

## NUTRACEUTICALS

The term 'nutraceutical' was coined from 'nutrition' and 'pharmaceutical' in 1989 by DeFelice and was originally defined as 'a food (or part of the food) that provides medical or health benefits, including the prevention and/or treatment of a disease'. A nutraceutical may be a naturally nutrient- rich food such as spirulina, garlic, soy or a specific component of a food like omega-3 oil from salmon. They are also known as medical foods, nutritional supplements and dietary supplements. It ranges from isolated nutrients, dietary supplements, genetically engineered 'designer' foods, herbal products, and processed products such as cereals and soups. They have received considerable interest because of their presumed safety and potential nutritional and therapeutic effects. Nutraceuticals are usually contained in medicinal forms such as capsule, tablet, powder or liquid in a prescribed dose. The term further implies that the extract or source food is demonstrated to have physiological benefits or provide protection against chronic disease.

People can improve their health by supplementation and by consuming foods that have been formulated or fortified. Another reason for the growing trend of nutraceuticals is public education, renewable source, cultivation and processing, environmental friendliness and local availability. In India, nutraceuticals are the food components made from herbal or botanical raw materials, which are used for preventing or treating different types of acute and chronic maladies. European medicine law has defined nutraceuticals as a medicine for two reasons:

1. It can be used for the prevention, treatment, or cure of a disease condition.
2. It can be administered with a view to restoring, correcting, or modifying physiological functions in human beings (Pandey et al., 2010).

## CATEGORIES OF NUTRACEUTICALS

Broadly, nutraceuticals can be classified into two groups (Pandey et al., 2010):

### 1. Potential nutraceuticals

### 2. Established nutraceuticals

A **potential nutraceutical** could become an established one only after efficient clinical data of its health and medical benefits are obtained. It is to be noted that much of the nutraceutical products still lay in the potential category.

Nutraceuticals can further be classified on the basis of food sources, mechanism of action, and chemical nature as follows:

- **On the basis of food sources**, nutraceutical substances can be grouped as plants, animals, and microbial sources. The food sources used as nutraceuticals are all natural and can be categorized as follows:

1. Dietary fiber 2. Probiotics and prebiotics 3. Polyunsaturated fatty acids 4. Antioxidant vitamins, 5. Polyphenols 6. Spices 7. Minerals

• **In case of classification by mechanism of action**, nutraceuticals can be grouped as those having antioxidant, antibacterial, antihypertensive, anti-inflammatory, anticarcinogenic, anti-aggregate, influence on blood or lipid profile, osteoprotective, and so on. This classification is based on the proven or purported physiological properties of the nutraceutical substances.

• **On the basis of chemical nature**, nutraceuticals can be grouped as the following: v

1. Carbohydrates and their derivatives
2. Fatty acids and lipid structures
3. Microorganisms
4. Proteins and amino acid structures
5. Phenolic compounds
6. Isoprenoid derivatives
7. Minerals

Nutraceuticals are non-specific biological therapies used to promote wellness, prevent malignant processes and control symptoms. They are also categorized as follows:

### 1. **Based on chemical constituents**

(a) **Nutrients**: Substances with established nutritional functions, such as vitamins, minerals, amino acids and fatty acids. Common nutrients and their associated health benefits are shown below.

Nutrients and its Health benefits

1. Vitamin A - Antioxidant, essential, for growth and development and in the treatment of certain skin disorders.
2. Vitamin E - Antioxidant, helps form blood cells, muscles, lung and nerve tissue, boosts the immune system.
3. Vitamin K- Essential for blood clotting.
4. Vitamin C - Antioxidant, for healthy bones, gums, teeth and skin, in wound healing, prevent common cold and attenuate its symptoms.
5. Vitamin B1 - Helps to convert food in to energy, essential in neurologic functions.
6. Vitamin B2 - Helps in energy production and other chemical processes in the body, helps maintain healthy eyes, skin and nerve function.
7. Vitamin B3 - Helps to convert food in to energy and maintain proper brain function.
8. Vitamin B6 - Produce the genetic material of cells, formation of RBCs, maintenance of central nervous system and synthesize amino acids and metabolism of fats, protein and carbohydrates.

