

HERBAL DRUG TECHNOLOGY

UNIT-II

NUTRACEUTICALS



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Define Nutraceuticals.

- The term Nutraceuticals was coined by Dr. Stephen MD, founder and chairman of foundation for innovation in medicine in the year 1989.
- Nutraceuticals is a term that combines nutrition and pharmaceuticals.
- Nutraceuticals are the chemical substances which can be considered as the food or its part which provide nutrition and , in addition to its normal nutritional value provides health benefits including prevention of disease or promotion of health



Classification based on	Example
Natural sources	
Plant	Allicin, curcumin
Animals	DHA, (Docosahexaenoic acid) EPA (Eicosapentaenoic acid)
Microorganisms	Lactobacillus acidophilus,
Pharmacological action	
Antibacterial	Curcumin
Anticancer	Alpha tocopherol
Anti-inflammatory	Curcumin, capsaicin, DHA, EPA



Important constituents of nutraceuticals

- ❖ **Antioxidant**
- ❖ **Polyunsaturated fatty acids**
- ❖ **Probiotics**
- ❖ **Prebiotics**
- ❖ **Dietary fibers**



Important constituents of nutraceuticals

Antioxidant

- Antioxidant nutraceuticals contain vitamin-C, E, A and carotene. They are present in some fixed oils, fruits, vegetables, and fishes.
- Antioxidants present in such food materials which prevent the formation of free radicals or scavenging activity.



Polyunsaturated fatty acids

- These are present in various vegetable oils and marine animals. These source include safflower, corn oil, musturd oil, soyabean oil, they help reduce cholesterol formation.
- Vegetable oil contain PUFA belonging to Linolenic group.
- Some marine fishes contain PUFA belonging to omega-6 type, omega-3 type.
- These reduce thromboxane formation and hence useful as preventive measures of atherosclerosis.



Omega-3-fatty acids

- Omega-3-fatty **acids** are Eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA).
- They are polyunsaturated fatty acids mainly in the marine groups.
- They are found in the cold water fishes, cod, salmon,



Dietary fibres

These are present in the cell wall of fruits, grains, vegetables.

Dietary fibres are generally categorized into two groups

1. water soluble and
2. water insoluble.

Insoluble fibres mainly helps in bulking of stools and their quick passage through digestive canal.

Ex:- brown rice , banana, vegetables, whole grain , cereals,

Soluble fibres dissolves in water and forms gel that binds the stool. And helps in lowering the cholesterol level in blood.

Ex:- apple, oats, dried beans etc.



Probiotics

- These are living microorganisms, which when taken with or without food, improve the intestinal microbial balance and in turn functioning of large intestine.
- Probiotics include Bifidobacterium and lactobacilli Acidophilus.
- These microorganism exert their effects by producing substances and conditions which inhibit the growth of harmful bacteria in the large intestine.
- The dairy products like sour milk, yoghurt containing probiotics.



Prebiotics

- Prebiotics are the food substances that prevent the digestion of probiotics by digestive enzymes and acids until they reach the large intestine.
- They also provide nutrition to the probiotics , thereby promoting their growth.
- Example: inulin(polyfructose) obtained from raw chicory.



Scope of Nutraceuticals

- Nutraceuticals play a significant role in modifying and maintaining normal physiological function that maintain healthy human beings.
- The food product used as nutraceuticals can be categorized as dietary fibers, probiotics, prebiotics, polyunsaturated fatty acids, antioxidant & other different types of neutral foods.
- The nutraceuticals are used in various diseases such as obesity, cardiovascular diseases, cancer, diabetes,.
- On the whole nutraceuticals, has to lead to a new era of medicine & health, in which the food industry has become a research oriented sectors.



Types of Nutraceutical products available in the market

The nutraceutical global market is categorized based on

On Types of edibles

Food:- it includes snacks, bakery products

Beverages:- it includes health drinks, energy drinks, juices

Dietary products:- it includes tablets, powders, liquids

On Distribution channel stores

Conventional stores:- warehouse clubs, online retailers

Speciality stores:- cosmetic stores, health centers.

On sources :-probiotics, proteins, aminoacids, vitamins, prebiotics.

On region :-north America, Europe, Africa.



Health benefits of nutraceuticals in Cancer

- Fibre content in fruits and vegetables may reduce the risk of cancer
- Plant derivative polysaccharides act as protective role in development of cancer lesions
- Dietary supplements such as microalgae, plant derivatives and vegetables are a rich source of vitamins, minerals, amino acids and other micro nutrients
- Adequate utilization of dietary nutraceuticals is a sensible way to maintain health and avoid the formation of cancer

Chestnut:

- Chest nut extract possesses antioxidant activity and is protective against gastric cancer
- Mild protective effect against prostate and breast cancer



Berries:

- Blue, black and strawberries are good source of antioxidants and phenolic compounds
- These berries act as chemo protective against breast cancer
- Exerts anti cancer effect by inhibiting growth of cancer cells by which activities of proteins involved in the oncogenesis gets interrupted in their path way

Soy:

- Soy contains iso flavones, which reduce the risk of breast cancer particularly in postmenopausal women
- Intake of high amount of soy reduced the risk of colorectal cancer



Garlic:

- Garlic is composed of sulphur compounds, proteins and amino acids
- Diallyl trisulphide prevents the development of prostate cancer and lung cancer
- Acts by inhibiting the expression of androgen receptor which is actively involved in the development of prostate cancer
- Garlic oil effective against liver cancer

Green Tea:

- Green tea contains polyphenols which prevent the advancement of cancer
- Protects the bladder against cell death, antioxidant potency of green tea reduces the oxidative stress induced by hydrogen peroxide in malignant/normal bladder cells



Grape Seed:

- Effective in the prevention of skin cancer (UV rays induced) and decreases risk of squamous cell carcinoma as it contains polyphenols and proanthocyanidin
- It also inhibits blood cancer and prostate cancer when taken as supplements

Dietary fibre:

- These fibres prevent constipation by increasing bulk of stool and hence reduce the risk of colorectal cancer
- Also reduce the risk of breast cancer in postmenopausal women
- Broccoli, cabbage, cauliflower, sprouts contain dietary fibres



Alfa Alfa

Botanical name : Leaves, seeds and stems of the plant

Medicago sativa

Family: Fabaceae

Chemical Constituents:

Vitamins – A, B1, B6 and C

Minerals: Calcium, zinc and iron

Phytoestrogens: coumestrol, genistein,

Amino acid – L-Canavanine,



Health benefits:

- **Healthy skin** : maintain healthy and glowing skin, helps to cure dry skin
- **Healthy hair**: maintain health of hair, used to treat baldness and prevent of hair loss
- **Cardiac disease**: Helps in elimination of bad cholesterol and thereby decreasing the risk of heart diseases
- **Digestive problems**: Gastritis, stomach ulcers, bloating, nausea can be prevented.
- **Cancer**: Prevents the risk of cancer
- **UTI**: prevents developing of UTI
- **Anti diabetic**
- **Weight loss**



CHICORY

Botanical name : Leaves, flowers & Roots of
Cichorium intybus

Family: Asteraceae

Chemical Constituents:

Vitamins – A, B6, C, E and K

Minerals: Zinc, magnesium, manganese, calcium

Volatile oil

Phyto chemicals – Inulin, coumarins, flavanoids, tannins, alkaloids and sesquiterpene lactones



Health benefits:

Digestion: Good for digestion as it contains inulin

Cardiac diseases: Inulin reduces the level of bad cholesterol, and thereby decreasing the risk of heart diseases

Anti cancer: Reduces tumor growth in various type of cancers.

Arthritis: used in the treatment of arthritis

Weight loss : inulin, which helps in the promoting weight loss.

Constipation: Inulin is a natural fibre, digestion is improved and constipation is reduced.

Relieves anxiety

Improves immunity



GINSENG

Botanical name : Roots of
Panax ginseng

Family: Araliaceae

Constituents:

Vitamins – Niacin and Riboflavin

Minerals –Iron, manganese, zinc, Copper

Phyto chemicals – Ginseng saponins –
Gensenosides, Panaxosides,



Health benefits:

Alzheimer's Disease:Improves the mental performance in people with alzheimer's disease

Pulmonary disease: Improves lung function.

Mental function: ginkgo leaf extract improves memory

Erectile dysfunction: Improves sexual function in men

Flu: Reduces the risk of getting cold or flu by improving immunity

Diabetes: Help to lower blood sugar by stimulating the production of insulin in pancreas



AMLA

B Source: fresh/dried fruits of *Emblica officinalis*

Family: Euphorbiaceae

Amla is a subtropical plant, is small or medium sized tree, fruits are fleshy.

Constituents:

Vitamins - Amla is a rich source of vit C (760mg/100g)

Minerals – Zinc, copper, Chromium

Amino acids – Alanine, lysine, proline, aspartic acid

Phyto constituents: Phyllembelin and curcuminoides



Health benefits

- Immunity booster
- Treats respiratory disorders
- Manages diabetes
- Remedy for heart disorder
- Cures eye disorder
- Prevents aging
- Cures anaemia
- Enhances food absorption
- Helps urinary system
- Good for skin
- Promotes healthier hair
- Remedy for Scurvy



ASHWAGANDHA

Biological Source : Dried leaves, roots and stem bases of *Withania somnifera*

Family: Solanaceae

Short perennial shrub

Chemical constituents

Triterpene lactones : Withanolides- which include withaferin-A, alkaloids, steroidal lactones, tropine and cuscohygrine



Health benefits

- Reduces blood sugar levels
- Anti-cancer properties
- Reduces cortisol levels
- Boosts testosterone and increase fertility in men
- Increase muscle mass and strength
- Reduces inflammation
- Lowers cholesterol and triglycerides
- Improve brain function and memory



GINGER

Synonyms- Rhizoma zingiberis, Zingibere.

Biological Source- Ginger consists of the dried rhizomes of the *Zingiber officinale* family Zingiberaceae.

