

HERBAL DRUG TECHNOLOGY

UNIT 2 NOTES

NEUTRACEUTICALS

- GENERAL ASPECTS
- ROLE OF NEUTRACEUTICALS
- STUDY OF HERBS

HERBAL DRUG

- GENERAL INTRODUCTION
- STUDY OF DRUGS



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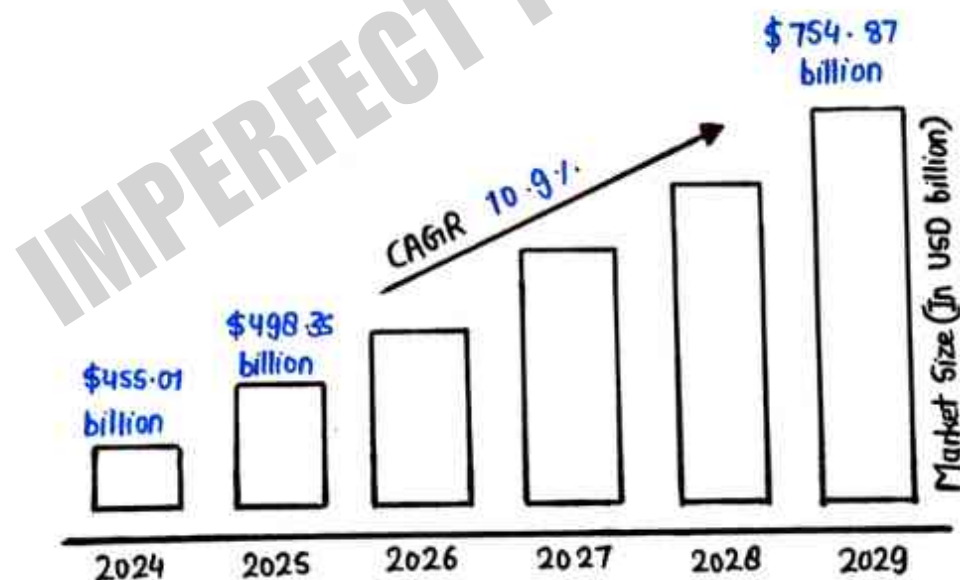
NUTRACEUTICALS

- The term 'Nutraceuticals' is derived from combination of two words 'Nutrition' & 'Pharmaceuticals'.
- It is defined as 'food or part of a food that provides pharmacological benefits, including prevention & treatment of disease.
- The term 'Nutraceuticals' was coined by Stephen De Felice in 1989.
- Examples- Vitamins, Minerals, Herbal products, Probiotics, Proteins, Omega 3 Fatty acids.

MARKET & NUTRACEUTICAL GROWTH

- The global nutraceuticals market is showing strong & continuous growth.
- In 2024, the market size was around USD 455.01 billion.
- In 2025, it increased to about USD 490.35 billion.
- The market is expected to grow further & reach approximately USD 754.87 billion by 2029.
- This shows that nutraceuticals have become an important part of the global healthcare & wellness industry.
- India is a major market due to its strong base of Ayurveda & Herbal medicines.
- Herbal Nutraceuticals products are widely sold through pharmacies, online platforms, gyms & wellness centers.
- The CAGR (Compound Annual Growth Rate) for Nutraceuticals ranges from 8.4 - 10.9%, which indicates rapid growth.
- Market size is increasing every year from 2024 to 2029, showing a clear upward trend.

- Major reasons for growth include:
 - Rising health awareness
 - Increase in lifestyle disease
 - Growing demand for preventive healthcare
 - Preference for Natural & food-based products.



SCOPE OF NUTRACEUTICALS

- Helps in prevention of lifestyle diseases like diabetes & heart disorders.
- Improves immunity, nutrition & overall health.
- Used as supportive therapy in chronic diseases.
- High demand due to increasing elderly population.
- Widely used in sports & fitness nutrition.
- Growth driven by preventive healthcare awareness.
- Preferred as natural & safe health products.
- Creates opportunities in pharma, research & marketing.

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Types Of Nutraceuticals

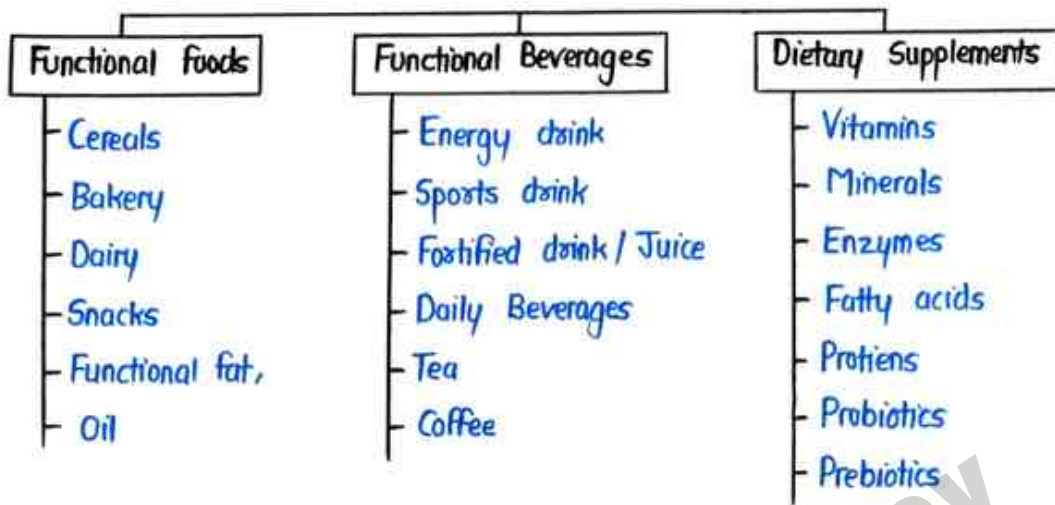
Nutraceuticals can be classified on 3 basis :

- ① On the basis of availability
- ② On the basis of Source
- ③ On the basis of Therapeutic Uses

① ON THE BASIS OF AVAILABILITY

- A) FUNCTIONAL FOODS : These are normal foods that provide extra health benefits beyond basic nutrition, such as improving digestion, immunity or health.
- B) FUNCTIONAL BEVERAGES : These are drinks formulated to give specific health benefits like energy, hydration or antioxidant effects along with refreshment.
- C) DIETARY SUPPLEMENTS : These are concentrated sources of nutrients or bioactive substances taken to supplement the normal diet & support overall health.

