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A REVIEW ON NUTRACEUTICALS: CLASSIFICATION AND IT'S ROLE IN VARIOUS DISEASES

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NUTRACEUTICAL



✞ INTRODUCTION

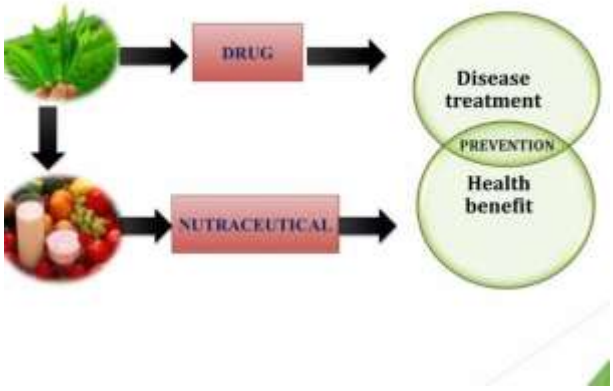
Nutraceuticals are products derived from food sources that are purported to provide extra health benefits, in addition to the basic nutritional value found in foods. Depending on the jurisdiction, products may claim to prevent chronic diseases, improve health, delay the aging process, increase life expectancy, or support the structure or function of the body. Nutraceutical means any non-toxic food component that has scientifically proven health benefits including prevention and treatment of disease. Products isolated or purified from food are sold in medicinal forms not usually associated with food. A nutraceutical has a physiological benefit that it provides protection against chronic diseases.

Nutraceuticals work through various pathways in the body, and either provide a replacement for something that the body doesn't produce on its own or add the necessary component for a cellular pathway to enhance its function Nutraceuticals can be used for managing a health condition, preventing a medical condition from developing or maintaining a healthy state in the body.

Several in vitro and in vivo studies suggest that nutraceuticals have a protective effect against chronic diseases, but the results are not supported fully by clinical evidence. It has also been demonstrated that they may serve as a useful adjunct to pharmaceuticals to better manage chronic conditions or offset negative side effects.(Refer 1)

✞ Nutraceutical Mainly Consist of

1. Nutrients: Substance which have establish nutritional functions for example, Vitamins, Minerals, Amino acids, Fatty acids, ete.
2. Herbals/ Phytochemicals: Herbs or Botanical products.
3. Dietary supplements: Probiotics, Prebiotics, Antioxidants, Enzymes, etc



❖ History

The word is a portmanteau of the word's "nutrition" and "pharmaceutical", was coined in 1989 by Stephen L. Defelice, founder and chairman of the Foundation of Innovation Medicine. Terms 'nutraceuticals", "food supplements, dietary supplements have evolved after the concept was originated by Dr. De Felice. Prior to the 1990s the term nutraceutical was not in use, but there was research on the functional properties and

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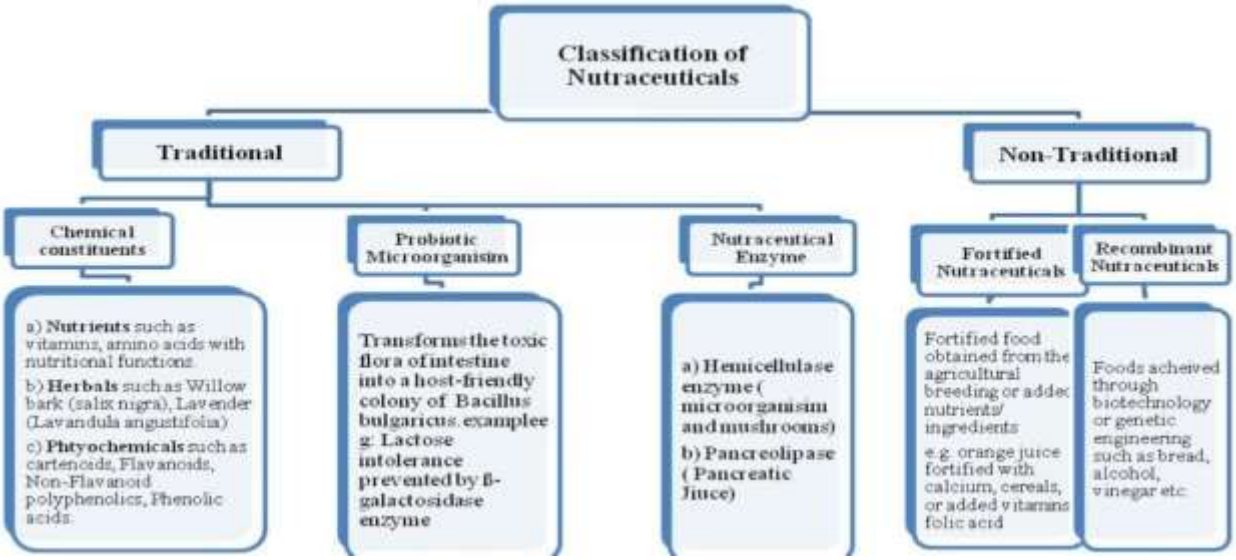
ability of food to alleviate and/or prevent certain conditions connected to different type of diseases. There is no sharp demarcation between food supplements and nutraceuticals given by regulatory authorities.

