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HERBAL DRUG TECHNOLOGY

UNIT 2

TOPIC :

- **Herbal-Drug and Herb-Food Interactions** : General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.



Herbal-Drug and Herb-Food Interactions

General Introduction and Classification

Introduction

- Pharmacognosy Herbal medicines are widely used along with modern medicines and dietary products. When herbs are taken together with drugs or foods, they may alter the action of each other. This phenomenon is called Herbal-Drug Interaction or Herb-Food Interaction.
- These interactions can:
 - Increase drug action
 - Decrease drug action
 - Produce toxic effects
 - Alter absorption, metabolism, or excretion
 - Affect therapeutic efficacy
- Herbal interactions are important in B.Pharm because many patients use herbal products without informing healthcare professionals.

Herbal-Drug Interaction

- It is the modification of the effect of a drug when administered together with a herbal product.

Example:

Garlic with anticoagulant drugs may increase bleeding risk.

Herb-Food Interaction

- It refers to the alteration in the activity of herbs due to food or nutrients taken simultaneously.

Example:

Tea or coffee may reduce absorption of iron-containing herbal preparations.

Importance of Herbal Interactions

- Helps in safe use of herbal medicines
- Prevents adverse drug reactions
- Avoids treatment failure
- Necessary in chronic diseases like diabetes, hypertension, and cardiac disorders
- Important in elderly patients using multiple drugs

Mechanism of Herbal Interactions

Herbal interactions mainly occur by two mechanisms:

1. Pharmacokinetic Interactions

These interactions affect:

- Absorption
- Distribution
- Metabolism
- Excretion of drugs

Example:

Ginseng may alter metabolism of antidiabetic drugs.

2. Pharmacodynamic Interactions

These interactions occur when herb and drug produce:

- Similar effects (synergistic)
- Opposite effects (antagonistic)

Example:

Ashwagandha with sedatives may increase CNS depression.

Classification of Herbal–Drug Interactions

A. Based on Mechanism

1. Pharmacokinetic Interactions

a) Absorption Interaction

Herbs alter gastrointestinal absorption of drugs.

Example:

Fiber-rich herbs decrease absorption of some medicines.

b) Metabolism Interaction

Herbs may induce or inhibit liver enzymes.

Example:

Garlic may affect cytochrome P450 enzymes.

c) Excretion Interaction

Herbs may alter renal elimination of drugs.

Example:

Diuretic herbs increase drug excretion.

2. Pharmacodynamic Interactions

a) Synergistic Interaction

Herb and drug produce enhanced effect.

Example:

Garlic + anticoagulants → excessive bleeding.

b) Antagonistic Interaction

Herb reduces activity of drug.

Example:

Herbs with high vitamin K reduce action of warfarin.

B. Based on Clinical Outcome

1. Beneficial Interaction

Interaction improves therapeutic effect.

Example:

Ginger enhances digestion.

2. Harmful Interaction

Interaction causes toxicity or adverse effects.

Example:

Garlic with aspirin increases bleeding tendency.

3. Neutral Interaction

No significant effect occurs.

Classification of Herb–Food Interactions

1. Positive Herb–Food Interaction

Food improves absorption or action of herbs.

Example:

Fatty food improves absorption of fat-soluble herbal constituents.

2. Negative Herb–Food Interaction

Food decreases herbal efficacy.

Example:

Milk may interfere with absorption of certain herbal compounds.

Study of following drugs and their possible side effects and interactions: Hypericum, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

St. John's Wort (Hypericum)

Biological Source

- Dried aerial parts of *Hypericum perforatum*.

Family

- Hypericaceae

Geographical Source

- Native to Europe; also found in Australia and Western Himalayas.

Morphology

- Small branched herb
- Yellow flowers
- Leaves contain translucent dotted glands

Chemical Constituents

- Hypericin
- Hyperforin
- Flavonoids

Uses



- Used in mild to moderate depression
- Helpful in anxiety and mood disorders

Possible Side Effects

- Insomnia
- Dizziness
- Gastrointestinal upset
- Skin rash
- Photosensitivity

Pharmacy Interaction

St. John's Wort is a strong inducer of liver enzymes:

- CYP_{3A4}
- CYP_{2C9}
- CYP_{1A2}
- P-glycoprotein

It increases metabolism and elimination of many drugs, thereby reducing their blood levels and therapeutic activity.

