



## Nutraceuticals: As a dietary supplement in health and disease

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### Abstract

Nutraceuticals have experienced considerable attention due to their speculative safety, potential nutritive and therapeutic effects. They are alternative to modern medicines and also provide healthy living. Now a days nutraceuticals and bioactive foods obtained from natural source have arose as promising supplements in various diseases like cancer and cardiovascular disease. Nutraceuticals are in high demand as they provide high health value, longer cell life healthy living and also reduces the risk of side effects from modern medicines. Nutraceuticals own innumerable biological benefits like anti-diabetic, natural antioxidant, anti-obesity, immune enhancement and also in heart diseases also, they also help to maintain better quality of health. A number of known bioactive foods show beneficial effects by different mechanisms like as antioxidant phenolic compounds are widely used.

**Keywords:** Nutraceuticals, therapeutic, speculative, beneficial

### 1. Introduction

Nutraceuticals or bioactive foods may be defined as dietary supplements or food ingredients which are beneficial in various health issues, apart from their nutritional value and also find effective in various cancer and heart related diseases. Now a days nutraceuticals and bioactive foods obtained from natural source have arose as promising supplements in various diseases like cancer and cardiovascular disease <sup>[1]</sup>. Vitamins, minerals and nutraceuticals rich nutrients, dietary supplements or food provides health or disease preventive benefits with higher nutrition values. An appreciable attention has been given to the nutraceuticals as they retain outstanding safety and potent biological activity apart from their nutritive value <sup>[2]</sup>. Nutraceuticals are in high demand as they provide high health value, longer cell life healthy living and also reduces the risk of side effects from modern medicines. Nutraceuticals own innumerable biological benefits like anti-diabetic, natural antioxidant, anti-obesity, immune enhancement and also in heart diseases also, they also help to maintain better quality of health. Both food industries and pharmaceutical industries have roped up to use bioactive food, pharmaceutical and nutrition products, from drinkable yogurt to mainstream designer bone, heart, and digestive health foods to calcium chews, from sports nutrition bar makers to soy burger manufacturers bioactive foods are poised to undergo very rapid growth in the coming years. Functional foods are defined as products that resemble traditional foods but possess demonstrated physiological benefits. There are many functional foods and nutraceuticals that are becoming increasingly available in the marketplace <sup>[3]</sup>. In order to reduce or minimize disease risk factor and promote health dietary supplements and nutraceuticals food ingredients are very important. A number of known bioactive foods show beneficial effects by different mechanisms like as antioxidant phenolic compounds are widely used. Nutraceuticals belonging to antioxidant

category especially phenolic/polyphenolic compounds like omega 3 or probiotics are now days in great demand as they are very useful in several chronic diseases like cancer and cardiovascular <sup>[4]</sup>.

#### 1.1 Phenolics and polyphenolics as antioxidants

Phenolic and polyphenolic compounds are mainly obtained from plant foods. As plant foods are abundant source of these phenolic compounds among which the skin and seeds of fruit contain maximum quantity of phenols and polyphenols as compared to its leaves. An example for this is blueberry leaves that are excellent sources of antioxidants. The expression of hepatitis C virus RNA is being suppressed by blueberry leaves. Although the term antioxidant is frequently used by the public to describe the health benefits of phenolic and polyphenolic compounds, the mechanism by which these effects are rendered are not limited to their antioxidant potential which may be described as their efficacy in scavenging free radicals, chelating pro-oxidant metal ions or acting as reducing agents <sup>[5-7]</sup>.

#### 1.2 Omega-3 oils and their health benefits

Edible marine algae, sometimes referred to as seaweeds, are of interest as good sources of nutrients including protein, long-chain polyunsaturated fatty acids (PUFA), dietary fibres, vitamins and minerals. More recently, many researchers have focused on marine algae and their constituents as nutraceuticals and functional foods for their potential health-promotion mostly attributed to their  $\omega$ 3 fatty acids, antioxidants, and other bioactives. Although the majority of marine algae have low lipid contents, ranging from 0.3% in *U. lactuca* to 7.2% in *Caulerpa lentillifera*. The proportions of EPA and DHA in oils from *Skeletonema costatum* and *Cryptocodinium cohnii* were 41 and 37%, respectively <sup>[8-9]</sup>. The omega-3 oils, although originating from phytoplanktons or algae, are transferred to marine fish

and mammals through the food web. Lipids from the body of fatty fish such as mackerel and herring, the liver of white lean fish such as cod and halibut, and the blubber of marine mammals such as seals and whales are rich in long-chain  $\omega$ 3 fatty acids <sup>[10]</sup>.