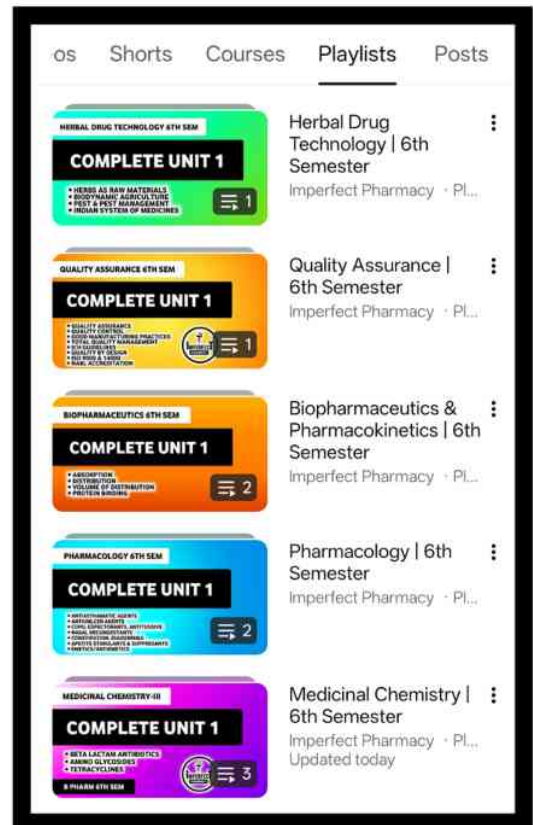
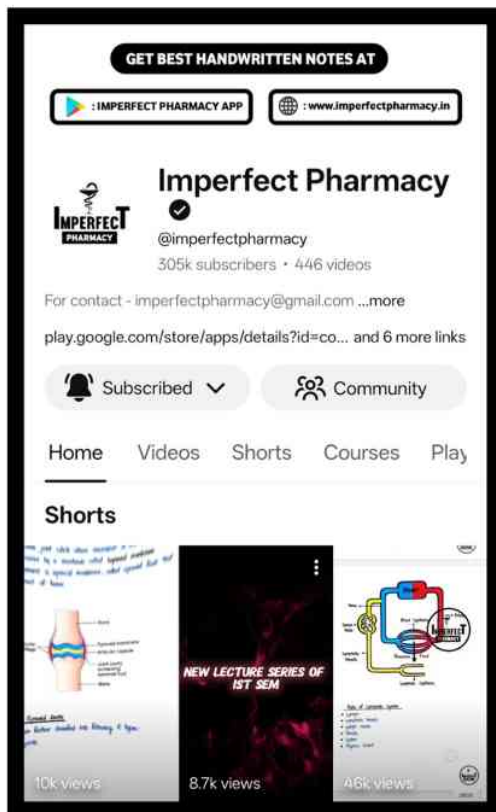
ON THE BASIS OF AVAILABILITY



