FOOD -DRUG INTERACTIONS

The management of many diseases requires drug therapy, frequently involving the use of multiple drugs

Food-drug interactions can change the effects of drugs, and the therapeutic effects or side effects of medications can affect the nutrition status of an individual

- For example, a drug that causes chronic nausea or mouth pain may result in poor intake and weight loss

Drug may affects on of the following:

- 1- Food intake.
- 2- weight gain .
- 3- nutrient Absorption .
- 4- nutrient metabolism .
- 5- nutrient excretion .

Alternatively, the diet and use of supplements, genetic makeup, or the nutritional status of the patient can decrease the efficacy of a drug or increase its toxicity.

For clinical, economic, and legal reasons, it is important to recognize food-drug interactions.

Food-drug interactions that reduce the efficacy of a drug can result in **longer or repeated stays in health care facilities**, the **use of multiple drugs**, and **deterioration of the patient** because of the effects of the disease

Additional health problems can occur because of
long-term drug-nutrient interactions
An example of this
type of interaction is the long-term effects of
corticosteroids on **calcium**
metabolism and the resulting
osteoporosis.

Medical team members should be aware that therapeutically important food-drug interactions can do the following

- Alter the intended response to the medication
- Cause drug toxicity
- Alter normal nutritional status

Benefits of Minimizing Food Drug Interactions

- Medications achieve their intended effects
- Improved compliance with medications
- Less need for additional medication or higher dosages
- Fewer caloric or nutrient supplements are required
- Adverse side effects are avoided

Benefits of Minimizing Food Drug Interactions

- Optimal nutritional status is preserved
- Accidents and injuries are avoided
- Disease complications are minimized
- The cost of health care services is reduced
- There is less professional liability
- Licensing agency requirements are met

Awareness of these interactions enables the health care professional and patient to work together to avoid or minimize problems

Food-drug interactions may be divided into two broad types:

(1) pharmacodynamic interactions,

which affect the pharmacologic action of the drug

(2) pharmacokinetic interactions, which affect the movement of the drug into, around, or out of the body

Pharmacodynamics

is the study of the biochemical and

physiologic effects of a drug. The mechanism of action of a drug might include the binding of the drug molecule to a receptor, enzyme, or ion channel, resulting in the observable physiologic response.

Ultimately this response may be enhanced or attenuated by the addition of other substances with similar or opposing actions

Pharmacokinetics

is the study of the time course of a drug in the body involving the **absorption**, **distribution**, **metabolism** ,

and **excretion** of the drug

Absorption is the process of the movement of the drug from the site of administration to the bloodstream.
This process depends on

(1) the route of administration

(2) the chemistry of the drug and its ability to cross biologic membranes

(3) the rate of gastric emptying (for orally administered drugs) and gastrointestinal (GI) movement

food components, and nutrition supplements can interfere with the absorption process, especially when the drug is administered orally

Many drugs are highly bound to plasma proteins such as albumin.

The bound fraction of drug does not leave the vasculature and therefore does not produce a pharmacologic effect.

Only the unbound fraction is able to produce an effect at a target organ.

A drug is eliminated from the body as either an unchanged drug or a metabolite of the original compound.

The major organ of metabolism, or biotransformation, in the body is the liver, although other sites, such as the intestinal membrane, contribute to variable degrees.

One of the more important enzyme systems that facilitate drug metabolism is the cytochrome P-450 enzyme system.

This is a multi enzyme system in the smooth endoplasmic reticulum of numerous tissues that is involved in detoxification

Food or dietary supplements may either increase or inhibit the activity of this enzyme system, which can significantly change the rate or extent of drug metabolism.

The general tendency of the process of metabolism is to transform a drug from a lipid-soluble to a more water-soluble compound that can be handled more easily by the kidneys and excreted in the urine

When grapefruit or grapefruit juice is ingested, the metabolizing enzyme is **irreversibly inhibited** which reduces the normal metabolism of the drug

This reduction in metabolism allows more of the drug to reach the systemic circulation; the increase in blood levels of unmetabolized drug results in a greater pharmacologic effect
and
possible toxicity

Unfortunately, the effects of grapefruit on intestinal cytochrome P-450 3A4 last up to

72 hours

until the body can reproduce the enzyme.