### 1.3 Dietary supplement <sup>[11]</sup>

The Dietary Supplement Health and Education Act (DSHEA) of 1994 formally defined "dietary supplement" using several criteria. A dietary supplement:

- May be formulated in following dosage form like tablet, pill, capsule and liquid forms.
- These dietary supplements cannot be consumed as traditional meal or food.
- They must be tagged as dietary supplement.
- Certified antibiotics, approved new drugs or licensed biologic are included in dietary supplements and are prior license or approval from a authorized committee is required to market them as a dietary supplement.

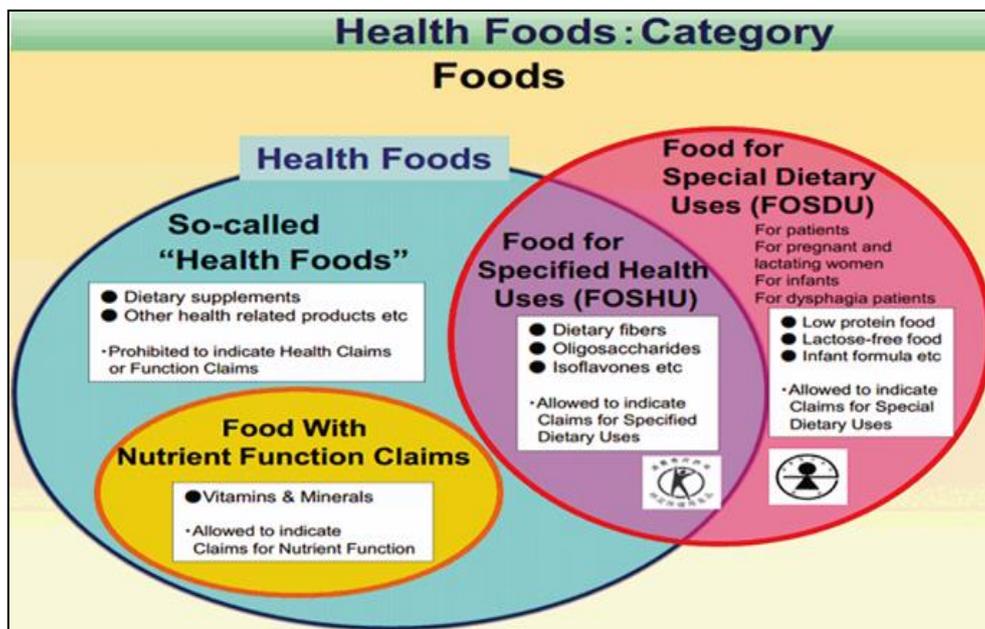


Fig 1: Health foods category <sup>[11]</sup>

### 1.4 Rationale for use of Nutraceuticals

Some dietary components mean a lot in unanticipated chronic disease emergence, disease evolution, morbidity and mortality. According to study modern diet and food intake attribute to evolution of various desases like about 35-50% part in cancers, 20% part in osteoporosis and 40-50% part in heart disease. For the prevention and therapy of different disorders utilizing food as medicine is not a current advancement. The table salt with iodine and wheat flour combined with folic acid and iron is used for the inhibition of iodine deficiency goiter and anemia. In order to reduce vitamin A deficiency vitamin A is combined with food as a supplement available at reasonable and cost effective price <sup>[11]</sup>.

### 1.5 Nutraceuticals and diseases

In recent time the nutraceuticals are very effective in the therapy of obesity, diabetes, cancer, cardio vascular disease, vitamin deficiency and other chronic decant diseases such as Parkinson's and Alzheimer diseases. The Scientific study shows that the mechanical behavior of nutraceuticals which includes a large variety of biological processes such as activation of antioxidants protections, signal transduction pathway, cell survival related gene expression, cell reproduction and distinction and conservation of mitochondrial integrality. It acts that these features mean a lot for the safety upon the dysfunctions of several age allied or chronic diseases. Fruits and vegetables naturally available are which in nutrients which are an essential for health and it is scientifically proved. For e.g. zeaxanthin and lutein

inhibit cataract and macular devolution; lycopene and beta – caretone protects the skin from ultraviolet radiation damage; lycopene and lutein are useful in cardiovascular health and lycopene is also used in treatment of prostate cancer <sup>[11]</sup>.

