these minerals are provided through the diet but their deficiency in diet may develop variety of health related problems and disease. EG- calcium, iron, magnesium, phosphorous, cobalt, copper, chromium, selenium, zinc.

V) Digestive enzyme
Much of the reflux is not caused by increase production of acid in the stomach but from poor digestion because of too little acid. As we grow older stomach cells responsible for acid production diminishes, this in turn slows the transit time of food in the stomach causing reflux of food from the esophagus. So we have to use a variety of digestive enzyme to help absorption and digestion of food material. There are animal as well as plant derivative digestive enzyme.

VI) Probiotics
Probiotic can be describe as a living microorganism which when ingested with or without food improves the intestinal microbial balance and consequently the health and functioning of large intestine. The major source are the cultured dairy products such as natural cheese, yoghurt and kefir and butter milk.

Most commonly used probiotics
- Lactobacilli-casei, acidophilus
- Streptococci-thermophilus
- Bifidobacteria-bifidum, breve, longum, thermophilum

VII) Prebiotics
Prebiotic are food components that escape digestion by the normal human digestive enzyme and reach the colon in intact from after passage through the stomach and small intestine where they selectively promote the growth of prebiotic.

Commonly known prebiotic are
- Oligofructose
- Insulin
- Galacto-oligosaccharides
- lactulose
Nutritional therapy is a healing system using dietary therapeutics. This therapy is based on the belief that foods can not only be sources of nutrients and energy but could also provide medicinal benefits.

Table 1. presents some of the more recognizable nutraceutical substances grouped according to food-source providers. Nonfood sources of nutraceutical factors have been sourced by the development of modern fermentation methods. For example, amino acids and their derivatives have been produced by bacteria grown in fermentation systems. The emergence of recombinant-genetic techniques has enabled new avenues for obtaining nutraceutical compounds. These techniques and their products are being evaluated in the arenas of the marketplace and regulatory concerns around the world. An example is the production of eicosapentaenoic acid (EPA) by bacteria. This fatty acid is produced by some algae and bacteria. The EPA derived from salmon are produced by algae and are later incorporated in the salmon that consume the algae. EPA can now be produced by non-EPA producing bacteria by importing the appropriate DNA through recombinant methods. The ability to transfer the production of nutraceutical molecules into organisms that allows for economically feasible production is cause for both optimism and discussion concerning regulatory and popular acceptance.

Table 1. Examples of nutraceutical substances grouped by food source

<table>
<thead>
<tr>
<th>Plants</th>
<th>Animal</th>
<th>Microbial</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-Glucan</td>
<td>Conjugated Linoleic Acid (CLA)</td>
<td><em>Saccharomyces boulardii</em> (yeast)</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>Eicosapentaenoic acid (EPA)</td>
<td><em>Bifidobacterium bifidum</em></td>
</tr>
<tr>
<td>γ-Tocotrienol</td>
<td>Docosahexenoic acid (DHA)</td>
<td><em>B. longum</em></td>
</tr>
<tr>
<td>Quercetin</td>
<td>Spingolipids</td>
<td><em>B. infantis</em></td>
</tr>
<tr>
<td>Luteolin</td>
<td>Choline</td>
<td><em>Lactobacillus acidophilus</em>(LC1)</td>
</tr>
<tr>
<td>Cellulose</td>
<td>Lecithin</td>
<td><em>L. acidophilus</em>(NCFB 1748)</td>
</tr>
<tr>
<td>Lutein</td>
<td>Calcium</td>
<td><em>Streptococcus salvarius</em> (subs. Thermophilus)</td>
</tr>
<tr>
<td>Gallic acid</td>
<td>Coenzyme Q10</td>
<td></td>
</tr>
<tr>
<td>Perillyl alcohol</td>
<td>Selenium</td>
<td></td>
</tr>
<tr>
<td>Indole-3-carbonol</td>
<td>Zinc</td>
<td></td>
</tr>
<tr>
<td>Pectin</td>
<td>Creatine</td>
<td></td>
</tr>
<tr>
<td>Daidzein</td>
<td>Minerals</td>
<td></td>
</tr>
<tr>
<td>Glutathione</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allicin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>δ-Limonene</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nutraceutical Factors In Specific Foods

In an organization model related to the one above, nutraceuticals can be grouped based upon relatively concentrated foods. This model is more appropriate when there is interest in a particular nutraceutical compound or related compounds, or when there is interest in a specific food for agricultural/geographic reasons or functional food-development purposes. For example, the interest may be in the nutraceutical qualities of a local crop or a traditionally consumed food in a geographic region, such as pepper fruits in the southwestern United States, olive oil in Mediterranean regions and red wine in Western Europe and Northern California.

