AL- Mustaqbal University College
Pharmacy Department

Principles of Pharmacy Practice

Lectuer: 7
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Calculation of Doses: General considerations

$$\frac{D}{H} \times Q = X$$

$$\frac{60\,mg}{30\,mg} \times 1\,cap = 2\,cap$$

$$18\,kg \times \frac{100\,mg}{kg} \times \frac{5\,mL}{200\,mg} = 4.5\,mL$$

$$12.5\,mL = x\ units$$
$$300\,mL = 500\ units$$

Objectives:

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 related 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.
  - 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*.

Calculation of Doses

Doses

Given two factors in the following equation, by rearrangement, the third may be calculated:

$$\text{Number of doses} = \frac{\text{Total quantity}}{\text{Size of dose}}$$

In using the equation, the total quantity and the size of dose must be in the same unit of measure.

- 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.

- **The usual adult dose:** Is the amount that ordinarily produces the medicinal effect intended in the adult patient.
- **The usual paediatric dose:** is similarly defined for the infant or child patient.
- **The usual dosage range for a drug:** Is the indication for the quantitative range or amounts of the drug that may be prescribed within the guidelines of usual medical practice.
- Drug use and dose information is provided in the package labelling and inserts that accompany manufacturers' pharmaceutical products, as well as in a variety of references

Dose Response

- The dose response of individuals varies and may require dosage adjustment in a given patient.
- For certain conditions, as in the treatment of cancer patients, drug dosing is highly specialized and individualized.
- Frequently, combinations of drugs are used, with the doses of each adjusted according to the patient's response.
- Many anticancer drugs are administered cyclically, usually for 21 to 28 days, with a rest period between dosing cycles to allow recovery from the toxic effects of the drugs. anticancer drugs are most commonly dosed on the basis of the patient's body surface area.

The person develops tolerance to a drug when a drug is used repeatedly

Inability to tolerate the adverse effects of medication at therapeutic or subtherapeutic doses

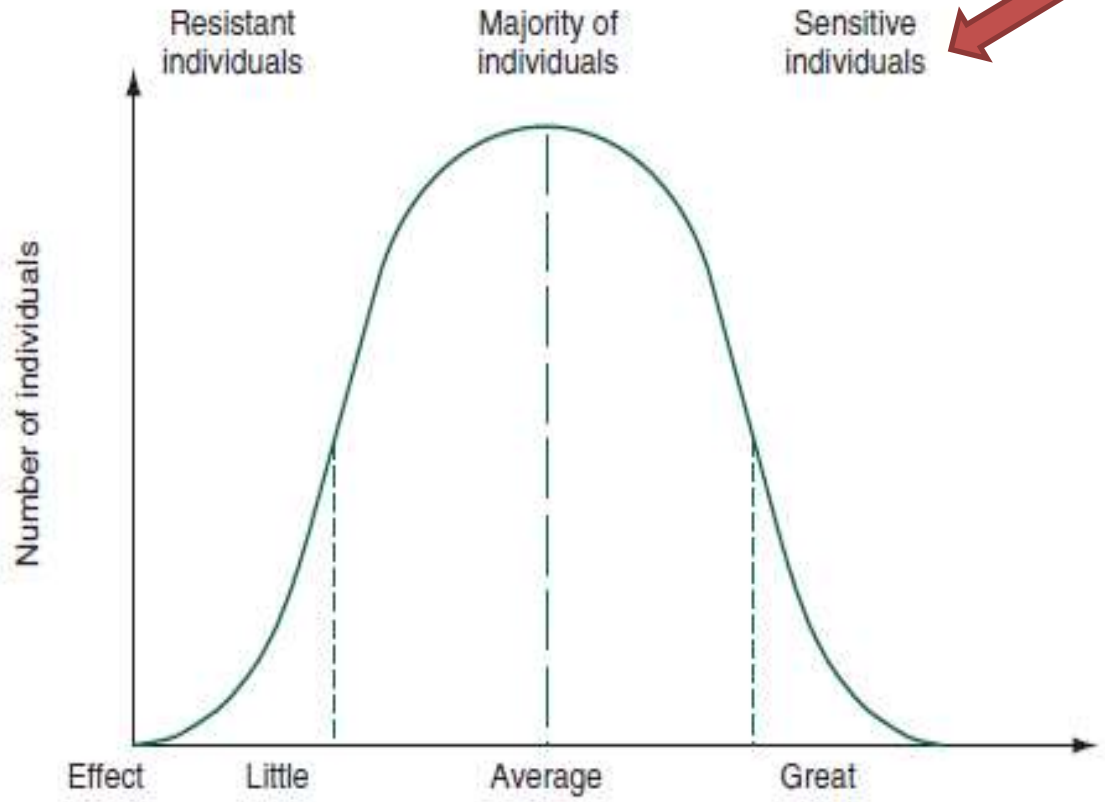

FIGURE 7.1 Drug effect in a population sample.