In the 19th century, in line with Hippocrates' philosophy "let the food be thy medicine and thy medicine be the food" the connection between nutrition and human health was conceptualized, as well as the relationship between the use of appropriate foods for health and their therapeutic benefits. Traditionally, the people of India and China consume various natural foods that are considered to be medicinal. Countries like Germany, France, and England were the first to consider one's diet more important than both exercise and hereditary factors in people's attempt to achieve good health.



Dietary supplement terminology was defined by The Dietary Supplement Health and Education Act (DSHEA) in 1994. The definition of DSHEA was: "a product (other than tobacco) that is intended to supplement the diet that bears or contains one or more of the following dietary ingredients: A vitamin, a mineral, an herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing the total daily intake, or a concentrate, metabolite, constituent, extract, or combinations of these ingredients".

In recent years, numerous scientific studies have shown that food is a very powerful means at our disposal for safeguarding the body in maintaining a state of well-being. In fact, many degenerative, autoimmune and neoplastic diseases are positively and negatively related to nutrition, and the nutrient organism interaction could define, throughout life, the balance between health and disease. Several in vitro and in vivo studies suggest that nutraceuticals have a protective effect against chronic diseases, but the results are not sapported fully by clinical evidence. Today, nutraceuticals have evolved from their traditional background to a highly scientific field where the efficacy and safety of the products are backed by evidence, new research, and developing technologies.(Refer 2)



❖ CLASSIFICATION OF NUTRACEUTICAL

1. Natural or Traditional Nutraceuticals:

This category consists of the food which does not undergo any manual changes. The components are natural and are having some potential which are actively involved in health benefits:

❖ These are mainly three types :-

1) Chemical Constituents

Nutrients
Herbal
Phytochemicals
ii. Nutraceutical enzymes
iii. Probiotic Micro-organisms
iv.PUFAs
v. Antioxidants



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a) Nutrients

Nutraceuticals the nutrients include amino acids, fatty acids, minerals, and vitamins, with recognized nutritional functions. Minerals found in plants, animals, and dairy products. are useful in osteoporosis, anaemia, and in building strong bones, teeth, muscles, and improved nerve impulse and heart rhythm antipyretic. Peppermint (Mentha Piperita) contains menthol as an active component that helps cure a cold and flu..

b) Phytochemicals

Phytochemicals are plant nutrients with particular biological activities that promote human health. They are also referred to as phytonutrients such as carotenoids, flavonoids, nonflavonoids, polyphenolics, phenolics etc.

