



Overview of Nutraceuticals in the Prevention of Diseases

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ABSTRACT

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Nutraceuticals are the hybridization of 'Nutrition' and 'Pharmaceutical'. Nutraceuticals are food or a element of food or a nutrient, which gives health profits comprising advancement of health and prevention of diseases. The dietary fibre, probiotics, antioxidants, polyunsaturated fatty acids and other types of herbal/natural foods are used as nutraceuticals. Several diseases such as Diabetes, Cardiovascular, Obesity, Cancer, Arthritis etc are treated by these nutraceuticals. Therefore Nutraceuticals performs an essential role in disease prevention.

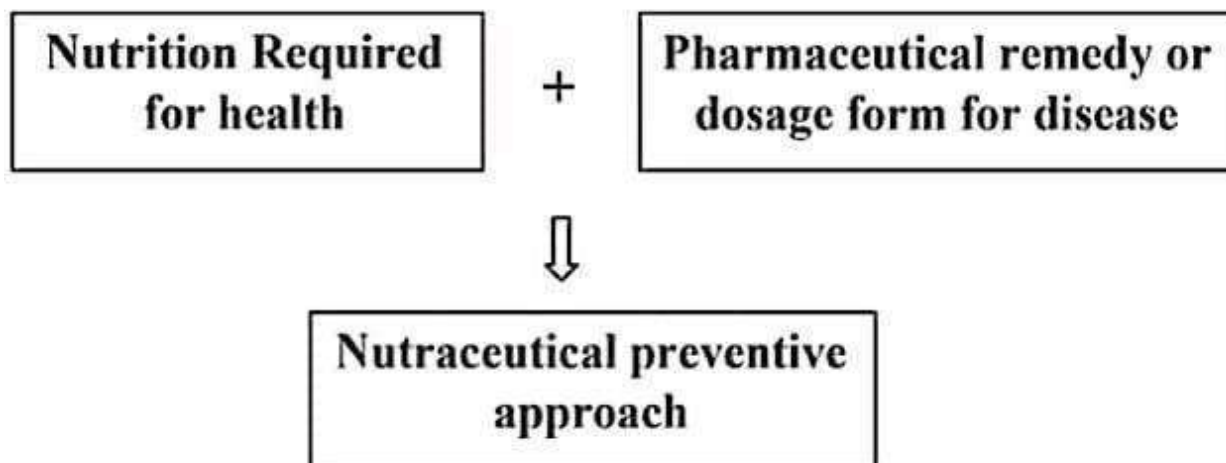
KEYWORDS:

Nutraceuticals, Prebiotics, Probiotics, Polyunsaturated Fatty Acids, Antioxidants, Diabetes.

INTRODUCTION

The term Nutraceuticals was derived from 'Nutrition' and 'Pharmaceutical'. In 1989, Dr. Stephen DeFelice was coined the term nutraceuticals and define the nutraceuticals as "Nutraceutical is any substance that is a food or a part of food that provide medicinal or health benefits including the prevention and treatment of disease".[1] Health Ministry of Canada defines it "As a product isolated or purified from the food generally sold in medicinal forms not assisted with food and demonstrated to have a physiological benefits and provide protection against chronic disease". Ex- Beta-Carotene and Lycopene.[2] Recently, endorsement of the new lifestyle by people has changed the primary food habits of the latter. Utilization of the junk food increases several number of diseases caused due to improper nutrition. In most of the developing countries, Obesity and heart disease are the main cause of death followed by cancer, osteoporosis, arthritis and several others. The normal functioning of body are controlled by Foods and nutrients and also helps to maintain the health of the individual and controls the risk of numerous disease.

CONCEPT OF NUTRACEUTICALS [5]



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BENEFITS OF NUTRACEUTICALS

The functional foods and nutraceuticals may offers several benefits for the human use such as:

- increase the health value of diet.
- avoid particular medical conditions.
- help to live longer.
- have a psychological benefit from doing something for one self.
- comprehended to be more “natural” than traditional medicine and reduces the unpleasant side effects. [6]

NUTRACEUTICALS AND DISEASES

Diabetes: Diabetes is a class of metabolic disease in which there is a fluctuation in blood sugar level through a prolonged period.[7] There are some nutraceuticals that are used to treat and prevent the diabetes:

- In predisposed patients to diabetes Omega 3-fatty acids have been suggested as to decrease the glucose tolerance.
- In Germany for the treatment of diabetic neuropathy Lipoic acid is used which is also a universal antioxidant.
- Dietary fibres from psyllium have been extensively used both as pharmacological supplements, in processed food to aid weight reduction, food ingredients, for glucose control in diabetic patients and to decrease the lipid level in hyperlipidemia.
- Maintained level of magnesium reduces diabetes risk and enhances insulin sensitivity.
- Extracts of bitter melon and of cinnamon have availability to treat and prevent the diabetes.
- Emblica officinalis, fenugreek, green tea anti-oxidants, vitamins like vitamin C and E are used to the prevent insulin resistance.[8,9,10]

Cancer: Cancer is a class of disease comprising abnormal cell growth with the ability to invade or spread to the other parts of body.[11,12] Features of cancer are:

- Cell growth and division absent from the proper signals.
- Prevention of programmed cell death.
- Unbounded number of cell divisions.
- Encouraging blood vessel construction.
- Invasion of tissue and formation of metastases.

Treatment and prevention of cancer are done by several nutraceuticals: [13]

Bioactive Compound	Source	Mechanism
Eugenol	Clove buds, cinnamon bark and leaves, tulsi leaves, turmeric, pepper, ginger	Inhibition of cell proliferation
Quercetin	Onions, grapes, berries, cherries, broccoli, and citrus fruits	Induces apoptosis
Allicin	Garlic (<i>Allium sativum</i> L.)	Induces apoptosis
Beta-carotene, lycopene	Tomato, red carrot	Induces apoptosis
Diosgenin	<i>Dioscorea alata</i> , <i>Smilax</i> China, and <i>Trigonella foenum graecum</i> .	Suppress of proliferation cancerous
Piperine	Black pepper (<i>Piper nigrum</i>)	Inhibition of cell proliferation
6-gingerol	fresh rhizome of ginger	anti-inflammatory and 5HT3 receptor antagonist

Cardiovascular Diseases: Cardiovascular diseases(CVD) are a group of disease which comprises the heart or blood vessels disorders such as Hypertension, Angina pectoris, Arrhythmias, Congestive heart failure, Peripheral vascular disease etc.[14,15]

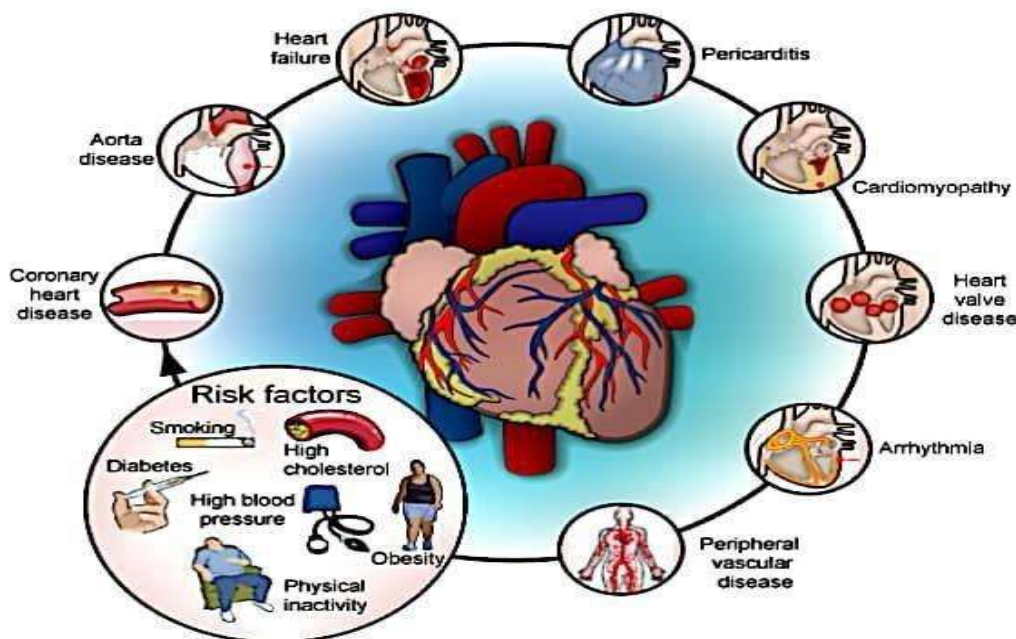


Figure:1 [16]

Some nutraceuticals are used to treat and prevent the cardiovascular diseases are:

- **Flavonoids:** Alteration in cellular metabolism and signalling are caused by Polyphenols present in grapes and wine.
- **Phytosterols:** Phytosterols compete with dietary cholesterol by interfering the uptake as well as facilitating its excretion from the body.
- **Dietary Fibers:** Dietary fiber preparations have laxative and cholesterol-reducing ability that prevent the cardiovascular diseases.
- **Essential Fatty Acids:** EFAs are used for the production and rebuilding of cells, to decrease the risk of blood clots, prevent numerous diseases including arthritis, arrhythmias and other cardiovascular diseases.
- Alpha-Lipoic acid, magnesium, Vitamin B6 (pyridoxine), Vitamin C have calcium channel blocking activity.[13]

Obesity: Obesity is a medical state in which excess body fat has aggregated to an extent that may affect the health in several ways. People are usually considered as obese when their body mass index (BMI) is over than 30kg/m². [17]

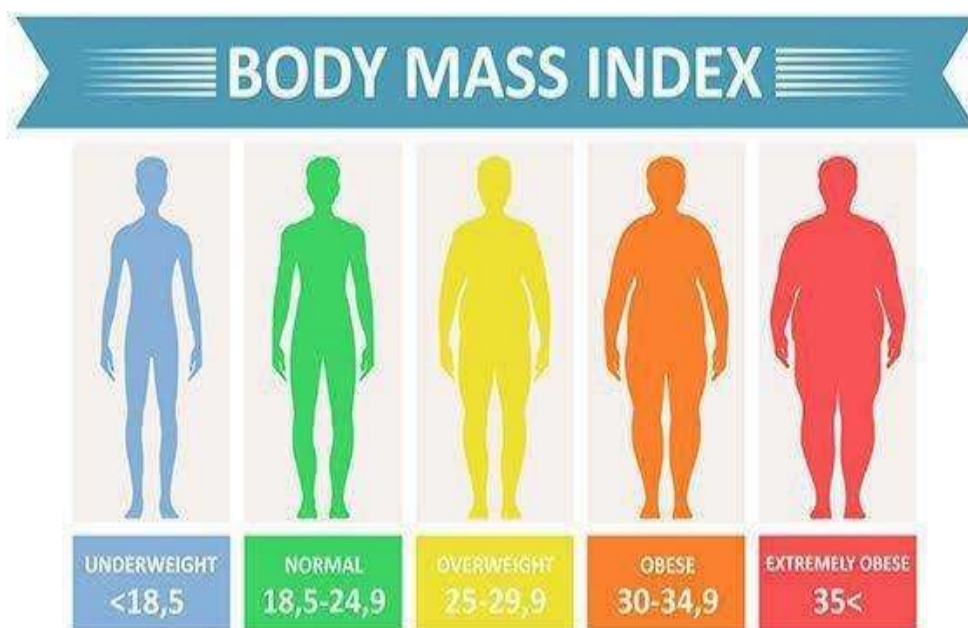


Figure: 2 [18]

Some nutraceuticals used for treatment and prevention of obesity are:

- Caloric restriction and raised physical activity has been shown in managing obesity.
- A blend of glucomannan, chitosan, fenugreek, G sylvestre, and vitamin C in the dietary supplement considerable in decreasing the body weight and promotes fat loss in obese patients.
- Nutraceuticals such as curcumin, bottle guard, black gram, green tea etc. helpful in reducing LDL and total cholesterol.[19]

Alzheimer's Disease: Alzheimer's Disease (AD) is a progressive neurodegenerative disease identified by cognitive deterioration, mood alterations, and neuropsychiatric disorders. In overall world there are more than 52 million people affected by AD (Alzheimer Report WHO).[20]

Progression of Alzheimer's Disease



Figure:3 [21]

Beta-carotene, lycopene, curcumin, turmerin and lutein may have positive effects on specific diseases by neutralizing the negative effects such as oxidative stress, mitochondrial dysfunction, and several forms of neural degeneration.[22]

Parkinson's Disease: Parkinson's disease is a neurodegenerative disorder, that leads to continuous destruction of motor function due to loss of dopamine-producing brain cells. Parkinson's disease is caused by loss of nerve cells in the part of the brain called the substantia nigra. A chemical called dopamine is produced by nerve cells present in substantia nigra.[23]