- **The minimum effective concentration (MEC). :** Is the minimum concentration determined that can be expected to produce the drug's desired effects in a patient.

- **The minimum toxic concentration (MTC) :** The base level of blood serum concentration that produces dose-related toxic effects.

- An appropriate drug dosage should result in blood serum drug concentrations that are above the MEC and below the MTC for the period of time that drug effects are desired.

Routes of Drug/Dose Administration and Dosage Forms

- Dosage Form means the physical form or the vehicle by which drug molecules are delivered to sites of action within the body to get therapeutic value. Example: Tablet is solid dosage form.

- 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 array of pharmaceutical ingredients are solvents, vehicles, preservatives, stabilizers, solubilizers, binders, fillers, disintegrants, flavorants, colorants, and others.

TABLE 7.1 SELECTED ROUTES OF ADMINISTRATION AND REPRESENTATIVE DOSAGE FORMS

ROUTE OF ADMINISTRATION	REPRESENTATIVE DOSAGE FORMS
Oral (mouth, GI tract)	Tablets, capsules, lozenges, solutions, drops, syrups, and suspensions
Sublinqual (under the tongue)	Tablets
Parenteral (injection)	Solutions and suspensions
Epicutaneous/ Transdermal (skin)	Ointments, creams, powders, lotions, aerosols, and patches
Conjunctival (eye)	Solutions, suspensions, and ointments
Intranasal (nose)	Solutions, sprays, and ointments
Intrarespiratory (lungs)	Aerosols and inhalant solutions
Rectal (rectum)	Ointments, creams, suppositories, solutions, and suspensions
Vaginal (vagina)	Ointments, creams, tablets, suppositories, gels, solutions, and emulsion foams
Urethral (urethra)	Solutions and suppositories

Dose Measurement

In the institutional setting, doses are measured and administered by professional and paraprofessional personnel.

A variety of measuring devices :

-calibrated cups for oral liquids (Fig. 7.3)

- syringes and intravenous sets for parenteral medication.

- In the home setting, the adult patient or a child's parent generally measures and administers medication- Liquid dosage is usually measured in "household" terms, most commonly by the teaspoonful and tablespoonful.

- An oral dispenser (Fig. 7.4) finds use in administering calibrated quantities of liquid medication to children. For calculating dosages, useful equivalent measures are provided in table 7.2.

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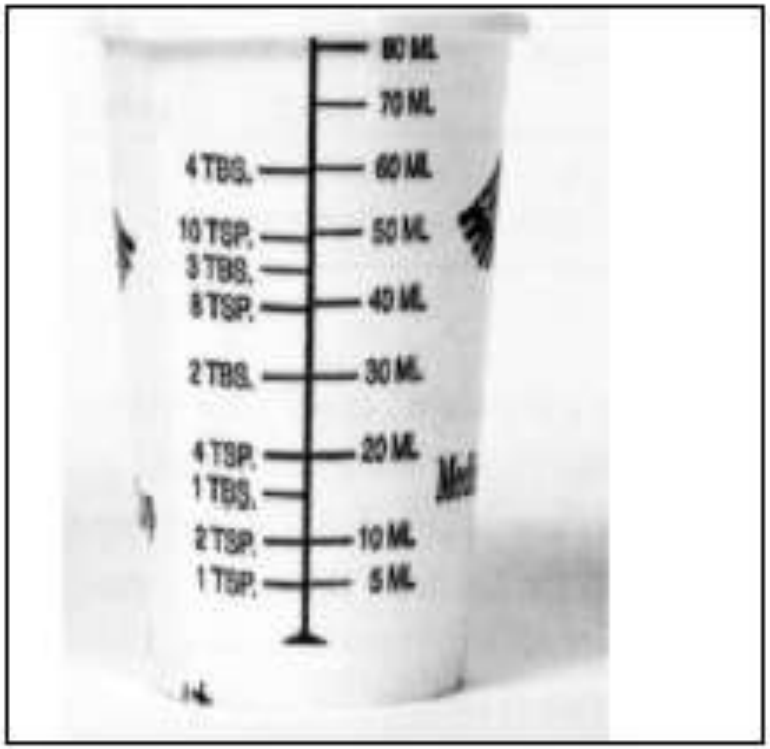

Figure 7.3An example of a calibrated medication cup for administering oral liquid preparation

Figure 7.4 An example of a calculated Exacted-Med Oral Dispenser liquid medication to pediatric patients

Teaspoon and Tablespoon

Teaspoon and Tablespoon

- In *calculating* doses, pharmacists and physicians accept a capacity of 5 mL for the teaspoonful and 15 mL 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 factors 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.

