

NUTRACEUTICALS: THEIR ROLE AS COMPLEMENTARY SOLUTIONS IN PHARMACEUTICAL THERAPEUTICS**Jagadeesh Yelamanda^{*1}, Niranjan Babu Mudduluru², Harikiran Addanki³**¹Department of Pharmaceutics, Seven Hills College of Pharmacy, Tirupati, A.P., India²Department of Pharmacognosy, Seven Hills College of Pharmacy, Tirupati, A.P., India³Department of Pharmaceutics, Seven Hills College of Pharmacy, Tirupati, A.P., India**Corresponding Author****Y. Jagadeesh**Assistant Professor, Department of Pharmaceutics, Seven Hills College of Pharmacy,
Tirupati, A.P., India – 517561, Contact: 9493100673, Email:jagadeeshlakshmi.16@gmail.com**ABSTRACT:**

Nutraceuticals are products that serve both nutritional and therapeutic purposes. They provide physiological benefits and can help prevent chronic diseases. Nutraceuticals are utilized to enhance overall health, slow down aging, prevent chronic illnesses, increase life expectancy, and support the structure and function of the body. Recently, nutraceuticals have gained popularity for their potential nutritional, protective, and therapeutic advantages. Recent research has shown promising results for these compounds across a range of health issues. Current reviews have focused on establishing new criteria for nutraceuticals based on disease-specific indications. There is a significant emphasis on natural nutraceuticals that are effective in managing challenging health conditions associated with oxidative stress, such as allergies, Alzheimer's disease, cardiovascular issues, eye diseases, obesity, hypertension, and others.

Keywords: Disease modifiers, oxidative stress, antioxidants, herbal nutraceuticals, as well as nutraceutical products

Introduction:

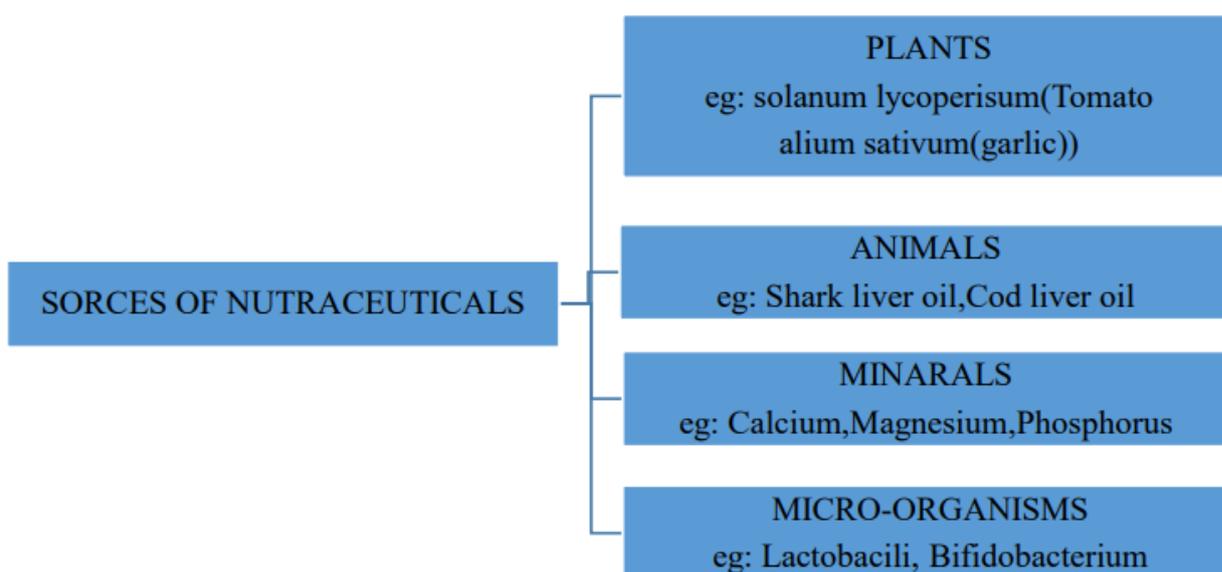
Nutraceutical is a term derived from combining "nutrition" and "pharmaceutics." It refers to products distinct from natural foods, dietary supplements (vitamins), specific diets, and processed foods like cereals, soups, and beverages that serve both nutritional and medicinal purposes. In the United States, products labeled as "nutraceuticals" are regulated as medicines, food additives, or dietary supplements. While definitions may vary by country, they generally describe products separated from food and marketed in medicinal forms unrelated to food. These substances offer physiological benefits or protection against chronic diseases, thereby classified as nutraceuticals. They have the potential to enhance well-being, delay aging, and prevent chronic illnesses[1].