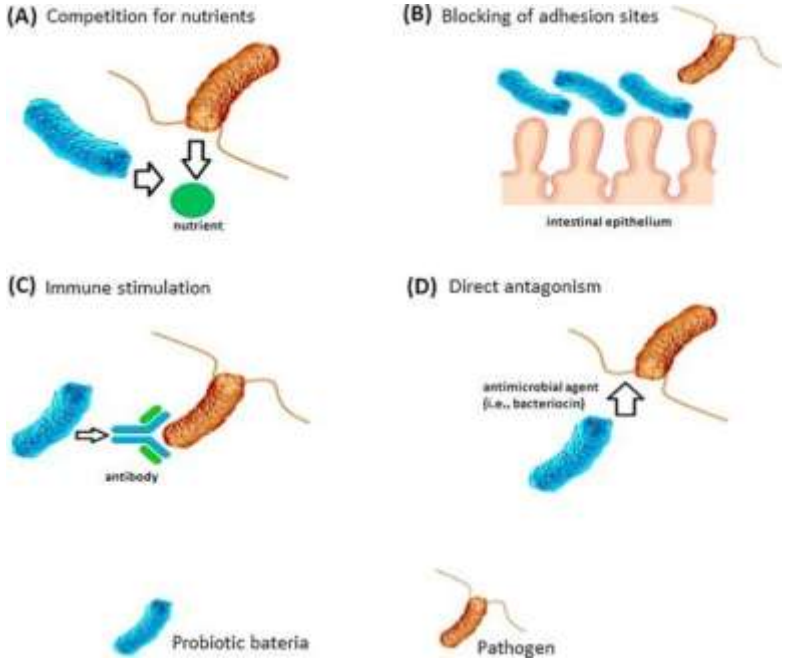
c) Nutraceuticals enzymes

Enzymes are an essential part of life these enzymes are derived from plants, animals, and microbial sources.

Food Sources	Examples
Plants	Ascorbic acid, Quercetin, Luteolin, Cellulose, Lutein, Gallic acid, Glutathione, Potassium, Allicin, Genestein, Lycopene, Lignin Carotene, Capsaicin, Geraniol, Selenium, Zeaxanthin and Minerals.
Animals	Conjugated linoleic acid (CLA), Eicosapentaenoic Acid (EPA), Choline, Lecithin, Calcium, Coenzyme Q10, Selenium, Creatine and Minerals
Microbes	Saccharomyces boulardii (yeast), Bifidobacterium bifidum, B.longum, B.infantis, Lactobacillus acidophilus (LCL), L. acidophilus (NCFB 1748).

d) Probiotic Microorganisms

Probiotics are very important to make life smoother by removing the toxic flora of the intestine and maintaining a friendly environment. Currently, various probiotics like. Bacillus bulgaricus products are available in the market with adequate nutrients to counter various pathogens so that several ailments related to the human body can be treated. These microorganisms are responsive bacteria that promote healthy digestion and absorption of some nutrients.



2) Un-natural or Non-Traditional Nutraceuticals

These are the artificial foods developed via biotechnology. The bioactive components in food samples are engineered to produce products for human wellness.

They were classified into two groups

- Fortified nutraceuticals.
- Recombinant nutraceuticals

i. Fortified Nutraceuticals

These are nutraceuticals from agrarian breeding or added nutrients and/or ingredients.

examples include cereals with added vitamins or minerals, milk fortified with cholecalciferol used in vitamins D deficiency, flour with added folic acids, prebiotic and probiotic fortified milk with Bifidobacterium Lactis HN019 used in diarrhoea, respiratory infections, and severe illnesses.

ii. Recombinant Nutraceuticals

It includes the making of prebiotics and the extraction of bioactive components by enzymes/fermentation technologies as well as genetic engineering technology. Also, energy-providing foods, such as bread, alcohol, fermented starch, yogurt, cheese. vinegar, and others are produced using modern biotechnology.

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3. Commercial Nutraceuticals

New molecule is difficult to discover and more expensive and riskier 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-arthritic, 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.

They are also classified into these two groups. :

- Dietary supplements
- Functional food

i. Dietary Supplements

They are concentrated sources of mutrients or other substances with a nutritional or physiological effect, alone or in combination. Dietary supplements contain all products that can be purchased by the consumer without a prescription. Many potential benefits have been attributed to antioxidants used in the form of dietary intake or supplementation. Antioxidants, in general, may be useful in the prevention of cancer and cerebrovascular disease.

Dietary supplements are not classified as drugs. The main difference is that they do not have approved therapeutic claims unlike in the case of drugs. Moreover, dietary supplements could either contain vitamins, minerals, herbals, or amino acids, all aimed to add to or supplement the diet of an individual. They are not intended to be taken alone as a substitute for any food or medicine.

ii. Functional Foods

Functional foods, according to their generally accepted definition, are "any food or food. ingredient that may provide a health benefit beyond the traditional nutrients it contains. Functional foods are designed to allow consumers to eat enriched foods close to their natural state, rather than by taking dietary supplements manufactured in liquid or capsule form. Functional foods have been either enriched or fortified, a process called nutrification. This practice restores the nutrient content in a food back to similar levels from before the food was processed. Sometimes, additional complementary nutrients are added, such as vitamin D to milk.