TABLE 7.2 USEFUL APPROXIMATE EQUIVALENT OF HOUSEHOLD MEASURE

HOUSEHOLD MEASURE (ABBREVIATION)	OUNCE	METRIC MEASURE
1 teaspoonful (tsp.)	≈ ⅙ fluidounce ≈	5 mL
1 tablespoonful (tbsp.)	≈ ½ fluidounce ≈	15 mL

The Drop as a 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 constricted 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 millilitre**
- The size of drops varies materially from one liquid to another.
- The "drop" should not be used as a measure until the volume that it represents has been determined for each specific liquid. This determination is made by calibrating the dispensing dropper. The calibrated dropper is the only one that should be used for the measurement of medicine.
- Most manufacturers include a specially calibrated dropper along with their pre-packaged medication for use by the patient in measuring the dosage.

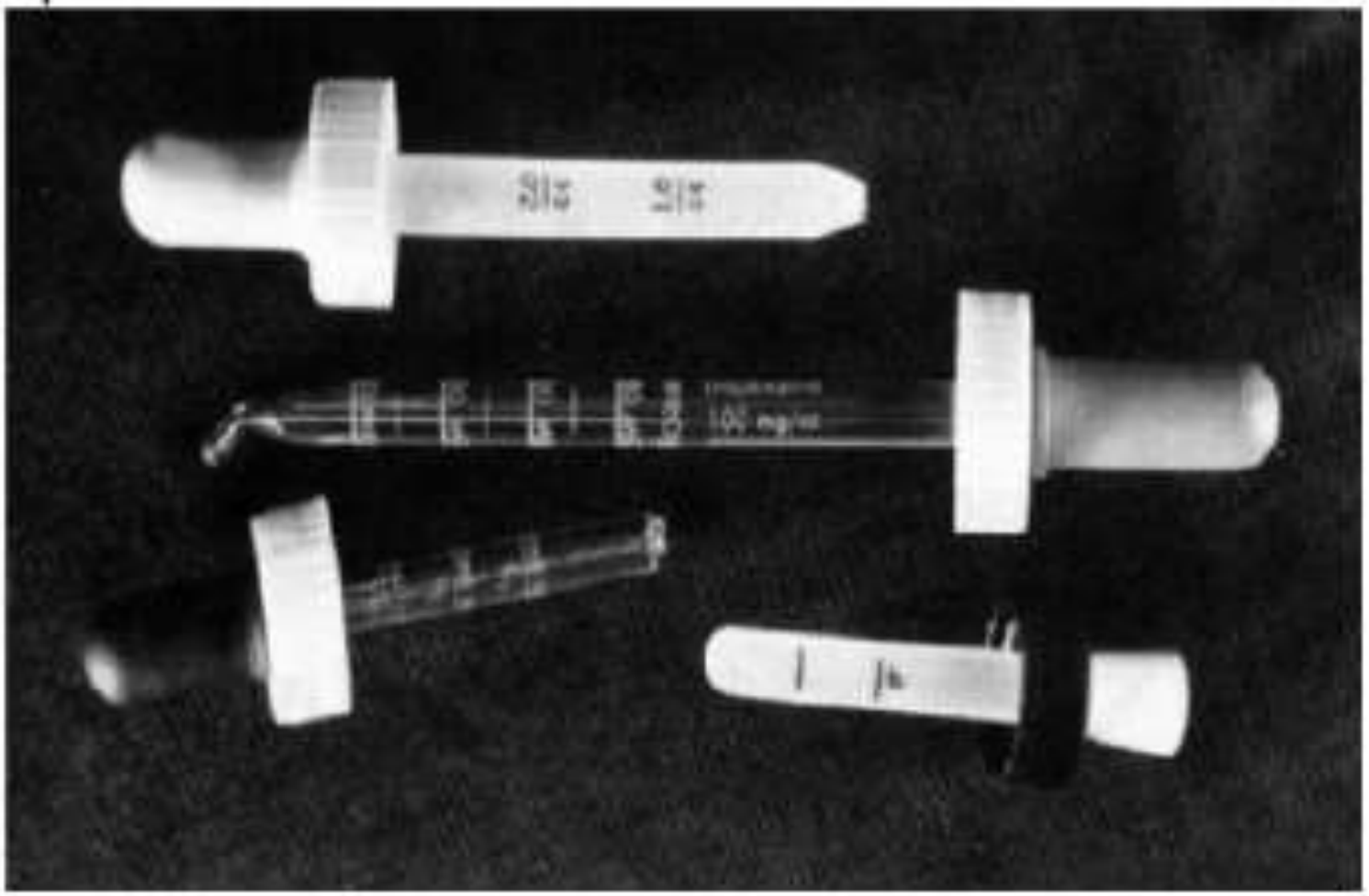

Figure 7.5 Examples of calibrated droppers

General Dose Calculations

- A pharmacist often needs to calculate
- The size of a dose
- The number of doses
- The total quantity of medication to dispense
- For these calculations the following equation is useful