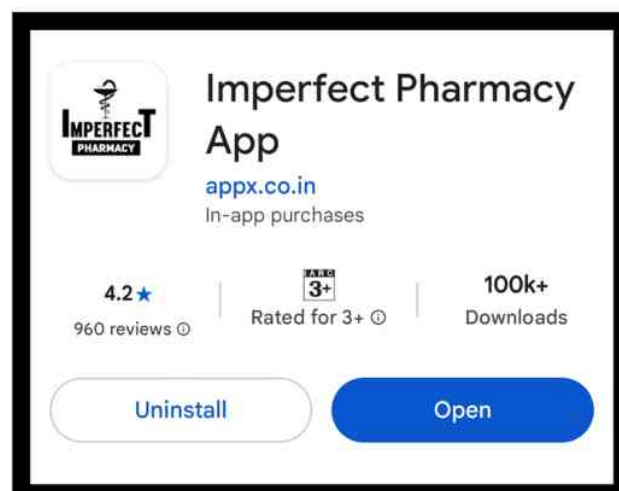
② ON THE BASIS OF SOURCE

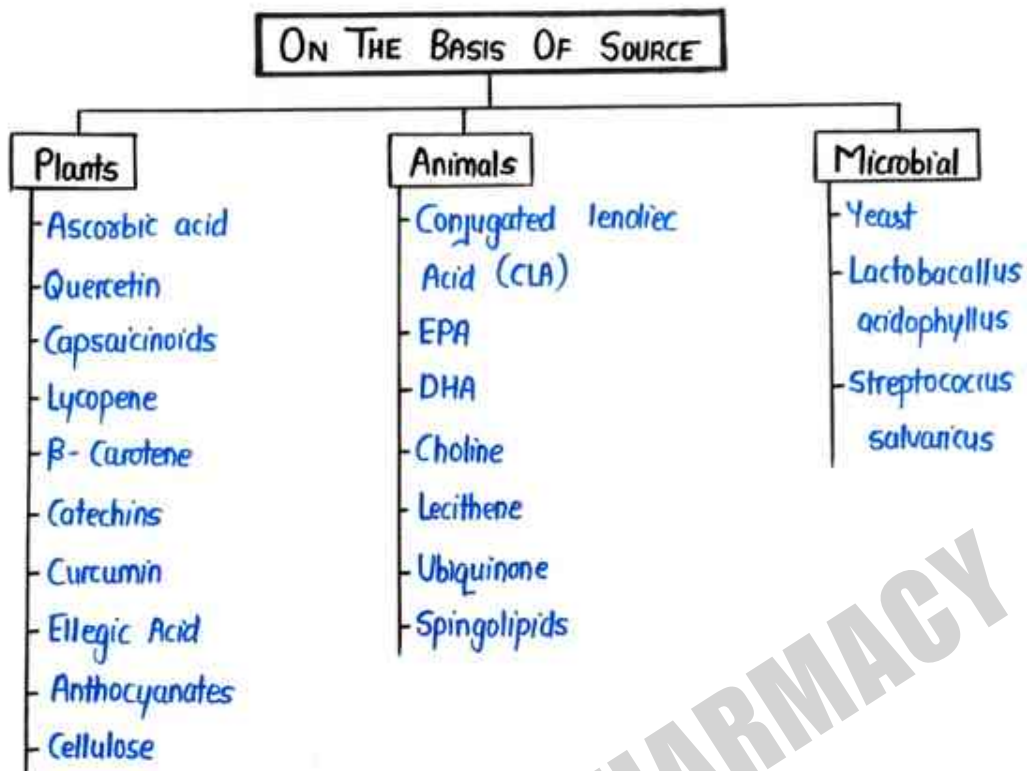
- A) PLANT SOURCES :
- These are nutraceuticals obtained from fruits, vegetables, cereals, herbs & spices.
 - They provide vitamins, minerals, fibers, antioxidants, & phytochemicals.
- B) ANIMAL SOURCES :
- These are nutraceuticals derived from milk, eggs, meat & fish.
 - They're rich in proteins, omega -3 fatty acids, vitamins, & minerals.
- C) MICROBIAL SOURCES :
- These are nutraceuticals produced by bacteria, yeast & fungi.
 - They mainly include probiotics, enzymes, amino acids, & vitamins beneficial for gut health.

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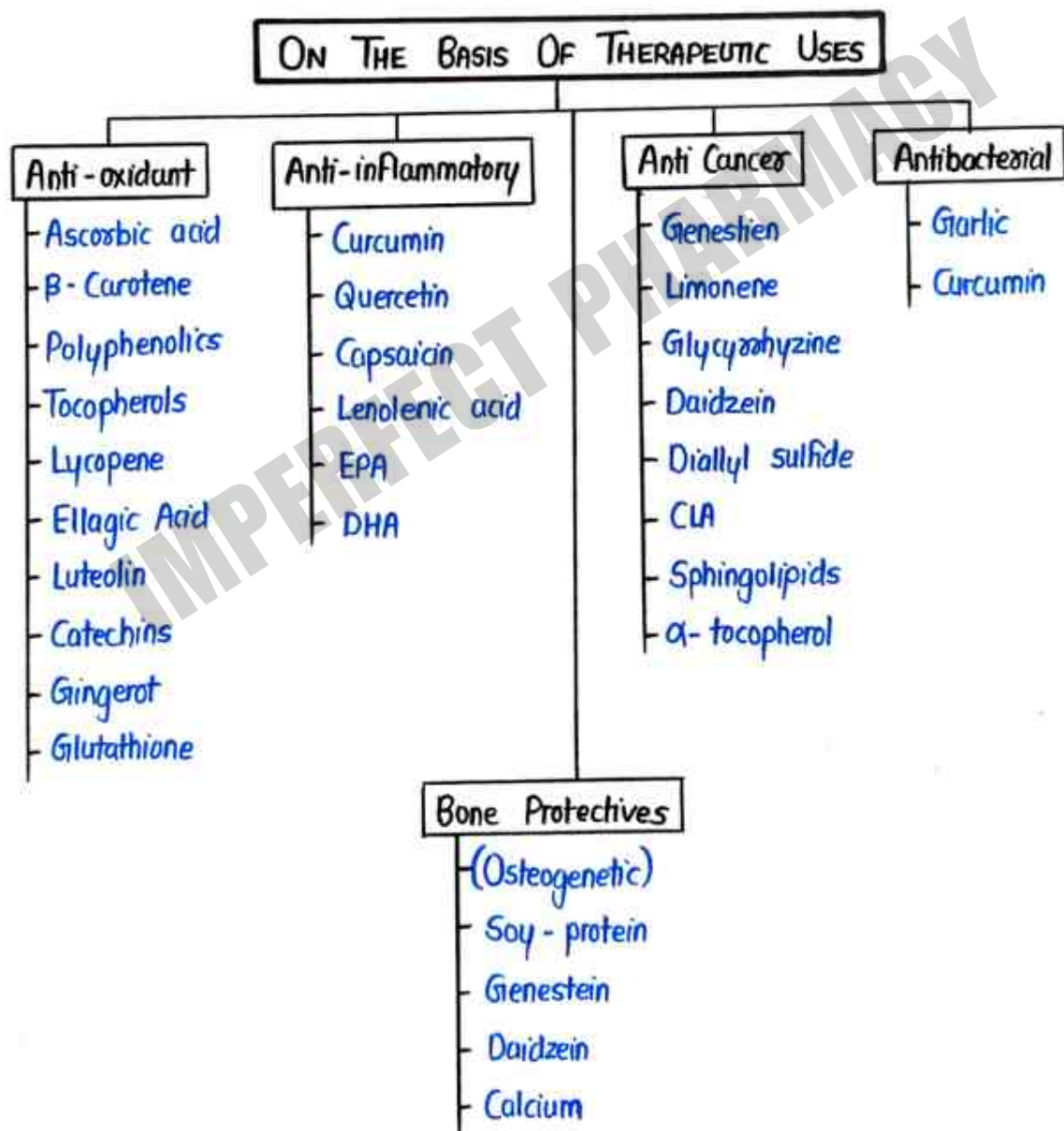


③ ON THE BASIS OF THERAPEUTIC USE

- A) ANTIOXIDANT: These nutraceuticals protect the body from free radicals damage & reduce oxidative stress.
- B) ANTI INFLAMMATORY: They help in reducing inflammation & swelling, especially in chronic diseases.
- C) ANTI CANCER: These compounds help in preventing cancer by inhibiting tumor growth & abnormal cell division.