Nutraceuticals, unlike prescription drugs, typically lack patent protection. While both pharmaceutical and nutraceutical compounds can treat or prevent diseases, only pharmaceutical compounds receive official government approval[2].

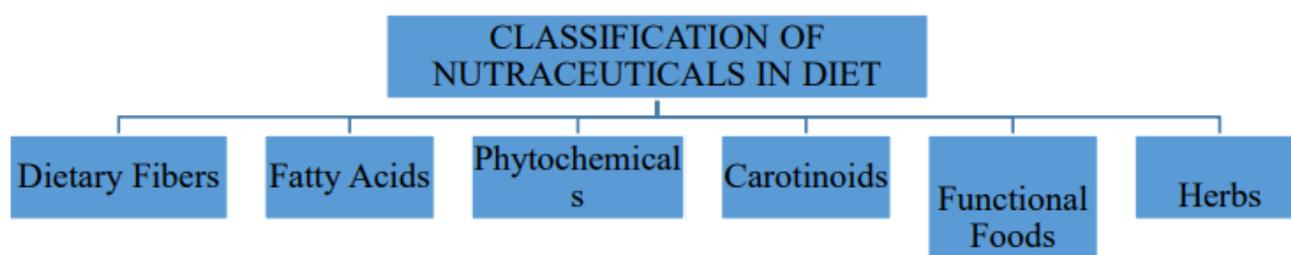
A dietary supplement is considered a product that contains one or more nutritional ingredients, such as vitamins, minerals, amino acids, medicinal herbs, or other botanicals, intended to supplement the diet. Nutraceuticals go beyond traditional nutritional supplements, often used for purposes other than basic nutrition[3].

Recent reviews have focused on establishing new criteria for nutraceuticals based on disease-modifying indications. The emphasis has been on natural nutraceuticals effective in managing challenging health conditions associated with oxidative stress, including allergies, Alzheimer's disease, cardiovascular issues, cancer, diabetes, eye diseases, immune disorders, inflammatory conditions, Parkinson's disease, and obesity[4].

SOURCES OF NUTRACEUTICALS:



CLASSIFICATION OF NUTRACEUTICALS IN DIET



Advantages of Nutraceuticals:

1. Enhance health.
2. Delay aging.
3. Accessible and cost-effective.
4. Extend lifespan.
5. Reduced side effects with favorable outcomes.
6. Holistic approach.
7. Naturally provide supplements.
8. Cater to special nutritional needs, such as nutrient-dense food for elderly populations.

Limitations of Nutraceuticals:

1. Subject to different testing and regulations compared to pharmaceuticals.
2. Lack of FDA regulation in most US states.
3. Some businesses prioritize profit over product regulation.
4. Reduced nutrient bioavailability.
5. Reports of occasional toxicity and side effects due to contamination or inherent properties.
6. Insufficient consumer information regarding efficacy, safety, interactions with prescription drugs, and impact on existing medical conditions.
7. Effects may sometimes be comparable to a placebo.