$$\text{Number of doses} = \frac{\text{Total quantity}}{\text{Size of dose}}$$

Example Calculations of the Number of Doses

If the dose of a drug is 200 mg, how many doses are contained in 10 g?

$$10\ \text{g} = 10{,}000\ \text{mg}$$

$$\text{Number of doses} = \frac{10{,}000\ (\text{mg})}{200\ (\text{mg})} = 50\ \text{doses, } \textit{answer.}$$

If 1 tablespoon is prescribed as the dose, approximately how many doses will be contained in 1 pint of the medicine?

$$\begin{aligned} 1 \text{ tablespoon} &= 15 \text{ mL} \\ 1 \text{ pint} &= 473 \text{ mL} \end{aligned}$$

$$\text{Number of doses} = \frac{473 \text{ mL}}{15 \text{ mL}} = 31.5 \text{ or } 31 \text{ doses, } \textit{answer.}$$

If the dose of a drug is 50 μg, how many doses are contained in 0.020 g?

$$\begin{aligned} 0.020 \text{ g} &= 20 \text{ mg} \\ 50 \ \mu\text{g} &= 0.05 \text{ mg} \end{aligned}$$

$$\text{Number of doses} = \frac{20 \text{ (mg)}}{0.05 \text{ (mg)}} = 400 \text{ doses, } \textit{answer.}$$

Example Calculations of the Size of a Dose

$$\text{Size of dose} = \frac{\text{Total quantity}}{\text{Number of doses}}$$

The *size of the dose* is expressed in whatever denomination is chosen for measuring the given total quantity.

How many teaspoonfuls would be prescribed in each dose of an elixir if 180 mL contained 18 doses?

$$\text{Size of dose} = \frac{180 \text{ mL}}{18} = 10 \text{ mL} = 2 \text{ teaspoonfuls, } \textit{answer.}$$

How many drops would be prescribed in each dose of a liquid medicine if 15 mL contained 60 doses? The dispensing dropper calibrates 32 drops/mL.

$$15 \text{ mL} = 15 \times 32 \text{ drops} = 480 \text{ drops}$$

$$\text{Size of dose} = \frac{480 \text{ (drops)}}{60} = 8 \text{ drops, } \textit{answer.}$$

Example Calculations of the Total Quantity of Product

Total quantity = number of doses × size of dose

It is convenient first to convert the given dose to the denomination in which the total quantity is to be expressed.

How many milliliters of a liquid medicine would provide a patient with 2 tablespoonfuls twice a day for 8 days?

Number of doses = 16
Size of dose = 2 tablespoonfuls or 30 mL
Total quantity = 16 × 30 mL = 480 mL, *answer.*

How many grams of a drug will be needed to prepare 72 dosage forms if each is to contain 30 mg?

Number of doses = 72
Size of dose = 30 mg
Total quantity = 72 × 30 mg = 2160 mg = 2.16 g, *answer.*

It takes approximately 4 g of ointment to cover an adult patient's leg. If a physician prescribes an ointment for a patient with total leg eczema to be applied twice a day for 1 week, which of the following product sizes should be dispensed: 15 g, 30 g, or 60 g?

Number of doses = 2 per day × 7 days = 14
Size of dose = 4 g
Total quantity = 14 × 4 g = 56 g; thus, 60 g product size, *answer.*

Homework

Q.1: *If 0.050 g of a substance is used in preparing 125 tablets, how many micrograms are represented in each tablet?*

Q.2: *If a preparation contains 5 g of a drug in 500 mL, how many grams are contained in each tablespoonful dose?*

Q.3: *A cough mixture contains 48 mg of hydromorphone hydrochloride in 8 fl. oz. How many milligrams of hydromorphone hydrochloride are in each 2-teaspoonful dose?*

Q.4: *How many grams of a drug substance are required to make 120 mL of a solution each teaspoonful of which contains 3 mg of the drug substance?*

Q.5: *A physician ordered 500-mg capsules of tetracycline to be taken twice a day for 10 days. How many total grams of tetracycline would be prescribed?*


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you