Table 2. Examples of foods with higher content of specific nutraceutical substances

<table>
<thead>
<tr>
<th>Nutraceutical Substance/Family</th>
<th>Foods of Remarkably High Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allyl sulfur compounds</td>
<td>Onions, garlic</td>
</tr>
<tr>
<td>Isoflavones (e.g., genistein, daidzein)</td>
<td>Soybeans and other legumes, apios</td>
</tr>
<tr>
<td>Quercetin</td>
<td>Onion, red grapes, citrus fruit, broccoli, Italian</td>
</tr>
<tr>
<td>Capsaicinoids</td>
<td>yellow squash</td>
</tr>
<tr>
<td>EPA and DHA</td>
<td>Pepper fruit</td>
</tr>
<tr>
<td>Lycopene</td>
<td>Fish oils</td>
</tr>
<tr>
<td>Isothiocyanates</td>
<td>Tomatoes and tomato products</td>
</tr>
<tr>
<td>β-Glucan</td>
<td>Cruciferous vegetables</td>
</tr>
<tr>
<td>CLA Beef and dairy</td>
<td>Oat bran</td>
</tr>
<tr>
<td>Resveratrol</td>
<td>Grapes (skin), red wine</td>
</tr>
<tr>
<td>β-Carotene</td>
<td>Rosemary</td>
</tr>
<tr>
<td>Catechins</td>
<td>Teas, berries</td>
</tr>
<tr>
<td>Adenosine</td>
<td>Garlic, onion</td>
</tr>
<tr>
<td>Indoles</td>
<td>Cabbage, broccoli, cauliflower, kale, Brussels sprouts</td>
</tr>
<tr>
<td>Curcumin</td>
<td>Tumeric</td>
</tr>
</tbody>
</table>
There are several nutraceutical substances that are found in higher concentrations in specific foods. These include capsaicinoids, which are found primarily in pepper fruit and allyl sulfur (organosulfur) compounds, which are particularly concentrated in onions and garlic.

**Mechanism of action**

Another term of classifying nutraceuticals is by their mechanism of action. This system groups nutraceutical factors together, regardless of food source, based upon their proven or purported physiological properties. Among the classes would be antioxidant, antibacterial, antihypertensive, antihypercholesterolemic, antiaggregate, anti inflammatory, anticarcinogenic, osteoprotective, and so on.\[27, 28\] Examples are presented in Table 3.