9. Folic acid - Produce the genetic materials of cells, in pregnancy for preventing birth defects, RBCs formation, protects against heart disease.
10. Calcium Bones and teeth and maintaining bone strength important in nerve, muscle and glandular functions.
11. Iron - Energy production, carry and transfer oxygen to tissues.
12. Magnesium- Healthy nerve and muscle function and bone formation, may help prevent premenstrual syndrome (PMS).
13. Phosphorous - Strong bones and teeth, helps in formation of genetic material, energy production and storage.
14. Chromium - With insulin helps to convert carbohydrates and fats into energy.
15. Copper - Essential for hemoglobin and collagen production, healthy functioning of the heart, energy production, absorption of iron from digestive tract.
17. Iodine - Essential for proper functioning of the thyroid.

(b) **Herbals:** Herbs or botanical products as concentrates and extracts. Common herbs and their therapeutic relevance are shown below. Herbs used and their therapeutic relevance are as follows:

1. Aloe vera gel -Dilates capillaries, anti-infl ammatory, emollient, wound healing properties.
2. Chamomile - Anti-infl ammatory, spasmolytic, antimicrobial, wound Healing.
3. Echinacea - Immunostimulant, treatment of cold and flu symptoms.
4. Ephedra - Bronchodilator, vasoconstrictor, reduces bronchial Edema.
5. Evening primrose oil - Dietary supplement of linoleic acid, treatment of atopic eczema.
6. Feverfew - Treatment of headache, fever and menstrual problem, severity and duration of migraine headaches.
7. Garlic - Antibacterial, antifungal, antithrombotic, hypotensive anti-infl ammatory.
8. Ginger - Carminative, antiemetic, cholagogue, positive inotropic.
9. Ginseng - Adaptogen.
10. Ginkgo - Vasodilation, increased peripheral blood flow, Treatment of post thrombotic syndrome.
11. Goldenseal - Antimicrobial, astringent, antihemorrhagic, treatment of mucosal inflammation, dyspepsia, gastritis.
12. Licorice - Teatment of peptic ulcer.
14. St. John's wort - Anxiolytic, anti-infl ammatory, antidepressant, monoamine oxidase inhibitor.
15. Willow bark - Anti-infl ammatory, analgesic, antipyretic, treatment of rheumatic and arthritic.

(c) **Dietary Supplement:** Dietary supplements are products administered through mouth that contain a dietary ingredient intended to add something to the foods you eat. Examples of dietary supplements are black cohosh for menopausal symptoms, ginkgo biloba for memory loss, and glucosamine/chondroitin for arthritis. They also serve specific functions such as sports nutrition, weight-loss supplements and meal replacements. Supplement ingredients may contain vitamins, minerals, herbs or other botanicals, amino acids, enzymes, organ tissues, gland extracts, or other dietary substances. They are available in different dosage forms, including tablets, capsules, liquids, powders, extracts, and concentrates. They could be categorized as shown below.

1. Phytoestrogens - Found in soya flour and linseeds and have been documented to enhance oestrogens levels when hormonal levels are low. This action may prevent against both hot flushes and breast cancer..
2. Glucosamine sulfate and chondroitin sulfate -They are effective and safer to alleviate symptoms of osteoarthritis.
3. Peptides/Hydrolysates - Found in casein and whey protein and have A.C.E.inhibitor activity.. Buckwheat proteins used as flour reduces cholesterol, hypertension; improve constipation and obesity by acting similar to dietary fibers and interrupting the in-vivo metabolism.
4. Dairy foods - Containing friendly or probiotic bacteria claimed to promote gut health. Bio yoghurts containing Lactobacillus acidophilus and Bifidobacteria lead the sector.

## **2. Traditional and Non- Traditional Nutraceuticals**

A wide variety of nutraceutical foods are available in the market which falls in the category of traditional foods and non traditional foods.