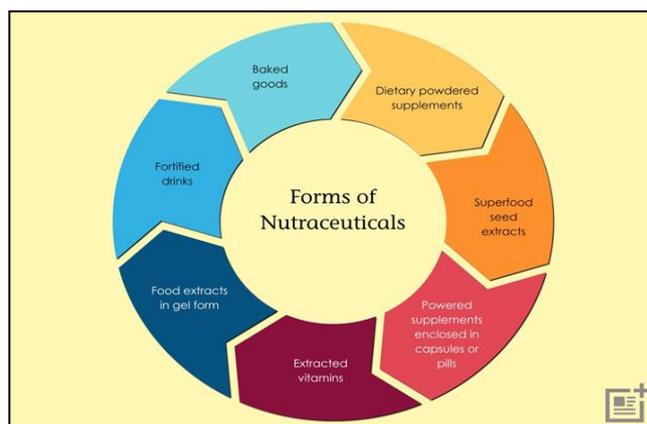


Fig 2: Forms of Nutraceuticals <sup>[11]</sup>

## 2. Classification of Nutraceuticals <sup>[12]</sup>

Nutraceuticals can be classified as follows:

### 2.1 On the basis of natural source

Products can be obtained from-

1. Plants- e.g. Indole-3-carbinol(cabbage), lycopene (tomatoes)
2. Animals- e.g. EPA and DHA (fish oil)
3. Minerals- e.g. selenium, iodine

4. Microbes- e.g. Phycocyanobilin (Spirulina), lactobacillus (yogurt)

## 2.2 On the basis of chemical constituents or therapeutic action of the nutraceutical

### 2.3 Nutraceuticals on basis of below properties:

1. Potential Nutraceuticals (plant-foods polyphenols for diabetes)
2. Established Nutraceuticals (polyvitamins, omega-3 fatty acids)

Most widely used food sources as Nutraceuticals are of natural sources and can be categorized as follows:

1. Dietary fibre- e.g. beans, fruits
2. Probiotics- e.g. yogurt, dark chocolate
3. Prebiotics- e.g. Asparagus, almonds, apples
4. Polyunsaturated fatty acids- e.g. olive oil, walnuts
5. Antioxidants vitamins- e.g. vitamin C, vitamin E
6. Polyphenols- e.g. tea, coffee, spinach

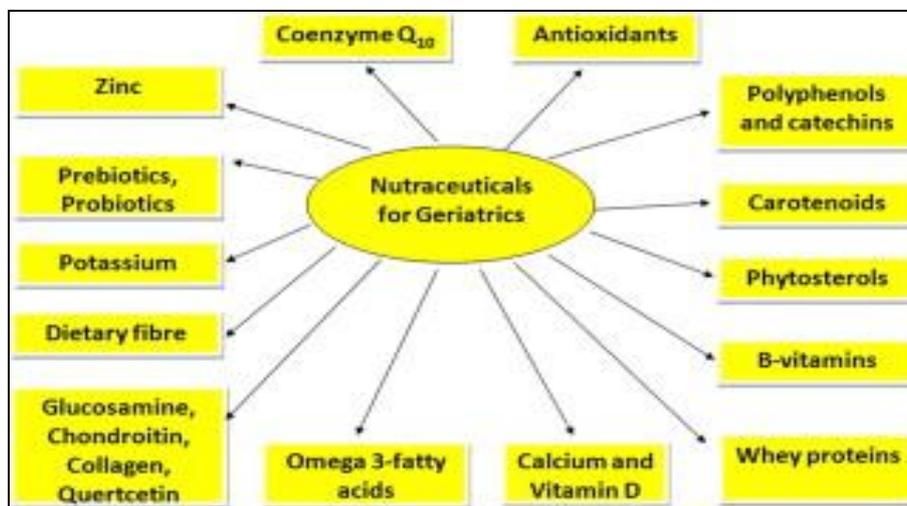


Fig 3: Classifications of Nutraceuticals <sup>[12]</sup>

## 3. Application of Nutraceuticals

### 3.1 Nutraceuticals in cancer treatment

Now days the chief cause of death among adult is cancer in adults. In generally the therapy of cancer includes the expensive and traumatic use of drug, surgery and irradiation. By change in lifestyle, reduction in the rates of cancer has been observed in recent times. Nutrition and foods are concerned up to 30% of cancers. In animal study it is scientifically proved that the deficiency of 40 nutrients which is important in our life can result in a risk of cancer. In human cancer scientific study has showed a large subset of organ specific subtypes. In the therapy of human cancers while testing the therapeutic activity of nutraceuticals, the lack of authenticated therapeutic target is the biggest challenge. In cancer or tumours DNA damaging factor and DNA transcription is controlled and regulated with the help nutraceuticals. Nutraceuticals have plentiful biological benefits like cardio vascular, immunity enhancement, anti-obesity, natural anti-oxidant, anti-diabetic and anti-inflammatory effects <sup>[13-15]</sup>.