D) BONE PROTECTIVES : They support bone formation , improve bone strength , & help prevent osteoporosis.

E) ANTIBACTERIAL : These nutraceuticals help inhibit or kill harmful bacteria & support immune defense.



HEALTH BENEFIT & ROLE OF NUTRACEUTICALS

- ① Diabetes
- ② CVS Diseases
- ③ Cancer
- ④ Irritable Bowel Syndrome
- ⑤ Gastrointestinal Diseases

DIABETES MELLITUS

- Diabetes Mellitus is a chronic metabolic disorder characterized by high levels of Glucose in blood.
- It occurs either due to inadequate production of Insulin by Pancreas or body's inability to effectively use Insulin.
- Insulin is a Hormone produced by Pancreas that helps to regulate Blood Sugar level by facilitating absorption of Glucose into cells to be used for Energy.

TYPES OF DIABETES MELLITUS

Diabetes Mellitus can be mainly classified into 3 types :

- ① Type 1 Diabetes Mellitus
- ② Type 2 Diabetes Mellitus
- ③ Gestational Diabetes

① TYPE 1 DIABETES

- Earlier it was known as Insulin dependent Diabetes Mellitus.
- It constitutes about 10% cases of Insulin
- It occurs because of destruction of β Cells of pancreas due to Autoimmune Disorders.
- It leads to deficiency of Insulin that leads to increase in Blood Glucose Level.
- Type 1 Diabetes often develops during childhood or Adult Age.

CAUSES

- Type 1 Diabetes Mellitus primarily occurs due to an Autoimmune Disorders, where body's immune system mistakenly attacks & destroys insulin producing β Cells in pancreas.
- The exact cause of this autoimmune response is not fully understood, it is believed to involve a combination of Genetic & Environmental factors.
- There are following factors that can be responsible for this AIR.
 - ① Genetic Mutations
 - ② Viral Infections
 - ③ Early childhood Exposures
 - ④ Geographical & Seasonal Patterns

② TYPE 2 DM

- Earlier it was known as Non Insulin Dependent Diabetes Mellitus.
- It constitutes about 90% cases of Diabetes.
- It generally occurs when cell doesn't respond to insulin properly.
- In Type 2 Diabetes receptor on cells becomes Insulin Resistance.
- Type 2 DM, if maintained for a long period of time can also leads to Insulin Deficiency.
- It generally occurs later (mostly after 30) due to physical inactivity, obesity & poor dietary habits.

CAUSES

- Type 2 diabetes is mainly a lifestyle disorder in which body becomes resistant to the effect of Insulin. Several factors contribute to the development of Type 2 DM as follows :
- Genetic Disorders
- Obesity
- Physical Inactivity
- Unhealthy Diet
- Age
- Gestational Diabetes
- Polycystic Ovary Syndrome (PCOS)

SYMPTOMS

- Excessive thirst
- Frequent urination
- Increased Hunger
- Weight Loss
- Fatigue
- Slow Healing

ROLE OF NUTRACEUTICALS

- Nutraceuticals are food - derived products that provide health benefits beyond basic nutrition.
- In diabetes, Nutraceuticals help in :
 - Reducing Blood glucose levels
 - Improving insulin sensitivity
 - Protecting pancreatic β Cells
 - Reducing oxidative stress & inflammation
 - Preventing diabetic complications

IMPORTANT NUTRACEUTICALS USED IN DIABETES

① DIETARY FIBRES

Sources: Whole grains, Oats, Fruits, Vegetables, Legumes

- Dietary fibers slows down gastric emptying & glucose absorption from the intestine.
- This helps in reducing post-prandial blood glucose levels.
- Soluble fibers also improve insulin sensitivity & lipid profile.

② ANTIOXIDANT VITAMINS (Vitamin C & E)

Sources: Citrus fruits, Berries, Nuts, Seeds

- Diabetes is associated with oxidative stress, which damages pancreatic β Cells.
- Antioxidant vitamins neutralize free radicals & protect tissues.

③ CHROMIUM

Sources : Whole grains, Broccoli, Brewer's Yeast

- Chromium is an essential trace element that enhances insulin receptor activity & improves glucose uptake by cells.

④ POLYPHENOLS

Sources : Green tea, Grapes, Berries, Cocoa

- Polyphenols increases insulin sensitivity and reduces intestinal glucose absorption.
- Green tea, catechins are especially beneficial.

⑤ ALPHA - LIPIC ACID

Sources : Spinach, Broccoli, Supplements

- Alpha-lipoic acid is a powerful antioxidant that improves glucose utilization & nerve function.

HERBAL NEUTRACEUTICALS (AS SUPPORTIVE AGENTS)

Based on traditional & scientific evidence, several herbs act as Nutraceuticals in diabetes:

- ① Aloe-vera : Stimulates insulin secretion & improves glucose homeostasis.
- ② Neem (Azadirachta Indica) : Enhances peripheral glucose utilization
- ③ Bael (Aegle Marmelos) : Improves glucose uptake
- ④ Onion (Allium cepa) : Lowers blood glucose & HbA1c
- ⑤ Fenugreek : Delays glucose level absorption & improves insulin sensitivity.

These herbs show hypoglycaemic activity with antioxidant benefits.

CANCER

- Cancer is a very serious disease characterized by the uncontrolled growth & spread of abnormal cells in the body.
- These abnormal cells can form tumours & spread throughout the body via blood & lymphatic system.
- Cancer can affect any part of body & often named after the organ or type of cell, where it starts, such as Breast Cancer, Lung Cancer.
- Other terms like, Neoplasm & Tumour are also used for cancer, however they have slight different meanings.

TUMOUR

- A Tumour is an abnormal growth of cells that forms a mass or lump.
- It can be classified into two types :
 - ① Benign Tumour
 - ② Malignant Tumour

BENIGN TUMOUR	MALIGNANT TUMOUR
• It's non-cancerous tumour. • It generally doesn't spread to other parts of body. • It can be surgically removed.	• It's Cancerous Tumour. • It spreads to other parts of body through bloodstream or lymphatic system. • It can't be removed.