(a) **Traditional Nutraceuticals:** Under the category of traditional Nutraceuticals comes food in which no change to the food are made; It is simply natural, whole foods with new information about their potential health qualities. There has been no change to the actual foods, other than the way the consumer perceives them. 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. Tomatoes and salmon are two types of food that researchers have found to contain benefits beyond basic nutrition.

(b) **Nontraditional Nutraceuticals :** They are the outcome from agricultural breeding or added nutrients and/or ingredients such as orange juice fortified with calcium, cereals with added vitamins or minerals and flour with added folic acid are nontraditional nutraceutical. Agricultural scientists successfully have come up with the techniques to boost the nutritional content of certain crops. Research currently is being conducted to improve the nutritional quality of many other crops. Non-traditional nutraceuticals are artificial foods prepared with the help of

biotechnology. Food samples contain bioactive components which are engineered to produce products for human- wellness. They are arranged into :

a) Fortified nutraceuticals

b) Recombinant nutraceuticals

a) **Fortified nutraceuticals:** It constitutes fortified food from agricultural breeding or added nutrients and/or ingredients. e.g. orange juice fortified with calcium, cereals with added vitamins or minerals and flour with added folic acid. Some examples are milk fortified with cholecalciferol used in vitamin D deficiency. Prebiotic and probiotic fortified milk with Bifidobacterium lactis HN019 used in diarrhea, respiratory infections and severe illnesses, in children.

b) **Recombinant nutraceuticals:** Energy-providing foods, such as bread, alcohol, fermented starch, yogurt, cheese, vinegar, and others are produced with the help of biotechnology. The production of probiotics and the extraction of bioactive components by enzyme/fermentation technologies as well as genetic engineering technology are achieved through biotechnology.

### **Nutraceuticals based on Diseases**

1. **Cardiovascular disease:** Anti-oxidants, Dietary fibres, Omega-3 polyunsaturated fatty acids, Vitamins, minerals for prevention and treatment of CVD. Polyphenol (in grape) prevent and control arterial diseases. Flavonoids (in onion, vegetables, grapes, red wine, apples, and cherries) block the ACE (Angiotensin Converting enzyme) and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells.

2. **Diabetes:** Ethyl esters of n-3 fatty acids may be beneficial in diabetic patients. Docosahexaenoic acid modulates insulin resistance and is also vital for neurovisual development. Lipoic acid, an antioxidant, for treatment of diabetic neuropathy. Dietary fibers from psyllium have been used for glucose control in diabetic patients and to reduce lipid levels in hyperlipidemia.

3. **Obesity:** Herbal stimulants, such as ephedrine, caffeine, chitosan and green tea help in body weight loss. Buckwheat seed proteins acting similar to natural fibers present in food. 5-hydroxytryptophan and green tea extract may promote weight loss, while the former decreases appetite, the later increases the energy expenditure. A blend of glucomannan, chitosan, fenugreek, G sylvestre, and vitamin C in the dietary supplement significantly reduced body weight. Conjugated linoleic acid (CLA), capsaicin, possesses potential anti obese properties.

4. **Cancer:** Flavonoids which block the enzymes that produce estrogen reduce of estrogen-induced cancers. To prevent prostate/breast cancer a broad range of phyto-pharmaceuticals with a claimed hormonal activity, called “phyto-estrogens” is recommended. Soyfoods source of isoflavones, curcumin from turmeric and soya isoflavones possess cancer chemopreventive properties. Lycopene concentrates in the skin, testes, adrenal

and prostate where it protects against cancer. Saponins (found in peas, soybeans, some herbs, spinach, tomatoes, potatoes, alfalfa and clover) contain antitumor and antimutagenic activities. Curcumin (diferuloylmethane) which is a polyphenol of turmeric possesses anticarcinogenic, antioxidative and anti-inflammatory properties. Beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes, were reported to possess anti tumor activity.

5. **Anti-inflammatory activities:** Gamma linolenic acid (found in green leafy vegetables, nuts, vegetable oils i.e.-evening primrose oil, blackcurrant seed oil, and hemp seed oil, and from spirulina, cyanobacteria) are used for treating problems with inflammation and auto-immune diseases.