**Table 3. Examples of nutraceuticals grouped by mechanisms of action**

<table>
<thead>
<tr>
<th>Anticancer</th>
<th>Positive Influence on Blood Lipid Profile</th>
<th>Antioxidant Activity</th>
<th>Anti inflammatory</th>
<th>Osteogenic or Bone Protective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capsaicin</td>
<td>α-Glucan</td>
<td>CLA</td>
<td>Linolenic acid</td>
<td>CLA</td>
</tr>
<tr>
<td>Genistein</td>
<td>γ-Tocotrienol</td>
<td>Ascorbic acid</td>
<td>EPA</td>
<td>Soy protein</td>
</tr>
<tr>
<td>Daidzein</td>
<td>δ-Tocotrienol</td>
<td>β-Carotene</td>
<td>DHA</td>
<td>Genistein</td>
</tr>
<tr>
<td>α-Tocotrienol</td>
<td>MUFA</td>
<td>Polyphenolics</td>
<td>GLA (gammalinolenic acid)</td>
<td>Daidzein</td>
</tr>
<tr>
<td>γ-Tocotrienol</td>
<td>Quercetin</td>
<td>Tocopherols</td>
<td>Calcium</td>
<td></td>
</tr>
<tr>
<td>CLA</td>
<td>ω-3 PUFAs</td>
<td>Tocotrienols</td>
<td>Casein phosphopeptides</td>
<td></td>
</tr>
<tr>
<td>Lactobacillus acidophilus</td>
<td>Resveratrol</td>
<td>Indole-3-carbonol</td>
<td>Capsaicin</td>
<td>FOS (fructooligosaccharides)</td>
</tr>
<tr>
<td>Sphingolipids</td>
<td>Tannins</td>
<td>α-Tocopherol</td>
<td>Quercetin</td>
<td></td>
</tr>
<tr>
<td>Limonene</td>
<td>β-Sitosterol</td>
<td>Ellagic acid</td>
<td>Curcumin</td>
<td>Inulin</td>
</tr>
<tr>
<td>Diallyl sulfide</td>
<td>Saponins</td>
<td>Lycopene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ajoene</td>
<td>Guar</td>
<td>Lutein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>α-Tocopherol</td>
<td>Pectin</td>
<td>Glutathione</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterolactone</td>
<td></td>
<td>Hydroxytyrosol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycyrrhizin</td>
<td></td>
<td>Luteolin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Classifying nutraceutical factors based on chemical nature

Another method of grouping nutraceuticals is based upon their chemical nature. This approach allows nutraceuticals to be categorized under molecular/elemental groups. This preliminary model includes several large groups, which then provide a basis for sub classification or subgroups and so on.\[^{29,30}\]

- Isoprenoid derivatives
- Phenolic substances
- Fatty acids and structural lipids
- Carbohydrates and derivatives
- Amino acid-based substances
- Microbes
- Minerals

### Table 4: Organizational scheme for nutraceuticals

<table>
<thead>
<tr>
<th>Isoprenoids (terpenoid)</th>
<th>Phenolic compound</th>
<th>Protein/Amino Acid- Based</th>
<th>Carbohydrate &amp; Derivative</th>
<th>Fatty acid &amp; struct, lipids</th>
<th>Mineral</th>
<th>Microbial</th>
</tr>
</thead>
<tbody>
<tr>
<td>carotenoids</td>
<td>coumarins</td>
<td>Amino-acid</td>
<td>Ascorbic acid</td>
<td>n-3 PUFA</td>
<td>ca</td>
<td>probiotics</td>
</tr>
<tr>
<td>saponins</td>
<td>tannins</td>
<td>Allyl-s compound</td>
<td>oligosaccharides</td>
<td>Sphingolipids</td>
<td>se</td>
<td>prebiotics</td>
</tr>
<tr>
<td>tocotrienols</td>
<td>lagnin</td>
<td>capsaicinoids</td>
<td>Non-starch ps</td>
<td>lecithin</td>
<td>k</td>
<td></td>
</tr>
<tr>
<td>tocopherol</td>
<td>anthocyanins</td>
<td>isothiocyanates</td>
<td></td>
<td></td>
<td>cu</td>
<td></td>
</tr>
<tr>
<td>Simple terpenes</td>
<td>isoflavones</td>
<td>indoles</td>
<td></td>
<td></td>
<td>zn</td>
<td></td>
</tr>
<tr>
<td>flavones</td>
<td></td>
<td>Folate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flavonol</td>
<td></td>
<td>choline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Marketed preparation of nutritional supplements

In world market various nutritional products\[^{31}\] are present some are given in Table no. 4.

### Table 5. Marketed preparation of nutritional supplements

<table>
<thead>
<tr>
<th>Product</th>
<th>Category</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coral calcium</td>
<td>Calcium supplements</td>
<td>Neuropathic pain supplements</td>
</tr>
<tr>
<td>Weight smart</td>
<td>Nutritional supplements</td>
<td>Vitamins and trace elements</td>
</tr>
<tr>
<td>Omega women</td>
<td>Immune supplements</td>
<td>Antioxidants, vitamins and</td>
</tr>
</tbody>
</table>

---
Use of Nutraceuticals in the Treatment of Different Diseases

1. Rice bran and Cardiovascular Diseases, Eye Sight

Rice bran lowers the serum cholesterol levels in the blood, lowers the level of (LDL) and increases the level (HDL) in cardiovascular health. Higher the ratio more will be the risk of coronary heart diseases. Rice bran contains both Lutein and Zeaxanthin, which improves eyesight and reduces the chance of cataracts. The essential fatty acids, omega-3, omega-6, omega-9 and folic acid in rice bran are also promoting eye health.