Treatment of Cardiovascular Diseases with Nutraceuticals:**A) Cardiovascular Diseases and Nutraceuticals:**

- Cardiovascular diseases (CVD) encompass various heart and blood vessel disorders such as coronary heart disease, peripheral vascular disease, stroke, hypertension, and heart failure. The global prevalence of CVD is increasing, prompting extensive research in this field[5].
- Diets low in fruits and vegetables are linked to higher mortality from CVD. Many studies highlight the protective benefits of diets rich in fruits and vegetables against CVD.
- Nutraceuticals such as vitamins, minerals, antioxidants, dietary fibers, and omega-3 polyunsaturated fatty acids (n-3 PUFAs) are recommended for both prevention and treatment of CVD. Polyphenols found in plant-based foods regulate cellular metabolism and signaling pathways, potentially reducing arterial diseases.
- Flavonoids, abundant in vegetables, fruits (like grapefruits, apples, berries), and red wine, are categorized as flavones, flavanones, and flavonols. They play a crucial role in preventing and treating CVD by inhibiting enzymes like angiotensin-converting enzyme and cyclooxygenase, which degrade prostaglandins and promote platelet aggregation[6].
- Plant foods containing anthocyanins, tannins (proanthocyanidins), tetrahydro- β -carbolines, stilbenes, dietary indoleamines, serotonin, and melatonin are believed to confer health benefits by protecting the vascular system and supporting cellular oxygenation and nutrient delivery.
- Hesperidin, a flavanone glycoside found in citrus fruits like oranges and tangelos, is particularly rich in flavonoids and beneficial for cardiovascular health.
- Phytosterols, found abundantly in plant species, compete with dietary cholesterol for absorption and facilitate its excretion from the body. This property reduces morbidity and mortality associated with CVD[7].
- Omega-3 fatty acids, predominantly found in fish, influence plasma lipid levels and cardiovascular health, including the prevention of arrhythmias.
- Octacosanol, present in whole grains, fruits, and leaves, exhibits lipid-lowering properties without adverse effects, contributing positively to cardiovascular health[8].

This comprehensive approach emphasizes the role of nutraceuticals in mitigating cardiovascular risks and promoting heart health through dietary interventions rich in beneficial compounds.

B) Diabetes and Nutraceuticals:

- Type 2 diabetes mellitus constitutes 95% of all diabetes cases globally, largely associated with obesity. Despite the availability of numerous pharmaceutical interventions, the prevalence of diabetes continues to rise due to various factors.
- Diabetes exerts a significant economic burden on individuals, families, and society at large.
- Recent years have seen a proliferation of natural nutritional supplements and herbal medicines that have shown promise in preclinical studies for managing type 2 diabetes mellitus. However, few have been validated in well-designed randomized clinical trials[9].
- Isoflavones, phytoestrogens structurally similar to human estrogens, have been extensively studied. Soy isoflavones, in particular, have been linked to reduced incidence and mortality rates from type 2 diabetes, coronary heart disease, osteoporosis, and certain cancers.
- Omega-3 fatty acids have been associated with improved glucose tolerance in diabetic patients. Insulin is crucial for the synthesis of long-chain n-3 fatty acids, making them beneficial for diabetics prone to insulin deficiency. Ethyl esters of n-3 fatty acids have shown potential benefits in diabetes management.
- Lipoic acid, an antioxidant used to treat diabetic neuropathy, shows promise as a long-term dietary supplement for protecting diabetics from complications.
- Psyllium dietary fibers are widely used as pharmacological supplements and food additives, aiding in weight loss, glucose control in diabetics, and reduction of lipid levels in hyperlipidemia[10].
- Several plant extracts, including *Toucrium polium*, cinnamon, and bitter melon, have demonstrated efficacy in preventing or managing diabetes.

These findings underscore the potential of nutraceuticals in complementing traditional treatments for type 2 diabetes mellitus, highlighting their role in improving outcomes and managing complications associated with the disease.

C) Cancer and Nutraceuticals:

- Cancer has become a significant global public health concern, with projections indicating a 50% increase to 15 million new cases by 2020. Adopting a healthy lifestyle and diet can substantially lower the risk of most cancers.
- Carotenoids, a group of phytochemicals responsible for the vibrant colors in food, possess potent antioxidant properties that contribute to cancer prevention. Research has highlighted lycopene's role in human health, particularly its impact on cancer prevention.
- Plant sources rich in daidzein, biochanin, isoflavones, and genistein inhibit the growth of prostate cancer cells. Lycopene, a powerful antioxidant concentrated in various organs including the prostate, protects against cancer.