6. **Allergy:** Quercetin(found in Onions, red wine and green tea) reduce the inflammation that results from hay fever, bursitis, gout, arthritis, and asthma.

7. **Alzheimer's disease:**  $\beta$ -carotene, curcumin, lutein, lycopene, turmerin etc may exert positive effects on specific diseases by neutralizing the negative effects oxidative stress mitochondrial dysfunction, and various forms of neural degeneration.

8. **Parkinson's disease:** Vitamin E in food may be protective against Parkinson's disease. Creatine modifies Parkinson's disease features as measured by a decline in the clinical signs.

9. **Vision Improving agents:** Lutein (found in mangoes, corn, sweet potatoes, carrots, squash, tomatoes and dark, leafy greens such as kale, collards and bok choy) also known as helenien is used for the treatment of visual disorders. Zeaxanthin(found in corn, egg yolks and green vegetables and fruits, such as Broccoli, green beans, green peas, brussel sprouts, cabbage, kale, collard greens, Spinach, lettuce, kiwi and honeydew) used in traditional Chinese Medicine mainly for the treatment of Visual Disorders.

10. **Osteoarthritis:** Glucosamine (GLN) and chondroitin sulfate (CS) alleviate symptoms of O.A.

## COMMERCIAL NUTRACEUTICALS

New molecule is difficult to discover and more expensive and risky than ever before. Many pharmaceutical companies are now trying to manufacture nutraceutical because there is undoubtedly a very huge and growing market. Nutraceuticals cover most of the therapeutic areas, such as anti-arthritis, cold and cough, sleeping disorders, digestion and prevention of certain cancers, osteoporosis, blood pressure, cholesterol control, pain killers, depression and diabetes. Recognition of health benefits from consumption of omega-3 rich seafoods is one of the most promising developments in human nutrition and disease prevention research in the past three decades .

<b>Product</b>	<b>Source</b>	<b>Category</b>
Probiotic Wraps & Hummus	GanedenBC30 (Bacillus coagulans)	Support immune function and support digestive health
Collagen enhance chews	Red wine from grapes	Age-defying properties
Collage glucosamine complex	Chicken cartilage	Slows down the secretion of joint cartilage degrading enzymes.
Fih oil plus	salmon	Perfect brain food
Rice protein concentrate	Brown rice	High protein alternative
Calcium plus milk	Fortified milks	Lower risk of osteoporosis.

## **NUTRACEUTICAL SCENARIO IN INDIA**

The Indian nutraceutical industry has great prospects. Over the last decade a wide range of products have been available, giving an insight into the tremendous growth. On one hand a booming economy has resulted in overall increase in disposable income of population. Added to this unhealthy, eating habits coupled with sedentary lifestyle have led to increase incidence of diet and its related health issues. On the other hand, there is a growing awareness on the importance of nutrition and diet for long term good health. These have contributed to a favorable market conditions for Nutraceutical industry in India. India has a lot of advantages like qualified human resources, world class R & D facilities and varied raw material-aspects that give our country a leading edge. The Indian nutraceutical market is dominated primarily by pharmaceuticals and FMCG companies with very few pure play nutraceutical companies. Some major companies Marketing Nutraceuticals in India are GlaxoSmithKline consumer healthcare, Dabur India, Cadila Health care, EID Parry's, Zandu Pharmaceuticals, Himalaya herbal Healthcare, Amway, Sami labs, Elder pharmaceuticals and Ranbaxy.

## **CONCLUSION**

Many nutraceuticals, functional foods and naturally occurring compounds that have been investigated and reported in various studies revealed that these products are extremely active,

have profound effect on cell metabolism and often have little adverse effect. It is natural that people's focus is shifting to a positive approach for prevention of diseases to stay healthy. Nutraceuticals is scientific area generated all over the world. In many cases nutraceuticals offer an advantage over the synthetic drugs under development by the pharmaceuticals industry. It is novel pharmacological activity that are become interesting in their possible clinical use and thus helping in prevention and therapeutic in several diseases. Most of the pharmaceuticals companies often lack motivation to pursue these difficulties in obtaining the patents. It is hope that government agencies and research centers will give support for further research in nutraceuticals.