AL-Mustaqbal university college
Pharmacy department

Principles of pharmacy practice

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Calculation of doses(1)

objective

Upon successful completion of this chapter, the student will be able to:

- Differentiate between the various kinds of doses.
- Describe the primary routes of drug/dose, administration and, for each, the dosage forms utilized.
- Perform calculations of doses involving household measures.
- Perform calculations pertaining to the quantity of a dose, the dosage regimen, and the supply of medication required for the prescribed period.

Dose definition

The **dose** of a drug is the quantitative amount administered or taken by a patient for the intended medicinal effect. The dose may be expressed as

- a **single dose,** the amount taken at one time;
- a **daily dose**; or
- a **total dose**, the amount taken during the course of therapy.

A daily dose may be subdivided and taken in **divided doses**, two or more times per day depending on the characteristics of the drug and the illness. The schedule of dosing (e.g., four times per day for 10 days) is referred to as the **dosage regimen**. Quantitatively, drug doses vary greatly among drug substances; some drugs have small doses, other drugs have relatively large doses.

The dose of a drug is based on

- its biochemical and pharmacologic activity,
- its physical and chemical properties,
- the dosage form used,
- the route of administration,
- and various patient factors.

The dose of a drug for a particular patient may be determined in part on the basis of the

- ✓ **patient's age**,
- ✓ **weight**,
- ✓ **body surface area**,
- ✓ **general physical health**,
- ✓ **liver and kidney function** (for drug metabolism and elimination).

and the **severity of the illness** being treated.

Pharmacokinetic dosing takes into account a patient's ability to metabolize and eliminate drugs from the body due to impaired liver or renal function, which often necessitates a reduction in dosage

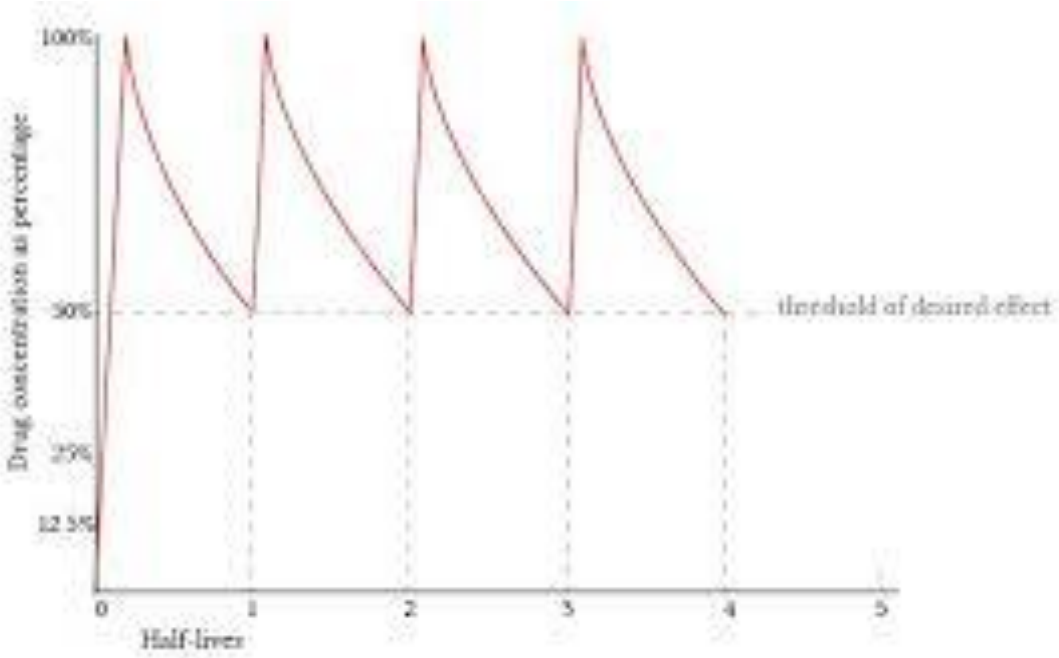
The usual adult dose of a drug is the amount that ordinarily produces the medicinal effect intended in the adult patient.

The usual pediatric dose is similarly defined for the infant or child patient.

The ''usual'' adult and pediatric doses of a drug serve as a guide to physicians who may select to prescribe that dose initially or vary it depending on the assessed requirements of the particular patient. The usual dosage range for a drug indicates the quantitative range or amounts of the drug that may be prescribed within the guidelines of usual medical practice.

The **median effective dose** of a drug is the amount that produces the desired intensity of effect in 50% of the individuals tested.
The **median toxic dose** of a drug is the amount that produces toxic effects in 50% of the individuals tested. Drugs intended to produce systemic effects must be absorbed or placed directly into the circulation and distributed in adequate concentrations to the body's cellular sites of action. For certain drugs, a correlation exists between drug dosage, the drug's blood serum concentration after administration, and the presentation and degree of drug effects. An average blood serum concentration of a drug can be measured , and the minimum concentration determined that can be expected to produce the drug's desired effects in a patient.