- Foods rich in lycopene reduce oxidative stress and DNA damage, providing protection against cancer. Tomatoes, guava, red grapefruit, watermelon, and papaya are primary sources of lycopene.
- β -carotene, another potent antioxidant found in tomatoes, guava, red grapefruit, watermelon, and papaya, plays a significant role in preventing cancer and other diseases.
- Chronic inflammation increases cancer risk and suppresses the immune system. Ginseng, known for its anti-inflammatory properties, targets key pathways involved in inflammation-associated cancer development.
- Phytochemicals with chemopreventive properties found in fruits and vegetables demonstrate anticarcinogenic and antimutagenic effects, offering additional health benefits.
- Citrus fruit flavonoids act as antioxidants and may help prevent cancer. Soyfoods, rich in isoflavones and polyphenols like epigallocatechin gallate (EGCG) from tea and curcumin from curry, possess cancer-preventive properties.
- Soybeans offer protection against various cancers including breast, uterine, lung, colorectal, and prostate cancers. Saponins, found in peas, soybeans, and herbs, inhibit cancer cell growth and are known for their antimutagenic properties.
- Tannins found in grapes, lentils, tea, blackberries, blueberries, and cranberries scavenge free radicals and remove carcinogens, demonstrating anticarcinogenic effects.
- Ellagic acid, present in walnuts, pecans, strawberries, cranberries, pomegranates, and red raspberry seeds, acts as an anticancer agent in alternative medicine practices.

D) Alzheimer's Disease and Nutraceuticals:

- Alzheimer's disease (AD) is the most common form of dementia and currently lacks a cure, eventually leading to death. It predominantly affects individuals over the age of 65, although early-onset cases can occur earlier. In 2006, there were 26.6 million patients worldwide, and projections suggest it will affect one in every 85 people by 2050.
- Women are more affected than men, with a ratio of nearly 2:1. Extensive evidence links oxidative stress to various neurodegenerative disorders, including Alzheimer's disease. Nutraceutical antioxidants such as curcumin, lutein, lycopene, turmerin, and β -carotene can mitigate oxidative stress and potentially benefit specific diseases.
- Nutraceuticals have gained popularity due to their perceived ability to delay the onset of dementias like Alzheimer's disease. Recent studies have shown promising effects of various nutraceutical plants on Alzheimer's disease, cognition, and memory, including *Zizyphus jujube* and *Lavandula officinalis*.

E) Allergy and Nutraceuticals:

- Allergies are immune system hypersensitivity disorders triggered when the immune system reacts to normally harmless substances. This reaction involves excessive activation of specific white blood cells called mast cells and basophils by an antibody known as immunoglobulin E (IgE). The resulting inflammatory response can range from mild discomfort to severe and life-threatening reactions.

F) Obesity and Nutraceuticals:

- Obesity has become a global public health concern, affecting approximately 315 million people worldwide. It significantly increases the risk of various diseases, including hypertension, congestive heart failure, angina pectoris, hyperlipidemia, respiratory disorders, osteoarthritis, cancer, renal vein thrombosis, and reduced fertility.

Future Scope:

Nutraceuticals represent the future of pharmaceuticals, driven by the global aspiration for better health:

- Soy protein nutrients, functional food components such as lutein, lycopene, omega-3 fatty acids, probiotics, and sterol esters, essential minerals like calcium and magnesium, herbal extracts such as garlic and green tea, and non-herbal extracts including chondroitin, glucosamine, and coenzyme Q10 are expected to experience substantial growth in the coming years.

Conclusion:

Nutraceuticals are substances known for their physiological benefits and protective effects against chronic diseases. They contribute to improving health, slowing down the aging process, preventing chronic illnesses, extending life expectancy, and supporting overall body function. Nutraceuticals have gained popularity recently due to their potential nutritional, preventive, and therapeutic benefits. Recent research has shown promising outcomes for these compounds in various health conditions. This review has focused extensively on presenting disease-modifying indications related to oxidative stress, including allergies, Alzheimer's disease, cardiovascular diseases, cancer, diabetes, eye disorders, immune disorders, inflammatory conditions, Parkinson's disease, and obesity.

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