2. Corn (heart attack, lung cancer)

Corn’s contribution to heart health lies not just in its fiber, but in the significant amounts of folate that corn supplies. Corn maintains the homocysteine, an intermediate product in an important metabolic process called the methylation cycle. Homocysteine is directly responsible for damage of blood vessel heart attack, stroke, or peripheral vascular disease. It has been estimated that consumption of 100% of the daily value (DV) of folate would, by itself, reduce the number of heart attacks suffered by 10% Corn also contains cryptoxanthin, a natural carotenoid pigment. It has been found that cryptoxanthin can reduce the risk of lung cancer of 27% on daily consumption.

3. Dietary Polyphenols Used in the Treatment of Diabetes

In recent years, there is growing evidence that plant-foods Polyphenols, due to their biological properties, may be unique nutraceuticals and supplementary treatments for various aspects of type 2 diabetes mellitus. Polyphenolic compounds can also prevent the
development of long-term diabetes complications including cardiovascular disease, neuropathy, nephropathy and retinopathy.

4. **Sorghum (against pathogen)**

sorghum is the main dietary source for 3-deoxyanthocyanidins, which are present in large quantities in the bran of some cultivars (Awika, 2004). The defense mechanism of sorghum against pathogen is due to an active process, resulting in the accumulation of high levels of 3-deoxyanthocyanidin phytoalexins in infected tissues.[32]

5. **Buck wheat (obesity-constipation)**

Buckwheat seed proteins have beneficial role in obesity and constipation acting similar to natural fibers present in food. 5-hydroxytryptophan and green tea extract may promote weight loss.

6. **Β-Carotene (cancer)**

Beta-carotene is the main source of vitamin A and has antioxidant properties which help in preventing cancer and other diseases. Among the other carotenes, beta carotene is the most active antioxidants. Alpha and beta carotenes, along with gamma carotene and the carotenes lycopene and lutein68 which do not convert to vitamin A, seem to offer protection against lung, colorectal, breast, uterine and prostate cancers. Β-Carotene is the more common form and can be found in yellow, orange and green leafy fruits and vegetables. These can be carrots, spinach, lettuce, tomatoes, sweet potatoes, broccoli, cantaloupe, oranges and winter squash.

7. **In the treatment of arthritis**

Arthritis is a common disease in which the end-point results in joint replacement surgery. The use of nutraceuticals is an alternative treatment for pathological manifestations of arthritic disease. The efficacy of fish oils (e.g. cod liver oil) in the diet has been demonstrated in several clinical trials, animal feeding experiments and *in vitro* models that mimic cartilage destruction in arthritic disease. Other than this, there is some evidence of other nutraceuticals, such as green tea, herbal extracts, chondroitin sulphate and glucosamine.
8. Nutraceuticals used against Alzheimer's disease (AD)

Alzheimer's disease (AD), also called senile dementia of the Alzheimer type (SDAT), primary degenerative dementia of the Alzheimer's type (PDDAT), or simply Alzheimer's, is the most common form of dementia. The various Nutraceuticals, which are used to cure Alzheimer's disease are:

a) **Anti-oxidants**: antioxidants like vitamin E and vitamin C.

b) **Gingko biloba**: Ginkgo biloba is perhaps the most studied herbs with reference to memory, cognition, overall brain performance and certainly AD.

c) **Huperzine alpha**: Huperzine alpha or huperzine A is a very appealing plant compound that is extracted from club moss, or Huperzia serrata. It is a sesquiterpene alkaloid, which is a potent and reversible inhibitor of acetylcholinesterase.[33]

d) **Moss, or Huperzia serrata**: It is a sesquiterpene alkaloid, which is a potent and reversible inhibitor of acetylcholinesterase.[33]