Therefore separating the ingestion of the grapefruit and the drug does not appear to alleviate this interaction.

The presence and type of meal or food ingested influence the rate of gastric emptying

Gastric emptying

may be delayed by the consumption of **high-fiber meals** and

meals with **high fat** content.

In general, a delay in drug absorption is not clinically significant as long as the extent of absorption is not affected.

However, delayed absorption of antibiotics or analgesics may be clinically significant.

Medication and Enteral Nutrition Interactions

Continuous enteral feeding is an effective method of providing nutrients to patients who are unable to swallow or eat adequately.

However, use of the feeding tube to administer medication can be a problem.

When liquid medications are mixed with enteral formulas, incompatibilities may occur.

Types of physical incompatibility include **granulation, gel formation, and separation of the enteral product**; these frequently clog feeding tubes and interrupt delivery of nutrition to the patient

Drug Excretion

Food and nutrients can alter the resorption of drugs from the renal tubule
Resorption of the antimanic agent lithium (Lithobid or Eskalith) is closely associated with the resorption of sodium

When sodium intake is low or when a patient is dehydrated, the kidneys resorb more sodium

In the person treated with lithium, the kidney resorbs lithium as well as sodium under these conditions

Higher lithium levels and possible toxicity result

When excess sodium is ingested, the kidneys eliminate more sodium in the urine and likewise more lithium
This produces lower lithium levels and possible therapeutic failure

Renal excretion is the major route of elimination for drugs and drug metabolites either by glomerular filtration or tubular secretion

To a lesser extent drugs may be eliminated in feces, bile, and other body fluids

EFFECTS OF DRUGS ON FOOD AND NUTRITION

Nutrient Absorption
Nutrient Metabolism
Nutrient Excretion

Medication can decrease or prevent nutrient absorption.
Chelation reactions between medications and minerals (metal ions) reduce the amount of mineral available for absorption.

An example is tetracycline and ciprofloxacin, which chelates calcium found in supplements or in dairy products such as milk or yogurt. This is also true for other divalent or trivalent cations such as iron, magnesium, and zinc found in individual mineral supplements or multivitamin-mineral supplements.

Drugs with the greatest effect on nutrient absorption are those that damage the intestinal mucosa

Damage to the structure of the villi and microvilli inhibits the brush-border enzymes and intestinal transport systems involved in nutrient absorption

Damage
to the gut mucosa commonly results from **chemotherapeutic agents**, **nonsteroidal antiinflammatory drugs** (NSAIDs), and **long-term antibiotic therapy**.

Nutrient Metabolism

Anticonvulsants
phenobarbital and phenytoin induce
hepatic enzymes and
increase the metabolism of vitamins **D**
and **K**, and **folic acid**

Supplements of
these vitamins are often prescribed
with these drugs

Carbamazepine (Tegretol) has been reported to affect the metabolism of **biotin, vitamin D, and folic acid**, leading to possible **depletion**. Measurement of vitamin D levels and supplementation if indicated are recommended with these anticonvulsants

The anti-TB drug INH blocks the conversion of pyridoxine (**vitamin B6**) to its active form, pyridoxal 5-phosphate. Particularly in patients with low pyridoxine intake, this interaction may cause pyridoxine deficiency and peripheral neuropathy

Nutrient Excretion

Some drugs can either
increase or **decrease**
the urinary excretion of nutrients.

Electrolyte and magnesium blood levels should be monitored.

Prolonged use of high-dose diuretics, particularly by older patients on low-sodium diets, can cause sodium depletion.

Phenothiazine-class antipsychotic drugs such as chlorpromazine (Thorazine) increase excretion of riboflavin and
can lead to riboflavin deficiency in those with poor dietary
intake.

Complete assessment