CLASSIFICATION OF CANCER

On the basis of tissue involved it can be classified into following types:

- ① Carcinomas
- ② Sarcomas
- ③ Leukemias
- ④ Lymphomas

Carcinomas

- Cancer that originates in epithelial cells, which line the inner & outer surfaces of body.
- Example: Breast Cancer, Lung Cancer etc.

Sarcomas

- Cancer that arises from connective tissues
- Example: Bone, Muscle, Joints etc.

Leukemias

- It is also known as Blood Cancer.
- It begins when healthy blood cells change & grow uncontrollably.

Lymphomas

- Cancer that originates in the lymphatic system.
- Example: Hodgkin Lymphoma.

ROLE OF NUTRACEUTICALS IN CANCER

- Nutraceuticals are bioactive compounds obtained from foods that provide protective & therapeutic benefits.
- In Cancer, nutraceuticals mainly act as chemopreventive & adjuvant agents.
- They help in :
 - Preventing initiation & progression of cancer.
 - Inhibiting tumour growth
 - Inducing apoptosis (programmed cell death)
 - Reducing oxidative stress & inflammation
 - Enhancing immune response
 - Reducing toxicity of chemotherapy & radiotherapy

IMPORTANT NUTRACEUTICALS USED IN CANCER

① ANTIOXIDANTS

Source: Fruits, Vegetables, Green tea, Nuts

- Oxidative stress plays a major role in cancer development.
- Antioxidants neutralize free radicals, thereby preventing DNA damage.
- Examples: Vitamin C, Vitamin , Selenium

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② POLYPHENOLS

Source: Green tea, Grapes, Berries, Cocoa.

- Polyphenols regulate cell proliferation & induce apoptosis in cancer cells.
- Epigallocatechin gallate (EGCG) from green tea is a well-known anticancer compound.

③ CAROTENOIDS

Source: Carrots, Tomatoes, Spinach

- Carotenoids protect cells by reducing oxidative stress & regulating cell growth.
- Example: - Beta-carotene
 - Lycopene
 - Lutein

④ CURCUMIN

Source: Turmeric (*Curcuma longa*)

- Curcumin shows strong anti-inflammatory, antioxidant & anticancer activity.
- It inhibits multiple signalling pathways involved in cancer progression.

CARDIOVASCULAR DISEASES

- Cardiovascular (CVS) diseases include disorders of the Heart & blood vessels such as hypertension, atherosclerosis, coronary artery diseases, heart attack & stroke.
- Major risk factors are high cholesterol, hypertension, diabetes, obesity, smoking & sedentary lifestyle.
- Along with drug therapy, nutraceuticals help in prevention & supportive management of CVD.

ROLE OF NUTRACEUTICALS IN CVD

- Nutraceuticals help by:
 - Lowering blood cholesterol & triglycerides
 - Reducing oxidative stress & inflammation
 - Preventing plaque formation in arteries
 - Improving heart & blood vessel function.

IMPORTANT NUTRACEUTICALS IN CVD

- ① Omega - 3 Fatty Acids (fish oil, flaxseed):
 - Reduce triglycerides, prevent platelet aggregation & protect the heart.
- ② Dietary fibers (Whole grains, fruits):
 - Decreases cholesterol absorption & lowers LDL levels.

Antioxidants (Vitamin C, Vitamin E, Polyphenols):

- Prevent oxidation of LDL cholesterol & protect blood vessels.

Plant sterols (Vegetable oils, Nuts):

- Reduce intestinal absorption of cholesterol.

Coenzyme Q10 :

- Improves energy production in cardiac muscle & acts as an antioxidant.

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IRRITABLE BOWEL SYNDROME

- Irritable Bowel Syndrome (IBS) is a functional gastrointestinal disorder characterized by abdominal pain, bloating, diarrhea, constipation or alternating bowel habits.
- It's not associated with structural damage but mainly occurs due to gut motility disorders, stress, altered gut microbim & food tolerance.
- Management focuses on symptom relief & lifestyle modification.

ROLE OF NUTRACEUTICALS IN IBS

- Nutraceuticals help in IBS by:
 - Improving gut microbiota balance
 - Regulating bowel movements
 - Reducing intestinal inflammation
 - Decreasing abdominal discomfort & bloating

IMPORTANT NUTRACEUTICALS IN IBS

① Probiotics (Lactobacillus, Bifidobacterium):

- Restore healthy gut flora & reduce bloating & diarrhea.

② Prebiotics (Inulin, fructo- oligosaccharides):

- Promote growth of beneficial intestinal bacteria.

③ Dietary fibers (Psyllium husk):

- Helps in constipation - predominant IBS & improves stool consistency.

④ Peppermint Oil :

- Relaxes intestinal smooth muscles & reduces abdominal pain.

⑤ Omega-3 fatty acids :

- Reduce mild intestinal inflammation.

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GASTROINTESTINAL DISEASES

- Gastrointestinal diseases include disorders of the stomach & intestine such as gastritis, peptic ulcer, gastro-esophagus reflux disease (GERD), diarrhea & constipation.
- These conditions are commonly caused by infection, improper diet, stress, drugs (NSAIDs), and imbalance of gut microflora.
- Management mainly focuses on symptom relief & restoration of gut health.

ROLE OF NUTRACEUTICALS IN GI DISEASES

- Nutraceuticals help in GI diseases by:
 - Protecting gastric mucosa
 - Improving digestion & absorption
 - Restoring normal gut flora
 - Reducing inflammation & acidity

IMPORTANT NUTRACEUTICALS IN GI DISEASES

① Probiotics (Lactobacillus, Bifidobacterium):

- Restore intestinal microflora & help in diarrhea & gastritis.

② Prebiotics (Inulin, FOS):

- Promote growth of beneficial gut bacteria & improve digestion.

③ Dietary fibers (Psyllium, oats):

- Useful in constipation & improves bowel movement.