❖ **Risk associated with functional food and nutraceutical**

- Risk of inaccurate health claims: the active ingredient of functional food may not be obvious; it may react with the food matrix altering bioavailability.
- Poor quality control: closely related herbs and other plants may not be correctly identified during manufacture resulting in lack of efficacy or toxicity.
- Adverse drug reaction to functional food: added ingredients can be toxic or nontoxic.
- Allergenicity: allergic reactions are mediated by the immune system. The incorporation of a foreign protein elicits the process.(Refer 3)

S. NO	CLASS	EXAMPLES
1.	Inorganic mineral supplements	Minerals
2.	Prebiotics	Digestive enzymes
3.	Probiotics	Helpful bacteria
4.	Dietary fibres	Fibres
5.	Antioxidants	Natural antioxidants
6.	Phytochemicals	
7.	Phenolies	Tea polyphenols
8.	Lipids	Sphingolipids
9.	Isoprenoids	Carotenoids

❖ **Source of Nutraceuticals: where can be found**

- An approximate number of about 30.000 Phyto-components have been identified in plants
- Approximately 5,000-10,000 are present in plant foods of common
- use/consumption
- Assuming 5 daily servings of fruits and vegetables, you ensure the intake of about 1.5 gm/day of nutraceutical phytocomponents.

❖ **Inorganic Mineral Supplements**

- **Calcium**
- **Magnesium**
- **Manganese**
- **Save**
- **Boron**
- **Zinc**
- **Copper**
- **Phosphorous**



a) Calcium: Essential for bones and teeth, maintaining bone strength, nerve, muscle, and glandular function, blood clotting etc.
b) Iron: Energy production, Hb, oxygen transport.
c) Magnesium: For healthy nerve and muscle function, bone formation.
d) Phosphorous: Energy production, phosphorylation process, bone and teeth, for genetic material.
e) Cobalt. Component of vit. B12 and B12 coenzymes.

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1) Copper: Hb and collagen production, function of heart, energy production, absorption of iron.
g) Iodine: Proper function of thyroid gland.
h) Chromium: With insulin it helps in conversion of carbohydrates and fat into energy. treatment of diabetes.
1) Selenium: Antioxidant, functioning of heart muscle, part of GPX enzyme.
j) Zine: Essential for cell reproduction, for development in neonates, wound healing.(Refer 4)

❖ **VITAMINS**

1. Fat Soluble Vitamins

a) Vitamin A (retinol); Cellular repair and maintenance, immune response, development of ns, normal vision, foetal development, reproduction, bone growth, antioxidant activity.
b) Vitamin D (cholecalciferol): Bone and dental mineralisation, absorption and metabolism of calcium and phosphorus.
c) Vitamin E (a-tocopherol): Powerful antioxidant, synthesis of heme group, antitoxic function.
d) Vitamin K (phylloquinone): Blood clotting, protein synthesis, bone metabolism.

2. Water Soluble Vitamins

a) Vitamin B1 (thiamine): Macronutrient metabolism, neuronal function.
b) Vitamin B2 (riboflavin): Energy metabolism, ocular function, antibody and red blood cells Formation, mucosal maintenance.
c) Vitamin B3 (niacin): Macronutrient metabolism, sex hormone production, glycogen synthesis.
d) Vitamin B5 (pantothenic acid): Energy metabolism, antibody synthesis, corticosteroid
e) Vitamin B6 (pyridoxine): Fat and protein metabolism, DNA and RNA synthesis, haemoglobin synthesis, antibody production. electrolyte balance, neuronal function, conversion of tryptophan to niacin
f) Vitamin B7 (biotin): Energy metabolism, cell growth, fatty acids amino acids and glycogen synthesis
g) Vitamin B9 (folic acid): DNA and RNA synthesis, growth and cell division, Leukocytes and erythrocytes, formation and maturation, fohe acid metabolism.
h) Vitamin B12 (cobalamin): Lipid and protein metabolism, red blood cells maturation, Iron absorption, DNA and RNA synthesis, Neuronal function.
i) Vitamin C (ascorbic acid); Multiple functions as coenzyme, iron absorption, wound healing, Antioxidant, corticosteroid synthesis (Refer 5)