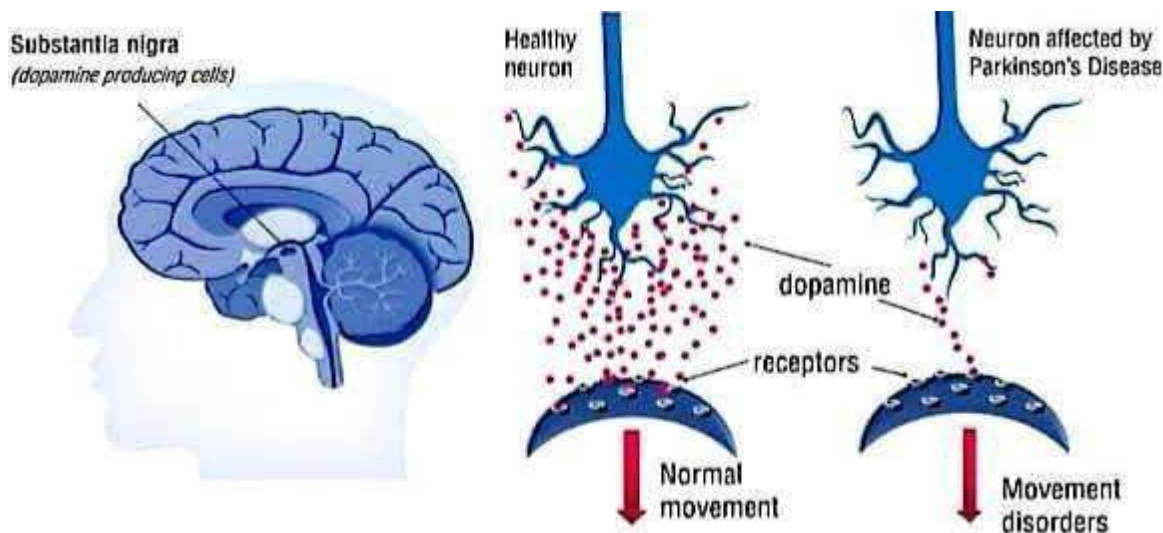


Figure:4 [24]

Some nutraceuticals are used to treat and prevent parkinson's disease are:

- Vitamin E is used in food may be protective against Parkinson's disease.[25]
- Seeds of the Mucuna plant, usually known as dopa bean, are thoroughly known for containing l-Dopa, for treating PD.
- Curcumin has antioxidant, anti-inflammatory, anti-cancer properties and protective against nerve cell injury.
- Creatine is an amino acid which elevates the levels of phosphocreatine, an energy source for muscles and brain. It also gives protection against nerve cell injury.
- Glutathione is a compound which has many effects on nerve cell metabolism. It is also act as a powerful antioxidant.[26]

Osteoarthritis: Osteoarthritis (OA) is the most common chronic joint state. It is also known as wear-and-tear arthritis, degenerative arthritis, and degenerative joint disease. The ends of the bones are usually covered by a protective tissue known as cartilage. In osteoarthritis, this cartilage breaks down that causes the bones within the joint to rub together which cause pain, stiffness, and other symptoms. Osteoarthritis generally found in hands, fingers, shoulder, spine, hips, knees etc.[27]

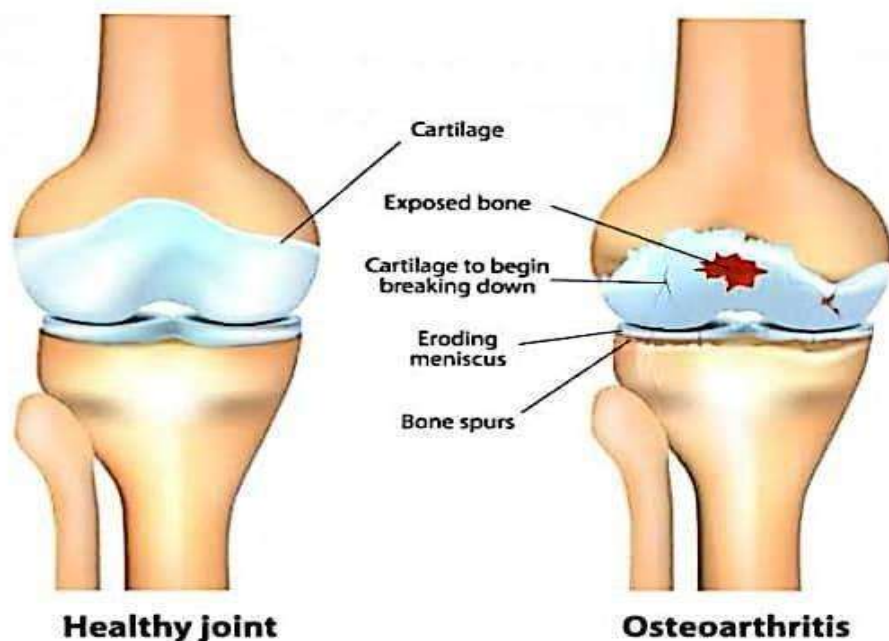


Figure:5 [28]