CAUSES / ETIOLOGY

Cancer often arises from a combination of genetic, environmental & lifestyle factors:

- Genetic Mutations
- Environmental Exposures
- Smoking
- Alcohol
- Age
- Virus, Bacterias, Parasites
- Hormonal Imbalances
- Chronic Inflammation

SIGN & SYMPTOMS

- Fatigue
- Weight changes
- Skin changes
- Bowel changes
- Persistent cough
- Breathing Trouble
- Unexplained Joint Pain
- Fever / Night sweats

HERBAL NEUTRACEUTICALS

Several medicinal plants act as nutraceuticals in cancer prevention & management:

- Garlic - Inhibits carcinogen activation
- Green tea - Prevents oxidative DNA damage
- Aloe vera - Immunomodulatory activity
- Ginseng - Enhances immune response & reduce fatigue

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④ Glutamine :

- Maintains intestinal mucosal integrity & supports gut healing.

⑤ Herbal Nutraceuticals (Aloe vera, Ginger) :

- Reduce gastric irritation, acidity & inflammation.

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STUDY OF FOLLOWING HERBS AS HEALTH FOODS

① ALFALFA

- Alfalfa is a nutraceutical herb used as a health food because it's rich in vitamins, minerals & bioactive compounds.

BIOLOGICAL SOURCE

- It consists of entire herbs of *Medicago sativa* Linn, Family Leguminosae.

DESCRIPTION

- It is a perennial plant which lives for many years.
- The plant has a deep root system.
- The stem is upright.
- The leaves are trifoliate, meaning three leaflets are present.
- It has yellow, blue or purple coloured flowers.

CHEMICAL CONSTITUENTS

- Alkaloids
- Amino acids
- Coumarins
- Flavonoids
- Phenolic compounds
- Phytoestrogens
- Saponins
- Phytosterols
- Volatile components
- Vitamins & Minerals

HEALTH BENEFITS

- Supports kidney & bladder health
- Helps in lowering blood cholesterol
- Shows neuroprotective effects
- Useful in Arthritis
- Helps in controlling blood sugar levels.

② CHICORY

- Chicory is used as health food mainly for digestive, liver & metabolic health.

BIOLOGICAL SOURCE

- It consists of dried root of *Cichorium intybus* L., family Asteraceae.

DESCRIPTION

- It is an erect & rough herb.
- The plant flowers in summer season.
- It has bright blue coloured flowers.
- The lower leaves are large in size.
- The upper leaves are small & narrow with toothed margins.

CHEMICAL CONSTITUENTS

- Inulin
- Volatile Oils
- Fatty acids
- Alkaloids
- Flavonoids
- Tannins & Saponins
- Phenols & Organic acids
- Vitamins & Minerals

HEALTH BENEFITS

- Helps in reducing blood sugar levels
- Lowers cholesterol & triglycerides
- Improves digestion
- Protects gastrointestinal tract
- Shows antimicrobial activity

③ GINGER

- Ginger is a commonly used medicinal herb & health food for digestive & metabolic problems.

BIOLOGICAL SOURCE

- It consists of fresh & dried rhizomes of *Zingiber officinale* Roscoe, belonging to Zingiberaceae.

DESCRIPTION

- It is a perennial plant with underground rhizomes.
- The plant grows up to about one meter in height.
- The rhizomes are thick & fleshy.
- The outer surface is light yellow & inside colour is pale yellow.
- It has a strong aromatic smell & pungent taste.

CHEMICAL CONSTITUENTS

- Volatile oils
- Gingerols
- Shogaols
- Zingerone
- Starch
- Vitamins & Minerals

HEALTH BENEFITS

- Improves digestion & appetite.
- Useful in nausea & vomiting.
- Helps in Diabetes management.
- Reduces cholesterol & Blood pressure.
- Shows antimicrobial activity.

④ FENUGREEK

- Fenugreek is used as a health food & traditional medicine for metabolic & digestive disorders.

BIOLOGICAL SOURCES

- It consists of herbs of *Trigonella foenum-graceum* L., belonging to Fabaceae.

DESCRIPTION

- The plant has roots with small nodules.
- The leaves are small & oblong in shape.
- The flowers are white to yellow in colour.
- The seeds are hard, yellowish-brown in colour.

CHEMICAL CONSTITUENTS

- Saponins
- Alkaloids (Trigonelline)
- Flavonoids
- Amino acids
- Steroids (Diosgenin)
- Vitamins & Minerals

HEALTH BENEFITS

- Helps in controlling blood sugar.
- Reduces cholesterol levels
- Improves digestion
- Increases milk secretion
- Acts as anti-inflammatory agent.

⑤ GARLIC

- Garlic is a medicinal herb widely used as health food for heart & immune health.

BIOLOGICAL SOURCE

- It consists of bulbs of *Allium sativum*, belonging to family Liliaceae.

DESCRIPTION

- It is a bulbous perennial plant similar to onion.
- The bulb is made up of many small cloves.
- The cloves are covered with a white or pinkish covering.
- The plant has a tall stem.
- Garlic has a strong pungent smell.

CHEMICAL CONSTITUENTS

- Alliin
- Allicin
- Organosulphur compounds
- Volatile Oil
- Vitamins & Minerals
- Proteins & Carbohydrates

HEALTH BENEFITS

- Helps in lowering blood pressure
- Reduces cholesterol
- Improves blood circulation
- Boosts immunity
- Useful in digestive disorders

⑥ HONEY

- Honey is a natural sweet substances used as a health food & energy source.

BIOLOGICAL SOURCE

- Honey is produced from the nectar of flowers by *Apis Mellifera*.
- Honey bees convert nectar into honey by regurgitation & evaporation using enzymes present in their gut.

DESCRIPTION

- It is a thick & sticky liquid.
- The colour is golden yellow to dark brown.
- It has pleasant smell.
- The taste is sweet.
- It becomes crystalline on storage.