Important Drug Interactions

- Oral contraceptives → contraceptive failure
- Warfarin → reduced anticoagulant effect
- Digoxin → reduced efficacy
- Cyclosporine → transplant rejection risk
- Antiretroviral drugs → loss of antiviral effect

Interaction with Antidepressants

When taken with SSRIs or MAO inhibitors, it may cause serotonin syndrome.

Symptoms of Serotonin Syndrome

- Confusion
- Tremor
- Fever
- Sweating
- Agitation

Kava (Kava-Kava)

Biological Source

- Dried rhizomes and roots of *Piper methysticum*.

Family

- Piperaceae

Geographical Source

Native to Pacific Islands such as:

- Fiji
- Hawaii
- Samoa
- Vanuatu



Morphology

- Shrubby perennial plant
- Thick knotty roots and rhizomes
- Heart-shaped green leaves
- Stem with swollen nodes

Chemical Constituents

- Kavalactones (main active constituents)
 - Kavain
 - Methysticin

- Yangonin
- Resin
- Alkaloids

Uses

- Anxiety and stress relief
- Sedative and relaxant
- Insomnia
- Muscle relaxation
- Mild mood disorders

Possible Side Effects

- Drowsiness
- Dizziness
- Headache
- Nausea
- Skin dryness
- Liver toxicity (hepatotoxicity)

Pharmacy Interaction

CNS Depressants

Kava enhances sedative effects of:

- Alcohol
- Benzodiazepines
- Barbiturates
- Sleeping pills

This may cause:

- Excessive drowsiness
- Poor coordination
- Respiratory depression

Liver Toxicity Interaction

Avoid use with hepatotoxic drugs:

- Paracetamol (high dose)
- Antitubercular drugs

- Alcohol

Parkinson's Disease Drugs

May worsen symptoms in patients taking levodopa.

Antidepressants

May increase CNS depression with antidepressants and antipsychotics.



Ginkgo biloba (Ginkgo Biloba)

Biological Source

- Dried leaves of *Ginkgo biloba*.

Family

- Ginkgoaceae

Geographical Source

Native to China; cultivated in:

- Japan
- Korea
- Europe
- USA



Morphology

- Tall deciduous tree
- Fan-shaped leaves
- Leaves have bilobed appearance
- Seeds are yellowish and fleshy

Chemical Constituents

- Ginkgolides
- Bilobalide
- Flavonoids
- Terpenoids

Uses

- Improves memory and concentration
- Used in Alzheimer's disease and dementia
- Improves blood circulation

- Used in vertigo and tinnitus
- Antioxidant activity

Possible Side Effects

- Headache
- Dizziness
- Stomach upset
- Allergic skin reactions
- Bleeding tendency

Pharmacy Interaction

Anticoagulants and Antiplatelet Drugs

Ginkgo may increase risk of bleeding with:

- Warfarin
- Aspirin
- Clopidogrel

Antiepileptic Drugs

May reduce effectiveness of anticonvulsants and increase seizure risk.

Antidepressants

Possible interaction with SSRIs and MAO inhibitors.

NSAIDs

Concurrent use with NSAIDs may increase bleeding risk.

Surgery Warning

Should be stopped 1–2 weeks before surgery due to bleeding risk.

Ginseng

Biological Source

- Dried roots of *Panax ginseng* (Asian ginseng) or *Panax quinquefolius* (American ginseng).

Family

- Araliaceae

Geographical Source

- China
- Korea
- Japan
- Siberia
- North America



Morphology

- Perennial herb
- Thick fleshy roots
- Palmately compound leaves
- Small greenish-white flowers
- Red berry-like fruits

Chemical Constituents

- Ginsenosides (main active constituents)
- Saponins
- Polysaccharides
- Volatile oils
- Peptides and vitamins

Uses

- General health tonic
- Improves physical and mental performance
- Reduces stress and fatigue
- Enhances immunity
- Used in diabetes management
- Improves memory and concentration

Possible Side Effects

- Insomnia
- Headache
- Nervousness
- Hypertension
- Nausea
- Diarrhea

Pharmacy Interaction

Anticoagulants

May reduce effect of warfarin and alter blood clotting.

Antidiabetic Drugs

Can lower blood glucose excessively when used with insulin or oral antidiabetic drugs.