✞ **EXAMPLES OF FUNCTIONAL COMPONENTS**

S. No	CLASS/ COMPONENTS	SOURCE	POTENTIAL BENEFITS
1.	Fatty acids	Milk and meat	Improve body composition, reduce cancers
2.	Polyphenols		
a).	Anthocyanidin	Fruits	Neutralises free radicals, reduce risk of cancer
b).	Flavanone	Citrus	
c).	Flavones	Fruits, vegetables. soya bean	
3.	Saponins	Soybeans, lucerne	Lower cholesterol, anti-cancer.
4.	Probiotic/Prebiotics/Synbiotics		
a).	Lactobacillus	Curd, yogurt	Improve Gl health.
b).	Fructo-oligosaccharides	Whole grains, onions, combination of pro & prebiotics	
5.	Phytoestrogen		
a).	Lignans	Vegetables	Reduce cancer & heart disease
6.	Carotenoids		
a).	Beta-carotene	vegetables, Carrots, fruits	Neutralises free radicals
b).	Luteine	Vegetables	Healthy vision
c).	Lycopene	Tomatoes	Reduce prostate cancer
7.	Dietary fiber		
a).	Insoluble fiber	Wheat bran	Reduce breast, colon cancer
b).	Beta-glucan	Oats	Reduce CVD
c).	Whole grain	Cereal grain	

✞ **Health benefits of Nutraceutical Tablet**

- Improving health and delaying aging.
- Preventing chronic diseases and increasing life expectancy.
- Supporting the structure and functioning of the body.
- Improving mental health and clarity.
- Enhancing sleep quality and quantity.

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- Boosting energy and relieving anxiety.
- Reducing drug cravings.

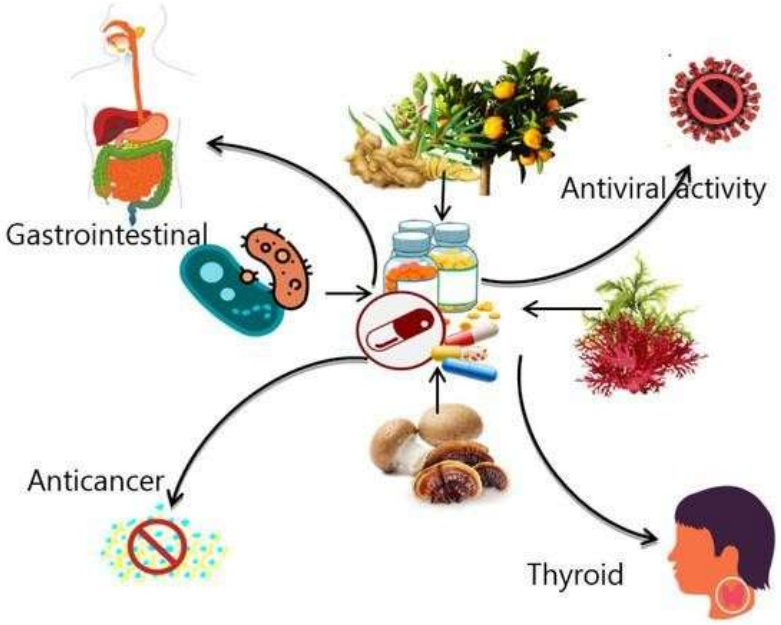
❖ **Advantages of Nutraceutical**

- They have potential to play a role in healthy eating and to contribute to the prevention and treatment of disease.
- New molecule is difficult to discover and more expensive, so many pharmaceutical companies are now trying to nutraceutical so that there is undoubtedly a very huge and growing market.
- The role of nutraceutical in treating inappropriate dietary habits are seen as contributing to the leading cause of death to coronary heart disease, certain type of cancers, etc.
- Plant constitutes to be major source of new lead generation of nutraceuticals ➢ They are affordable and widely accessible.
- They are less harmful than traditional medicine.
- Assist customers in getting their recommended daily intake of vitamins and minerals.