Some nutraceuticals used to treat and prevent osteoarthritis are:

- chondrocytes and synoviocytes are used in synthesis of Hyaluronic acid, glucosamine sulfate, and chondroitin sulfate are glycosaminoglycans (GAGs), and are the basic components of the extracellular matrix and synovial fluid. The nutritional supplementation of these molecules are used to protect the joints from possible alterations caused by trauma or wear and, therefore, for OA prevention.[29]
- Methionine is an essential amino acid for humans. The active form of methionine is Sadenosylmethionine (SAdMe) is a precursor of glutathione. SAdMe helps in promotion of anabolic processes of cartilage, which leads cartilage regeneration in patients with OA.[30]

Various nutraceuticals used against different diseases: [13]

Sr.No.	Disease	Examples
1.	Alzheimer	Vitamin A and C, alpha-lipoic acid
2.	Cardiovascular	Flavonoids (onion, black grapes)
3.	Parkinson	Vitamin E
4.	Obesity	Fenugreek, Vitamin C
5.	Diabetes	Calcium, Vitamin D, Emblica officinalis
6.	Osteoarthritis	Glucosamine, Chondroitin sulphate
7.	Constipation	Buck wheat
8.	Vision improving	Carrot, mangoes, spinach, kiwi, egg yolk
9.	Antioxidant	Oats, fruits, carrots
10.	Anti- Inflammatory	Turmeric
11.	Hypertension	Curry leaf, green tea
12.	Hyperlipidemia	Emblica officinalis

Nutraceuticals and their uses: [31]

Chemical constituent	Source	Potential benefit
<i>Carotenoids (Isoprenoids)</i>		Reduces risk of prostate cancer
Lycopene	Tomatoes & Tomato products	Health vision
Lutin	Green vegetables	Neutralizes free radicals which may cause damage to cells
Alpha-carotene	Carrots	Neutralizes free radicals
Beta-carotene	Various fruits, vegetables	Health vision
Zeaxanthin	Eggs, citrus, corn	Improves some symptoms associated with osteoarthritis
<i>Collagen hydrolysate</i>		
Collagen hydrolysate	Gelatine	
<i>Dietary fibre</i>		
Insoluble fibre	Wheat bran	Reduce risk of breast and colon cancer
Beta-glucan	Oats	Reduces risk of CVD
Soluble fibre	Psyllium	Reduces risk of CVD

Whole grains	Cereal grains	Reduces risk of CVD
Fatty acids		
Omega-3 fatty acids- DHA/EPA	Tuna, fish and marine oils	Reduces the risk of CVD & improves mental, visual functions
CLA	Cheese, meat products	Improve body composition, may reduce the risk of cancer
Flavonoids		
Anthocyanins	Fruits	Neutralizes free radicals, may reduce the risk of cancer

Catechins	Tea	Neutralizes free radicals, may reduce the risk of cancer
Flavanones	Citrus	Neutralizes free radicals, may reduce the risk of cancer
Flavones	Fruits/vegetables	Neutralizes free radicals, may reduce the risk of cancer
Glucosinolates, Indoles, Isothiocyanates		
Sulforaphane	Cruciferous vegetables (Broccoli, kale), Horse radish	Induces detoxification enzymes, may reduce the risk of cancer
Phenols		
Caffeine acid	Fruits, vegetables, citrus	Antioxidant like activities, may reduce the risk of degenerative diseases, heart diseases & eye diseases

CONCLUSION

Nutraceuticals have been appeared as an alternative to modern medicines and have proven health benefits. A large number of dietary supplements are derived from plants and animals. The latest trend is moved towards nutrigenomics and nutraceuticals has led to new era of medicine and health. Nutraceuticals have disease prevention capability with good nutritional value and food ingredients. Due to their higher quality, purity, safety and efficacy, promoting health and help to cure diseases they are widely accepted by all age groups.

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