For certain drugs, a larger-than-usual initial dose may be required to achieve the desired blood drug level. This dose is referred to as the **priming** or **loading dose**. Subsequent **maintenance** doses, similar in amount to usual doses, are then administered according to the dosage regimen to sustain the desired drug blood levels or drug effects. To achieve the desired drug blood level rapidly, the loading dose may be administered as an injection or oral liquid, whereas the subsequent maintenance doses may be administered in other forms, such as tablets or capsules.



there are certain instances in which **low-dose therapy** or **high-dose therapy** is prescribed for a particular patient. And, for certain drugs there may be different doses required depending on whether the use is for **monotherapy** , that is, as the primary drug treatment, or **adjunctive therapy**, that is, additional to or supportive of a different primary treatment. Certain biologic or immunologic products, such as vaccines, may be administered in **prophylactic doses** to protect the patient from contracting a specific disease. Other products, such as antitoxins, may be administered in **therapeutic doses** to counter a disease after exposure or contraction. The doses of some biologic products, such as insulin, are expressed in **units of activity**, derived from biologic assay methods.

Routes of drug /doses administration and dosage forms

Doses of drugs are administered by a variety of dosage forms and routes of administration. In addition to the drug itself, dosage forms contain **pharmaceutical ingredients,** which provide the physical features, stability requirements, and aesthetic characteristics desired for optimal therapeutic effects. Included in the group of pharmaceutical ingredients are solvents, vehicles, preservatives, stabilizers, solubilizers, binders, fillers, disintegrants, flavorants, colorants, and others

With added pharmaceutical ingredients, the quantity of an active ingredient in a dosage form represents only a portion (often a small portion) of the total weight or volume of a product. For example, a tablet with 10 mg of drug actually could weigh many times that amount because of the added pharmaceutical ingredients

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Teaspoons and tablespoons

In calculating doses, pharmacists and physicians accept a capacity of **5 mL** for the teaspoonful and **15mL** for the tablespoonful. It should be noted that the capacities of household teaspoons may vary from 3 to 7 mL and those of tablespoons may vary from 15 to 22 mL. Such factor as **viscosity** and **surface tension** of a given liquid, as well as the technique of the person measuring the liquid, can influence the actual volume held by a household spoon.

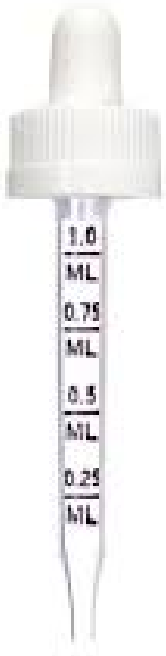
Any **dropper**, **syringe**, **medicine cup**, **special spoon**, or other device used to administer liquids should deliver 5 mL wherever a teaspoon calibration is indicated.

In general, pharmaceutical manufacturers use the 5-mL teaspoon and the 15-mL tablespoon as a basis for the formulation of oral liquid preparations through habit and tradition, the **f-symbol (fluidram)** still is used by some physicians in the ***Signa*** portion of the prescription when indicating teaspoonful dosage. The pharmacist may interpret this symbol as a teaspoonful in dispensing prefabricated manufacturers' products called for on prescriptions and allow the patient to use the household teaspoon. Doses less than a teaspoonful **(usually for children)** are often indicated on the labeling as fractions of a teaspoonful, such as 1⁄4 or 1⁄2 of a teaspoonful. Special medicinal spoons for these amounts are available, or standard household (kitchen) measuring spoons may be used.

The Drop as unit of measure

Occasionally, the drop (abbreviated **gtt**) is used as a measure for small volumes of liquid medications. A drop does not represent a definite quantity, because drops of different liquids vary greatly. In an attempt to standardize the drop as a unit of volume, the United States Pharmacopeia defines the official medicine dropper as being limited at the delivery end to a round opening with an external diameter of about 3 mm. The dropper, when held vertically, delivers water in drops, each of which weighs between 45 and 55 mg. Accordingly, the official dropper is calibrated to deliver approximately 20 drops of water per milliliter (i.e., 1 mL of water 1 gram or 1000 mg $\div$ $50mg(ava)$ $\cong$ drop 20 drops).

Most manufacturers include a specially calibrated dropper along with their prepackaged medications for use by patients in measuring dosage. Examples of specially calibrated droppers are shown in Figure below. A dropper may be calibrated by counting the drops of a liquid as they fall into a graduate until a measurable volume is obtained. The number of drops per unit volume
drops/mL).



Example

If a pharmacist counted 40 drops of a medication in filling a graduate cylinder to the 2.5-mL mark ,how many drops per milliliter did the dropper deliver?.

$$\frac{40\ (\text{drops})}{x\ (\text{drops})} = \frac{2.5\ (\text{mL})}{1\ (\text{mL})}$$

$$x = 16\ \text{drops mL},\ \textit{answer}.$$