9. In the treatment of diet-related diseases

In Western societies, the incidence of diet-related diseases is progressively increasing due to greater availability of hypercaloric food and a sedentary lifestyle. Obesity, diabetes, atherosclerosis and neurodegeneration are major diet-related pathologies that share a common pathogenic denominator of low-grade inflammation. Functional foods and nutraceuticals may represent a novel therapeutic approach to prevent or attenuate diet-related disease in view of their ability to exert anti-inflammatory responses. In particular, activation of intestinal Tregulatory cells and homeostatic regulation of the gut microbiota have the potential to reduce low-grade inflammation in diet-related diseases.[33]

10. Vision improving agents

Lutein is one of most important carotenoids, found in many fruits and vegetables like mangoes, corn, sweet potatoes, carrots, squash, tomatoes, etc. Lutein dipalmitate is found in the plant Helenium autumnale. Lutein is also known as helenien is used for the treatment of visual disorders. Zeaxanthin is used in traditional Chinese medicine mainly for the treatment of visual disorders. Food sources of zeaxanthin include corn, egg yolk and green vegetables and fruits, such as broccoli, green beans, green peas, brussel sprouts, cabbage, kale, collard greens, spinach, lettuce, kiwi and honeydew. Lutein and zeaxanthin are also found in nettles, algae and the petals of many yellow flowers. In green vegetables, fruits and egg yolk, lutein and zeaxanthin exist in non-esterified forms.[34]
Current Research in Nutraceuticals
A great deal of current research is focused on traditional herbal extracts. Investigators are examining claims linking these extracts with health enhancement and prevention of chronic diseases. At least in part, this represents an effort to legitimize homeopathic remedies and Eastern medicine. Additionally, it seeks to provide patients and physicians with much-needed safety and efficacy data. The explosive demand growth for bioactive ingredients for nutraceuticals and functional foods is being driven by frequently cited health concerns:

- Cardiovascular disease
- Breast, skin, colorectal and brain cancers
- Female health concerns
- CNS disorders
- Metabolism management
- Gastrointestinal disorders
- Immuno modulation

A significant problem with the use of nutraceuticals in treating diseases is the lack of serious studies published with clear clinical evidence. The development, production, packaging, marketing and sales of nutraceuticals has come a long way and is evolving constantly. Nutraceuticals are the preferred choice of today's consumer for regular usage. The latest scientific research and clinical trials continue to boost and add impetus to this industry.\cite{35}

Safety and Efficacy
Nutraceuticals hold great potential, as an alternative to substance obtained by plant. Yet, some time they also cause haemful 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 lake of solid information about intraction andside effect.\cite{36}

Future issues and proposals
Change in the lifestyle can prevent the diseases like metablic syndromes. One of the solutions in the lifestyle change is changes in their diet. The key issues for Nutraceuticals are:

- Establishment of scientific assessment standard for prevention of diseases
- Establishment of assessment system for disease prevention by human trials
Establishment of seamless system to transfer stage from basic research to industrialization.

Nutraceuticals are not necessarily a single material; therefore the expected effect for the prevention of disease might be the complex action of several components which are present in the product, it is also necessary to compare preventative effects for different types of food. Hence, it is necessary to conduct biomarker research for prevention of target diseases. Therefore, it is also necessary to define the measurement method of biomarkers and standardize indicators.\textsuperscript{[37]}

CONCLUSION

Nutraceuticals has proven their health benefits and disease prevention capability, which should be taken according to their acceptable recommended intake. In the present scenario of self-medication nutraceuticals play major role in therapeutic development. But their success depends on maintaining on their quality, purity, safety and efficacy. Nutraceuticals constitute a rapidly growing focus for research, product development and consumer interest as well as regulatory efforts in recent years. Nutraceuticals represents a unique intersection of the pharmaceutical and food industries with a wide scope. The approach to regulating and marketing of nutraceuticals is notably heterogeneous on the global level. This is largely due to the challenges in classifying these products, absence of a suitable regulatory category for these hybrid products and varying views on what is considered sufficient scientific substantiation to conclude the functionality.

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