Chemical Constituents

- Ginger contains volatile oil, pungent resinous mass and starch.
- Main active constituent is gingerol.
- Volatile oil is composed of sesquiterpene hydrocarbon like α -zingiberol; α -sesquiterpene alcohol.
- gingerone and shogaol are also present.



Health benefits

- Ginger is used as an antiemetic, carminative, and flavouring agent.
- It is used for cold, cough, and asthma.
- Sore throat, hoarseness, and loss of voice are benefited by chewing a piece of ginger.



Spirulina

Scientific Name(s): *Spirulina maxima*

Family- Phormidiaceae

Chemical constituents

Spirulina is a type of blue-green algae that is rich in protein, vitamins, minerals, carotenoids,



Health benefit

Anti-inflammatory

Anticoagulant

Antihypertensive

Antioxidant

Antiobesity

Antiviral

Antidiabetic

Anticancer

Antimicrobial



HERB DRUG AND HERB FOOD INTERACTION

Herb-drug interaction:-

- The interaction between herbal drug and western drug is known as Herb-drug interaction
- In this interaction the effect of western drug is either increased or decreased by herbal drug.

Example:-The anticoagulant action of warfarin (western drug) is enhanced by Ginseng (herbal drug).



Herb- food interaction

- The interaction between herbal drug and food is known as Herb-food interaction
- In this interaction the effect of herbal drug is either increased or decreased by food.
- **Example:** -The anticoagulant action of garlic (herbal drug) is enhanced by cranberry (food)



Hypericum

Synonyms John's Wort (SJW)

Biological sources *Hypericum perforatum*,

Family Hypericaceae

Geographical sources plant is native to Europe

Chemical constituent:- include

- Naphodianthrone derivative hypericin, pseudohypericin
- flavonoids such as hyperoside, isoquercitin and rutin.
- Phloroglucinol derivative hyperforin and adhyperforin
- It also contain tannins, amino acids and essential oil



Uses: _-

- It is known to be effective in mild to moderate depression.
- It is used as sedative, relaxing nervine and
- anti inflammatory.
- It is also used in anxiety, stress, menstrual cramps, neuralgia, and rheumatism.

Side effect

- Dizziness
- Tiredness
- Dry mouth



Pharmacodynamic interactions may occur when SJW is given together with drugs that enhance 5-HT signalling in the brain

Pharmacokinetic interactions have been known with drugs like warfarin, oral contraceptives, HIV protease inhibitors, digoxin and cyclosporine. Such types of interactions occur may be due to induction of cytochrome P450 isoenzymes CYP3A4, CYP2C9, CYP1A2 and the transport protein P-glycoprotein resulting in decrease in concentration or effect of these prescribed drugs.



Garlic

Synonyms:- Allium, Lassan

Biological sources :- *Allium sativum*

Family :- Liliaceae

Geographical sources :- Central Asia, India and West of the Himalayas.

Chemical constituent:-

Garlic contains sulphur-based compounds called **Alliin** which is odorless chemical derived from the amino acid cysteine.

It is further converted into allicin and finally into ajoene, strongly smelling compound.

It also contains peptides, terpenoids, flavonoids, phenol derivatives and protein, fat, crude fibre, potassium, iron, magnesium etc



Uses:-

Garlic is useful in skin diseases, arthritis,, backache, chronic fever, malaria, tuberculosis, urinary diseases, diabetes, kidney stones, anaemia, epilepsy, etc.

Allicin and other compounds possess antihypertensive, hypolipidaemic, hypocholesterolemic and antithrombotic effects. Sulphur compounds in Garlic also have anticarcinogenic properties. These also prevent arteriosclerosis



Side effect:-

Inhalation of garlic powder Can leads to asthama.

Drug interaction:-

Garlic competitively inhibits the activity of CYP3A4, CYP2C9 and CYP2C19 in drug metabolism

Decreased activity of CYP3A4 and induction of P-glycoprotein by Garlic is responsible for increased clearance and decreased bioavailability of drugs.



Ginkgo biloba

Synonyms:- Kew tree

Biological sources :- *Leaves of Ginkgo biloba*

Family :- Ginkgoaceae

Geographical sources :- China , Germany and United states

Chemical constituent:-

Ginkgo biloba contains a wide number of **phytoconstituents** such as alkylphenols (ginkgolic acids), flavonoids (bilobetin, ginkgetin, quercetin, etc.) and terpenoids (ginkgolide A, ginkgolide B, ginkgolide C, ginkgolide J, etc.) and organic acids (6-hydroxykynurenic acid, protocatechuic acid, p-hydroxybenzoic acid, ferulic acid, clorgenic acid,



Use :-

It is used to treat anxiety, dementia and other vascular disorders especially alzheimer disease. It also has the ability to improve blood circulation and improves psychomotor function

Side effect:-

Headache

Allergic skin reactions

Drug interaction:-

Gingkgolide (mainly ginkgolide B) are potent inhibitors of PAF(platelet activation factor) and increasing bleeding time. Therefore, it could increase the effect of anticoagulant drugs.