### 3.2 Nutraceuticals as anti-inflammatory

Nutraceuticals own anti-inflammatory activity also which is widely used for the treatment of rheumatoid arthritis. Rheumatoid arthritis is a chronic inflammatory disease where in oxidative stress and inflammatory biomarkers are elevated. Synthetic drugs suggested for its therapy has acute reaction or various side effects due to which new and securer methods are being utilized for its treatment. There are many rich sources of food containing anti-inflammatory activity such as phenolic compound, phytosterols, tocopherols and polyunsaturated fatty acids. The example of foods including those components are tomato, carrot, green tea, fish oil, fenugreek, coriander, coconut etc. as an anti-

inflammatory agent nutraceuticals act following mechanism such as inhibiting the activation of NK-kappa B, Enzymes like COX-2, down regulation of over expression of CAMs and Phospholipase A2 etc. Nutraceuticals also have the ability to remove reactive oxygen species and block the expression of pro-inflammatory cytokines such as IL-1, IL-6. A common mechanism of action or molecular target is followed by non-steroidal anti-inflammatory drugs and compounds acting as anti-inflammatory nutraceuticals. Nutraceuticals have capacity to prevent the metastatic processes which cause to inflammation by the activation of NK-kappa B, induction and up regulation of pro-inflammatory cytokines, production of ROS <sup>[16-17]</sup>.

### 3.3 Nutraceuticals as antioxidants

Nutraceuticals work as an antioxidants which act on free radicals or their actions. This is scientifically proved that the major consumption of foods/ mixtures having an antioxidants activities lower the different human fatalities. Some of the compositions of food that have an antioxidant activities are garlic, onion, turmeric, rosemary etc. Nutraceuticals having antioxidants activity is useful in treatment of neurodegenerative diseases like Alzheimer's, Parkinson's disease etc. Flavonoid polyphenols are the major category which retain antioxidant activity such as green tea apples, non- flavonoid polyphenols- turmeric, grapes phenolic acids or phenolic diterpenes- rosemary, organ sulphur compounds- garlic, cabbage etc. They increase endogenous cellular antioxidant protections by acting on purifying free radicals. They act on ROS and RNS. The Nutraceuticals also inhibits the production of oxidized LDL. Now at a present time the Nutraceuticals and biomolecules are utilized to produce increased number of antioxidant in human body <sup>[18-19]</sup>.

### 3.4 Nutraceuticals as anti-aging

In modern society people are more conscious about their skin and age related degenerative diseases. So scientific research has evolved out that utilization of good dietary supplements especially containing antioxidant and also considering suitable cosmetics for skin may be helpful in skin and age related treatment. As studies has show that excessive release of free radicals in body are mainly responsible for skin damage and even to the DNA also so we need to focus on use of antioxidants. They also affect the processes that stimulates the production of reactive species ROS, RON, etc. Right selection of nutrients plays a vital role in the treatment of various disease which can be achieved by proper diet containing intake of food supplements rich in vitamine E, folic acid, vitamin B12, iron, etc. and they are mainly present in plenty of food sources like green vegetables, nuts, egg yolk, etc. curcumin, green tea, and black gram are most widely used as nutraceutical in obesity. They secrete leptin and other cytokines like IL-1, IL-6 that are critically involved in obesity and chronic inflammation. They also help in reducing LDL and total cholesterol. Some act by limiting overall food daily intake<sup>[20]</sup>.

### 3.5 Nutraceuticals as anti-diabetic

Diabetes is a metabolic syndrome where a person suffers from high blood glucose. It is caused due to lack of insulin production or the body cells do not respond properly to insulin or both. Some nutraceuticals used to treat and prevent diabetes are *Embllica officinalis*, fenugreek, green tea, etc. It also includes anti-oxidant vitamins like vitamin C and E and minerals like magnesium and chromium. They generally act by affecting insulin sensitivity and also prevent insulin resistance. Some act by increasing hepatic glycogen concentration and decreasing the concentration of glycogen phosphorylase and glyconeogenic enzymes<sup>[21-23]</sup>.

### 4. Conclusion

Nutraceuticals have been emerged as an alternative to modern medicines and have proven health benefits. Nutraceuticals has disease prevention capability with good nutritional value and food ingredients with additional health benefits. They are widely accepted by all age groups due to their higher quality, purity, safety and efficacy, promoting health and help to cure diseases. Nutraceuticals, such as glucosamine and chondroitin sulfate, offer possible chondroprotective effects against joint injury. The latest trend is moved towards nutrigenomics and nutraceuticals has led to new era of medicine and health.

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