❖ **Disadvantages of Nutraceutical**

- Not subjected to same testing and regulations as pharmaceuticals.
- Majority not regulated by FDA in USA.
- Companies creating unregulated products to create a wide profit margin.
- Bioavailability od nutrients is lower.
- No regulatory definition.
- The nutraceutical dose and quality are unclear.
- One of the main drawbacks is the existence of adulterations brought on by a lack of pharmaceutical quality control. (Refer 6)

❖ **Role of Nutraceutical in health and disease prevention**



1. Cardiovascular diseases

Anti-oxidants, Dietary fibres, Omega-3 poly-unsaturated 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 and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells. Rice bran lowers the serum cholesterol levels in the blood, lowers the level of (LDL) and increases the level (HDI) in cardiovascular health.

Higher the ratio more will be the risk of coronary heart diseases.

2. Diet related diseases

In Western societies, the incidence of diet-related diseases is progressively increasing due to greater availability of hyper caloric 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 T regulatory cells and homeostatic regulation of the gut microbiota have the potential to reduce low-grade inflammation in diet-related diseases.

3. Heart attack and Lung Cancer

Corn's contribution to heart health lies not just in its fibre, but in the significant amounts of folate that corn supplies. Com maintains the homocysteine; an intermediate product is an important metabolic process called the methylation cycle. Homocysteine is directly responsible for damage of blood vessel heart attack, stroke, or peripheral vascular disease.

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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.

4. Diabetes

Ethyl esters of n-3 fatty acids may be beneficial in diabetic patients. Docosahexaenoic acid modulates insulin resistance and is also vital for neuro visual 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 hyperlipidaemia.

5. Obesity

Obesity is a global public health problem and it is defined as accumulation of unhealthy amount of body fat. It is a well-established risk factor for many disorders like angina pectoris, congestive heart failure (CHF), hypertension, hyperlipidemia, respiratory disorders, renal vein thrombosis, osteoarthritis, cancer and reduced fertility

6. Cancer

Flavonoids who block the enzyme produce estrogen reduces the estrogen-induced cancers. Prevent prostate/breast cancer a broad range of Phyto-pharmaceuticals with a claimed hormonal activity, called "phytoestrogens" is recommended. Soy foods source of isoflavones, curcumin from curry and soya isoflavones possess cancer chemo preventive properties. Lycopene concentrates in the skin, testes, adrenal and prostate where it protects against cancer.

7. Anti-Inflammatory Activities

Curcumin (diferuloylmethane) which is a polyphenol of turmeric possesses anticarcinogenic, antioxidative and anti-inflammatory properties. Top of Form beet roots, cucumber fruits, spinach leaves, and turmeric rhizomes, were reported to possess anti-tumour activity. 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.

8. Alzheimer's Disease

B-carotene, curcumin, lutein, lycopene and turmeric may exert positive effects on specific diseases by neutralizing the negative effects oxidative stress mitochondrial dysfunction, and various forms of neural degeneration.

9. Parkinson's Disease

Vitamin E in food may be protective against Parkinson's disease. Canadian researchers indicated that vitamin E in food may be protective against Parkinson's disease. Creatine appeared to modify Parkinson's disease features as measured by a decline in the clinical signs. The patients should be cautioned that over-the-counter medications do have side effects and interactions with other drugs and are also expensive.