CHEMICAL CONSTITUENTS

- Fructose
- Glucose
- Disaccharides & oligosaccharides
- Enzymes (Invertase, diastase, catalase)
- Amino acids
- Vitamins & Minerals
- Flavonoids & phenolic acids

HEALTH BENEFITS

- Provides instant energy
- Useful in cough & cold.
- Helps in wound healing.
- Improves digestion.
- Shows antimicrobial activity.

⑦ AMLA

- Amla is an important medicinal fruit used as health food due to its high Vitamin C Content.

BIOLOGICAL SOURCE

- It consists of fresh & dried fruits of *Emblica officinalis* Gaertn or *Phyllanthus Emblica*, belonging to family *Euphorbiaceae*.

DESCRIPTION

- It's a medium sized deciduous tree.
- The fruits are round & green in colour.
- The surface is smooth & hard.
- The fruit taste is sour & astringent.
- A hard seed is present inside.

CHEMICAL CONSTITUENTS

- Hydrolysable tannins (Emblicanin A & B)
- Gallic acid
- Ellagic acid
- Polyphenols
- Amino acids
- Vitamin C
- Minerals

HEALTH BENEFITS

- Boosts immunity
- Acts as long antioxidant
- Improves digestion
- Useful for liver health
- Good for hair & skin.

⑧ GINSENG

- Ginseng is an adaptogenic herb used as a health food to improve energy & stamina.

BIOLOGICAL SOURCE

- It consists of dried roots of Panax species like Panax ginseng, Panax notoginseng & Panax quinquefolium, belonging to family Araliaceae.

DESCRIPTION

- It is a perennial deciduous plant.
- The roots are thick & fleshy.
- The roots resemble human body shape.
- The leaves are compound with five leaflets.
- It bears small white or greenish-yellow flowers.

CHEMICAL CONSTITUENTS

- Ginsenosides
- Saponins
- Polyphenols
- Polysaccharides
- Alkaloids
- Volatile components

HEALTH BENEFITS

- Increases physical & mental stamina.
- Reduces stress & fatigue.
- Improves immunity
- Enhances concentration.

⑨ ASHWAGANDHA

- Ashwagandha is a traditional Ayurvedic herb used as a health food for strength & vitality.

BIOLOGICAL SOURCES

- It consists of dried roots of *Withania Somnifera* Dunal, belonging to family Solanaceae.

DESCRIPTION

- It is an evergreen, erect & branched shrub.
- The plant grows up to about 30-150 cm in height.
- The leaves are simple & oval in shape.
- Flowers are small & greenish-yellow.
- Fruits are orange-red berries.

CHEMICAL CONSTITUENTS

- Withanolides
- Alkaloids
- Steroidal lactones
- Amino acids
- Flavonoids

HEALTH BENEFITS

- Acts as anti-stress agent.
- Improves strength & stamina
- Helps in better sleep.
- Boosts immunity.

⑩ SPIRULINA

- Spirulina is a protein - rich blue-green algae used as a health food supplement.

BIOLOGICAL SOURCE

- These are blue-green microalgae of species like *Spirulina platensis*, *Spirulina Maxima* & *Spirulina Fusiformis*, belonging to family *Oscillatoriaceae*.

DESCRIPTION

- It is a microscopic blue-green algae.
- It has spiral or helical shaped filaments.
- It grows well in alkaline water.
- It is autotrophic in nature.
- It is available as powder or tablets.

CHEMICAL CONSTITUENTS

- Proteins
- Carbohydrates
- Fatty acids
- Vitamins (A, B - complex, C, D, E)
- Minerals (iron, calcium, magnesium, zinc)

HEALTH BENEFITS

- Acts as nutritional supplement
- Improves immunity
- Useful in malnutrition
- Acts as antioxidant
- Improves overall health

INTERACTION

- An interaction occurs when two or more substances are taken together and one substance alters the effect of the other.
- These substances may be drugs, herbs or foods.
- Interactions can increase or decrease the desired effect or may cause side effects & toxicity.
- Understanding interactions is important to ensure safe & effective therapy.

HERBAL - DRUG INTERACTIONS

- Herbal - Drug Interactions means when a herbal medicine is taken along with a allopathic drug & it changes the effect of the drug.
- The effect may be increased, decreased or cause side effects.
- Common examples:
 - Garlic + anticoagulants → increased bleeding risk
 - Aloe vera + laxatives → severe diarrhea & electrolyte imbalance.

HERB - FOOD INTERACTIONS

- Herb - food interaction occurs when food alters the action or absorption of herbal medicines or increases side effects.
- Example of Herb - food Interactions:
 - Garlic + high-fat food → increased risk of gastric irritation
 - Ginseng + caffeine (tea + coffee) → Nervousness, Insomnia.
 - Turmeric + Black pepper → increased absorption of curcumin.

TYPES OF INTERACTION

Herbal Drug or Herb food Interaction are of generally two types :

- ① Pharmacokinetic Interaction
- ② Pharmacodynamic Interaction

① PHARMACOKINETIC INTERACTION

These interactions affect ADME (Absorption, Distribution, Metabolism, Excretion) of drugs.

- ④ Absorption: Some herbs alter drug absorption from GIT.
Example - Psyllium husk (Isabgol) + oral drugs → reduces drug absorption.
- ⑥ Distribution: Herbs may displace drugs from plasma protein binding sites.
Example - Ginkgo + Warfarin → increased free warfarin → bleeding risk.
- ⑦ Metabolism: Herbs may induce or inhibit liver enzymes.
Example - St. John's Wort + oral contraceptives → increased metabolism → reduced effect.
- ⑧ Elimination: Herbs may increase or decrease renal excretion of drugs.
Example: Licorice + diuretics → increased potassium loss.

② PHARMACODYNAMIC INTERACTIONS

These interactions affect drug action at receptor or target site.

① ADDITIVE EFFECT: Herb & drug produce similar effects, increasing overall action.

Example - Garlic + Aspirin → increased antiplatelet effect → Bleeding

② ANTAGONISTIC EFFECT: Herb reduces or opposes drug action.