CNS Stimulants

May increase stimulation with caffeine and other stimulants causing:

- Nervousness
- Increased heart rate
- Sleeplessness

Antidepressants

May interact with MAO inhibitors causing headache, tremor, or mania-like symptoms.

Corticosteroids

Long-term combined use may alter hormonal balance and immune response.

Garlic

Biological Source

- Bulb of *Allium sativum*.

Family

- Liliaceae / Amaryllidaceae

Geographical Source

Cultivated worldwide; mainly in:

- India
- China
- Egypt
- Central Asia

Morphology

- Underground bulb made of cloves
- Strong characteristic odor
- Long narrow flat leaves
- White or pinkish flowers

Chemical Constituents

- Allicin
- Alliin
- Sulfur compounds
- Volatile oils
- Flavonoids
- Selenium



Uses

- Reduces cholesterol levels
- Antihypertensive
- Antimicrobial activity
- Cardioprotective effect
- Antioxidant
- Used in cold and infections

Possible Side Effects

- Gastric irritation
- Heartburn
- Nausea
- Bad breath
- Allergic reactions
- Increased bleeding tendency

Pharmacy Interaction

Anticoagulants and Antiplatelet Drugs

Garlic may increase bleeding risk with:

- Warfarin
- Aspirin
- Clopidogrel

Antihypertensive Drugs

May enhance blood pressure lowering effect causing hypotension.

Antidiabetic Drugs

Can enhance glucose lowering effect leading to hypoglycemia.

HIV Drugs

May reduce blood levels of some antiretroviral drugs such as saquinavir.

Surgery Warning

Should be discontinued before surgery because of bleeding risk.

Black Pepper

Biological Source

- Dried unripe fruits of *Piper nigrum*.

Family

- Piperaceae

Geographical Source

Cultivated mainly in:

- India
- Sri Lanka
- Indonesia
- Vietnam
- Brazil

Morphology

- Climbing perennial vine
- Small round green fruits which become black after drying
- Heart-shaped leaves
- Spike-like fruit clusters

Chemical Constituents

- Piperine (main alkaloid)
- Volatile oils
- Chavicine
- Resin
- Terpenes



Uses

- Improves digestion
- Carminative
- Appetite stimulant
- Antioxidant activity
- Enhances bioavailability of drugs and nutrients
- Used in cough and cold preparations

Possible Side Effects

- Gastric irritation
- Burning sensation
- Sneezing
- Skin or eye irritation
- Excess intake may cause stomach upset

Pharmacy Interaction

Drug Bioavailability

Piperine inhibits drug-metabolizing enzymes and increases absorption of many drugs.

Interaction with Drugs

May increase blood levels and toxicity of:

- Phenytoin
- Propranolol
- Theophylline
- Rifampicin

Anticoagulants

May increase bleeding risk when used with anticoagulant drugs.

Antidiabetic Drugs

May enhance glucose lowering effect causing hypoglycemia.

CNS Drugs

Can alter absorption and metabolism of certain CNS-active drugs.

Ephedra

Biological Source

- Dried stems of *Ephedra sinica* and related species.

Family

- Ephedraceae

Geographical Source

Found in:

- China
- India
- Mongolia
- Central Asia

Morphology

- Small shrub-like plant
- Green jointed stems
- Reduced scale-like leaves
- Cone-shaped reproductive structures

Chemical Constituents

- Ephedrine
- Pseudoephedrine
- Alkaloids
- Tannins
- Flavonoids



Uses

- Bronchodilator in asthma
- Nasal decongestant
- CNS stimulant
- Used in cold and cough preparations
- Traditionally used for weight loss

Possible Side Effects

- Hypertension
- Palpitations
- Insomnia
- Nervousness
- Headache
- Stroke risk
- Heart attack risk

Pharmacy Interaction

CNS Stimulants

May increase stimulant effects with:

- Caffeine
- Amphetamines
- Other stimulants

This can cause:

- Increased heart rate
- Anxiety
- Hypertension

MAO Inhibitors

Severe hypertensive crisis may occur with MAO inhibitors.

Antihypertensive Drugs

May reduce effectiveness of blood pressure lowering drugs.

Cardiac Drugs

Can increase risk of arrhythmias with digitalis and other cardiac medicines.

Anesthetics

May increase cardiovascular complications during surgery.