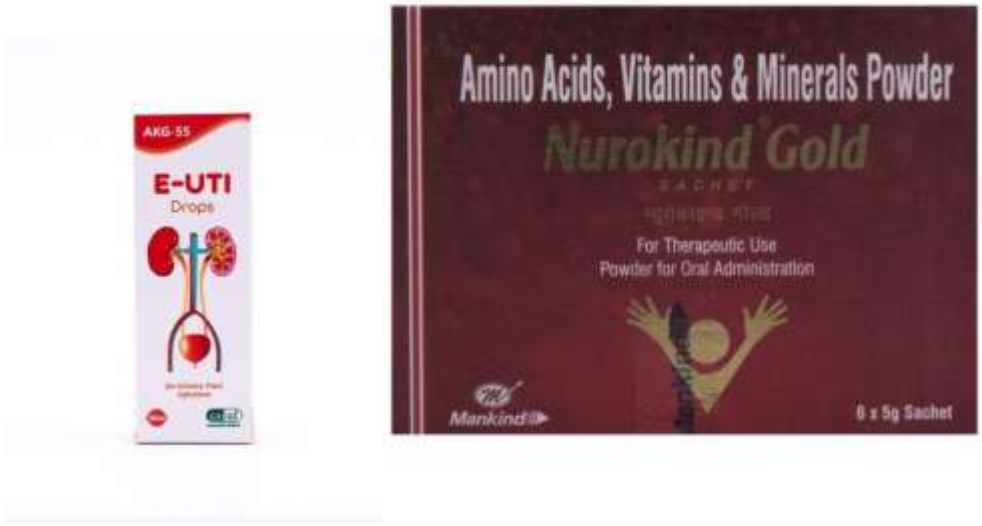
10. Adrenal Dysfunction

Adaptogens are natural herbs that have nonspecific, normalizing effects on physiology; they influence normal body functions only enough to encourage non-specific resistance to stressors. Adaptogens include herbs Eleuthero coccus senticosus, Ginkgo biloba, Ocimum sanctum, Panax ginseng and, Withania somnifera and the mushroom Cordyceps sinensis. Following is a short description of each. Ginkgo biloba has been used for several thousand years by the Chinese for various maladies, including vertigo, short-term memory loss, and lack of attention or vigilance. (Refer 7)

✞ **Common Nutraceuticals in the market**

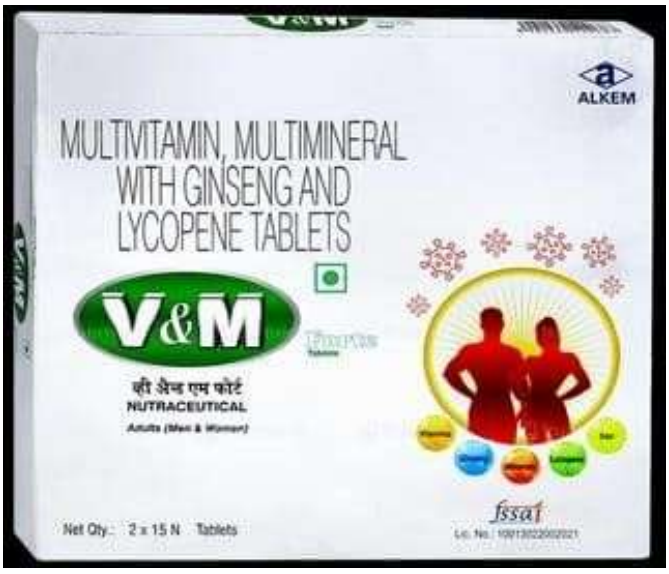
NAME	COMPONENTS	FUNCTION
Bettine	Carotenoids	Immune function
Xangold	Lutein esters	Eye health
Lipoec	Alpha-lipoic acid	Potent antioxidants
Generol	Phytosterol	Reduction of CVD
Premium probiotics	Probiotics	Intestinal disorder
Soya life	Soya bean, phytoestrogen	Bone health
z-trim	Wheat	Zero calories fat replacer
Linumlife	Ligan extract, flax	Prostate health
Fenulife	Fenugreek, galactomannon	Control blood sugar
Teamax	Green tea extract	Potent antioxidant
Marinol	FA	Heart health protection
Clarinol	CLA	Weigh loss ingredients
Cholestaid	Saponin	Reduce cholesterol

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RESULTS AND DISCUSSION

The nutraceutical tablet of clove and cinnamon was formulated by direct compression method. This technique was used for conventional from nutraceutical tablet which minimize processing steps and eliminated wetting and drying process. The physiochemical property shows satisfactory results by nutraceutical tablet which are within the range of prescribed standards required for investigation of present study.

CONCLUSION

From the above study, we conclude that the nutraceutical tablets were prepared by direct compression method and gave satisfactory and acceptable result. Conventional tablet of nutraceutical shows immediate drug release due to direct compressed tablet. The formulation containing clove could be more beneficial as an analgesic due to the presence of eugenol than cinnamon containing tablet. From the above research work it was concluded that herbal nutraceutical tablet prepared in the form of cost-effective tablet to minimize patients' compliance in regarding supressing side effects and enhancing positive effects on the body.

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