Example - Ginseng + Antidiabetic drugs → alters blood glucose control

IMPERFECT PHARMACY

① HYPERCIUM (St. John's Wort)

- Biological Source: Dried aerial parts of *Hypericum perforatum*.
- Family: *Hypericaceae*
- Geographical source: Europe, Australia, Western Himalayas.
- Morphology: Small branched herb with yellow flowers & dotted leaves.
- Chemical constituents: Hypericin, Hyperforin, flavonoids.
- Uses: Used for mild to moderate depression, anxiety & mood disorders.
- Possible side effects:
 - Insomnia
 - Dizziness
 - GI Upset
 - Skin rash

INTERACTION

- St. John's Wort is a stronger inducer of liver enzymes (CYP3A4, CYP2C9, CYP1A2) & P-glycoprotein.
- It increases the metabolism & elimination of many drugs, reducing their blood levels & activity.
 - ↓ Effect of oral contraceptives → contraceptive failure
 - ↓ Effect of Warfarin, digoxin, cyclosporine & antiretroviral drugs → loss of efficacy.
 - With SSRIs or MAO inhibitors → risk of serotonin syndrome (confusion, tremor, fever).

② KAVA - KAVA

- Biological Source : Dried roots of *Piper methysticum*
- Family : *Piperaceae*
- Geographical source : Melanesia, Polynesia, Micronesia
- Morphology : Shrub with large heart-shaped leaves & woody stems
- Chemical constituents : Kavalactones (kavain, Methysticin)
- Uses :
 - Anxiety
 - Stress
 - Insomnia
- Possible side effects :
 - Liver toxicity
 - Drowsiness
 - Nausea

INTERACTION

- Kava produces CNS depressant action similar to sedative drugs.
- When combined with alcohol, barbiturates, benzodiazepenes, or antidepressants, it can cause:
 - Excessive sedation, dizziness & loss of coordination.
 - Severe liver damage with hepatotoxic drugs (e.g., acetaminophen).

③ GINGKO BILOBA

- Biological Source : Dried leaves of Ginkgo biloba
- Family : Ginkgoaceae
- Geographical Source: China, Japan, Korea
- Morphology : Fan-shaped leaves
- Chemical constituents : Flavonoids, Ginkgolides
- Uses :
 - Improves memory
 - Concentration
 - Blood Circulation
- Possible side effects :
 - Headache
 - Nausea
 - Allergic skin reaction
 - Bleeding tendency

INTERACTION

- Ginkgo shows antiplatelet & vasodilatory activity.
- When taken with drugs that affect clotting, it increases bleeding risk.
 - With warfarin, aspirin, clopidogrel, NSAIDs → high chance of internal or nasal bleeding.
 - With anticonvulsants → May lower seizure threshold, causing convulsions.
 - Before surgery → increases risk of postoperative bleeding.

④ GINSENG

- Biological source: Roots of *Panax ginseng*
- Family: *Araliaceae*
- Geographical source: China, Korea, Siberia
- Morphology: Fleshy, Branched root
- Chemical constituents: Ginsenosides (saponins)
- Uses: Adaptogen; improves physical performance, immunity & vitality.
- Possible side effects:
 - Insomnia
 - Nervousness
 - High BP

INTERACTION

- Ginseng affects blood glucose regulation & CNS activity.
 - With antidiabetic drugs or insulin → excessive fall in blood sugar (hypoglycemia)
 - With warfarin → decreases anticoagulant activity, leading to clot formation.
 - With stimulants or caffeine → causes anxiety, rapid heartbeat, & tremors.
- Hence, diabetic & hypertensive patients should use it carefully.

⑤ GARLIC

- Biological source: Bulb of *Allium sativum*
- Family: Liliaceae
- Geographical source: India, Europe, Mediterranean countries.
- Morphology: Bulb with multiple cloves, strong odor
- Chemical constituents: Allicin, allinin, sulfur compounds
- Uses:
 - Reduces cholesterol, BP
 - Acts as antimicrobial
- Possible side effects:
 - Heartburn
 - Gastric irritation
 - Body odor

INTERACTION

- Garlic has antiplatelet & enzyme-inducing properties.
 - With warfarin, aspirin, clopidogrel → increased bleeding tendency
 - With anti-hypertensive drugs → excessive lowering of BP
 - With antiretroviral drugs (saquinavir) → decreased drug levels

⑥ PEPPER (BLACK PEPPER)

- Biological Source: Dried unripe fruits of pepper nigrum
- Family: Piperaceae
- Geographical Source: India, Sri Lanka
- Morphology: Small round black fruits
- Chemical constituents: Piperine
- Uses:
 - Used as Spice,
 - Digestive stimulant
 - Bioavailability enhancer
- Possible side effects: Gastric irritation at high doses.

INTERACTION

- Piperine inhibits drug-metabolizing enzymes (CYP3A4, CYP2D6) & increases drug absorption.
- This enhances the bioavailability of several drugs:
 - ↑ Levels of Phenytoin, Propranolol, theophylline, rifampicin
 - May increase toxicity if combined with narrow-therapeutic-range drugs.
 - With herbs like turmeric → improves curcumin absorption (beneficial use)

⑦ EPHEDRA

- Biological Source: Dried stems of Ephedra Sinica
- Family: Ephedraceae
- Geographic Source: China, Mongolia
- Morphology: Green jointed stems, small scale-like leaves
- Chemical constituents: Ephedrine & Pseudoephedrine (Alkaloids)
- Uses: - Bronchodilator
- Nasal Decongestant
- Stimulant
- Possible side effects: - Insomnia
- Palpitations
- Anxiety
- Hypertension

INTERACTION

- Ephedra is a sympathomimetic stimulant, acting on adrenergic receptors.
 - With antihypertensive drugs → reduces their effect, causing high BP.
 - With MAO inhibitors or antidepressants → may lead to hypertensive crisis
 - With caffeine or other stimulants → excessive CNS stimulation & Heart attack risk

THANK YOU

FOR CHOOSING IMPERFECT PHARMACY AS YOUR STUDY PARTNER



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