Study of Absorption, Excretion and Bioavailability of drugs in Human.

Practical / Experiment on the human

Lab-2

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Absorption

- Defined as the passage of a drug from its site of administration into the plasma. Therefore, it is important for all routes of administration, **except** intravenous injection.
- Cell membranes form the barriers between aqueous compartments in the body.
- An epithelial barrier, such as the gastrointestinal mucosa or renal tubule, consists of a layer of cells tightly connected to each other so that molecules must traverse at least two cell membranes (inner and outer) to pass from one side to the other

Types of transport across cell membrane

1. Diffusion through lipid layers
2. Transfer through aqueous pores
3. Transport by carrier proteins: which include two main subtypes:.
   - a. Passive transport
   - b. Active transport: Need energy to transport against concentration gradient.
4. Pinocytosis

Factors affect the absorption of drug from GIT

- **First: Biological factors**
- **Second: Physiochemical factors**
- **Third: Pharmaceutical factors**

Biological factors

1. surface area of GI absorption sites
2. pH of gastrointestinal fluids
3. Gastrointestinal motility
4. Influence of food and diet in GIT
5. Hepatic metabolism (first pass effect)
6. Gastrointestinal disorders and presence of disease states

Physiochemical *factors*

1. Drug dissociation constant
2. Lipid solubility
3. Dissolution rate of drugs
4. Drug stability and degradation condition in GIT
5. Drug interaction properties with other constituents

Pharmaceutical factors

1. Types of dosage forms
2. Influence of excipients
3. Polymorphisms

Excretion

- **Is the elimination of drug molecules from the bloodstream outside the body.**
- **Drugs are excreted or eliminated from the body as parent compounds or metabolites.**

Renal excretion

- The kidney is the most important organ for the excretion of drugs and/or their metabolites.
- Some compounds are also excreted via bile, sweat, saliva, exhaled air, tears, hairs or milk, the latter a possible source of unwanted exposure in nursing infants.
- Drugs need to be reasonably hydrophilic to be excreted by the kidney, so that they will remain in the fluid that becomes the urine.
- Patients with impaired kidney function usually have a reduced ability to eliminate hydrophilic drugs.

Factors affect the excretion of drug from the body

- First: Biological factors
- Second: Physiochemical factors
- Third: Pharmaceutical factors

Biological factors

1. surface area of excretion sites
2. pH
3. Hepatic metabolism
4. Renal and hepatic disorders and presence of disease states

Physiochemical factors

1. **Lipid solubility**
2. **Dissolution rate of drugs**
3. **Drug interaction properties with other constituents**
4. **Molecular size**
5. **Protein and tissue binding**
6. **Doses adminstrated**

Pharmaceutical factors

1. **Types of dosage forms**
2. **Influence of excipients**

Saliva

- In recent years, saliva has been utilized for TDM. The advantage is that collection is noninvasive and painless and so it has been used as a specimen of choice in pediatric TDM.
- Due to the low protein content of saliva, it is considered to represent the **unbound or free fraction of drug** in plasma. Since this is the fraction considered available for transfer across membranes and therefore responsible for pharmacological activity, its usefulness is easy to understand.
- Drugs excreted in saliva enter the mouth and may be reabsorbed and swallowed.

Potassium iodide (KI)

- It's a salt of iodine added to Iodized table salt to keep most people healthy under normal conditions.
- KI is a **safe** and medically effective drug; Short-term use of KI at the proper dosage is safe for most people. KI is available without a prescription.
- The thyroid gland needs iodine to carry out its hormone production and iodine deficiency can cause hypothyroidism and most of the stable iodine in our bodies comes from the diet.

Objectives

- The aims of this experiment is to illustrate the considerable variation that exists in the rate of absorption and excretion of potassium iodide in two different dosage forms (**capsule** ,**solution**) when administered orally.

- At the end of the practical class the student shall be able to:

1. Quantitatively estimate the levels of iodide in the saliva.
2. Understand the importance of timing sample collection in relation to drug intake when estimating drug levels.
3. Understand the importance of bioavailability and pharmacokinetics in clinical practice.

Materials

Drugs and solutions:

a) Potassium iodide 300mg capsules
b) Potassium iodide 300mg/5ml solution
c) Sulphuric acid 10% solution
d) Hydrogen peroxide 5%
e) Starch solution 1% in distilled water.

Apparatus: Droppers,containers and test tubes.

Procedure

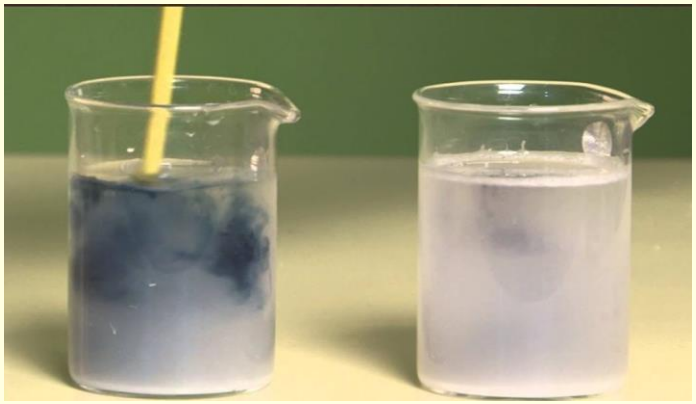
Assigned students into 2 groups

1- A random sample of students was allocated to receive potassium iodide 300 mg in capsules and another receives potassium iodide 300 mg in solution.

2- Two samples of saliva are collected every 10 minutes for 1 hour. These samples are tested as follow:

Testing the samples of saliva :

- 4 drops (saliva) + 5 drops (H_2O_2) + 4 drops (H_2SO_4) +1 ml starch solution
- Shaking for 3 seconds.
- Blue color indicate a positive test (presence of iodide) ,the intensity of which indicates the concentration of KI.
- The approximate values are obtained by color intensity (+ve,++ve,+++ve….etc).
- Tabulate the results and plotted in a graph paper (X axis time, Y axis concentration) to show the rate of excretion consequent to absorption as below:



Result

Time	KI (capsule)	KI (solution)
	Presence of iodide in Saliva	Presence of iodide in Saliva
10 min		
20 min		
30 min		
40 min		
50 min		
60 min		

Plot the graph (X axis time, Y axis concentration (intensity of the color) to show the rate of excretion consequent to absorption of capsules vs. solution dosage forms