AL-Mustaqbal university college
Pharmacy department

Principles of pharmacy practice

lec7

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Calculation of doses(2)

Objectives

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.

General dose calculations

A pharmacist often needs to calculate the size of a dose, the number of doses, or the total quantity of medication to dispense. For these calculations the following equation is useful with the terms rearranged depending on the answer required. In using the equation, the units of weight or volume must be the same for the total quantity and size of the dose.

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

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 g =10,000 mg

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

Or, solving by dimensional analysis:

$$\frac{1\ \text{dose}}{200\ \text{mg}} \times \frac{1000\ \text{mg}}{1\ \text{g}} \times 10\ \text{g} = 50\ \text{doses, } \textit{answer}.$$

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

tablespoon =15 mL
1 pint =473 mL

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

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

0.020 g = 20 mg
50μg = 0.05 mg

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

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.

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

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

Or, solving by dimensional analysis:

$$\frac{32 \text{ drops}}{1 \text{ mL}} \times \frac{1}{60 \text{ doses}} \times 15 \text{ mL} = 8 \text{ drops/dose, } \textit{answer.}$$

Example Calculations of the Total Quantity of Product

$$\text{Total quantity} = \text{number of doses} \times \text{size of dose}$$

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 x 30 mL = 480 mL, *answer.*

- How many milliliters of a mixture would provide a patient with a teaspoonful dose to be taken three times a day for 16 days?

Number of tsp doses = 16 x 3 = 48 tsp
Total quantity =48 x5 mL =240 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 x30 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 x7 days = 14
Size of dose = 4 g
Total quantity = 14 x 4 g =56 g; thus, 60 g product size, answer

Additional Examples of Calculations of Dose

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

$$0.050\ \text{g} = 50\ \text{mg} = 50{,}000\ \mu\text{g}$$

$$\frac{50{,}000\ (\mu\text{g})}{125} = 400\ \mu\text{g},\ \textit{answer.}$$

Or, solving by dimensional analysis:

$$\frac{1{,}000{,}000\ \mu\text{g}}{1\ \text{g}} \times \frac{1}{125\ \text{tablets}} \times 0.050\ \text{g} = 400\ \mu\text{g/tablet},\ \textit{answer.}$$

- If a preparation contains 5 g of a drug in 500 mL, how many grams are contained in each tablespoonful dose?

$$1 \text{ tablespoonful} = 15 \text{ mL}$$

$$\frac{500 \text{ (mL)}}{15 \text{ (mL)}} = \frac{5 \text{ (g)}}{x}$$

$$x = 0.15 \text{ g, } \textit{answer.}$$

- 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?

$$\begin{aligned} 1 \text{ fl. oz.} &= 6 \text{ tsp.} \\ 8 \text{ fl. oz.} &= 48 \text{ tsp.} \\ 48 \text{ tsp} \div 2 &= 24 \text{ doses} \\ 48 \text{ mg} \div 24 &= 2 \text{ mg, } \textit{answer.} \end{aligned}$$

Or,

$$\frac{48\ (\text{tsp.})}{2\ (\text{tsp.})} = \frac{48\ (\text{mg})}{x\ (\text{mg})}$$

$$x = 2\ \text{mg},\ \textit{answer.}$$

- How many milligrams each of hydrocodone bitartrate and guaifenesin will be contained in each dose of the following prescription?

℞ Hydrocodone Bitartrate 0.12 g
Guaifenesin 2.4 g
Cherry Syrup ad 120 mL
Sig. Teaspoonful for cough.
1 teaspoonful = 5 mL
120 ÷ 5 = 24 doses
0.12 g ÷ 24 = 0.005 g = 5 mg hydrocodone bitartrate, *and*
2.4 g ÷ 24 = 0.1 g = 100 mg guaifenesin, *answers.*

- 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?

$$1 \text{ teaspoonful} = 5 \text{ mL}$$

$$\frac{5 \text{ (mL)}}{120 \text{ (mL)}} = \frac{3 \text{ (mg)}}{x \text{ (mg)}}$$

$$x = 72 \text{ mg or } 0.072 \text{ g, } \textit{answer.}$$

Or, solving by dimensional analysis:

$$\frac{1 \text{ g}}{1000 \text{ mg}} \times \frac{3 \text{ mg}}{5 \text{ mL}} \times 120 \text{ mL} = 0.072 \text{ g, } \textit{answer.}$$

- 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?

Size of dose = 500 mg
Total number of doses = 2 (a day) x10 (days) =20 doses
Total quantity 500 mg x20 (doses) = 10,000 mg 10 g, *answer*

Dosing Options

Low-Dose and High-Dose Therapies

The administration of doses that are much smaller or much larger than the usual dose of a drug is referred to as low-dose or high-dose therapy, respectively. This terminology is different in intent from the normal variation in a standard dose based on a patient's age, weight, renal function, or other specific parameter .The most common example of low-dose therapy is the use of aspirin in 81-mg amounts (rather than the usual dose of 325 mg) to lower the risk of heart attack and clot-related stroke. Another example is the use of low-dose postmenopausal hormone therapy, in which doses often 50% smaller than standard doses are administered.

High-dose therapy is commonly associated with the chemotherapeutic treatment of cancer, in which there is an attempt, through increased dose intensity, to kill tumor cells. Another example is the specialized use of high-dose progestin in the treatment of endometriosis.

Pharmacists must be aware of the use of high-dose therapies while remaining cautious in protecting patients against unintended high doses and consequent drug overdose. A related and important worry both for **patients** and for **pharmacists** is the careless taking of an excessive quantity of a particular drug substance. This circumstance most often occurs when a patient takes multiple medications prescription and nonprescription) containing a common ingredient which, in total, may exceed a safe level. The drug acetaminophen, which is a component of a great number of products, is an example of such a drug.

Example Calculations of Low-Dose and High-Dose Therapies

- If a patient is changed from a daily standard-dose postmenopausal product containing 0.625 mg of conjugated estrogens (CE) to a low-dose formulation containing 0.35 mg CE, how many milligrams less of CE would the patient take per week?

  0.625 mg - 0.350 mg = 0.275 mg x 7 (days) = 1.925 mg conjugated estrogens, *answer.*

- To reduce the inflammation of an optic nerve, a patient is administered high-dose prednisone, 900 mg/day for 5 days by intravenous infusion. The usual daily dose of prednisone is 5 to 60 mg/day, depending on the condition being treated. Calculate the dose that the patient received, as a multiple of the highest usual daily dose

$$\frac{900 \text{ mg}}{60 \text{ mg}} = 15, \text{ multiple of the highest usual dose, } \textit{answer.}$$

Splitting Tablets

number of tablets are **scored**, or grooved, to allow breaking into approximately equal pieces (usually halves). This allows dosage flexibility, particularly when a patient is started at a half dose and then is titrated up to a full dosage level. It also enables a patient to take a product at a strength that is not otherwise available.

Some patients use tablet-splitting devices to cut scored or unscored tablets for economic reasons. For some medications, the price of tablets of twice the strength required is similar to the lower-strength tablets, and the patient can double his or her supply by tablet splitting. Unfortunately, this practice often results in unequal portions of tablets and thus in uneven doses.

Example Calculation Based on Tablet Splitting

A patient attempted to split in half 20-mg unscored tablets of a drug, resulting in ‘‘half-tablets’’ differing by 1.5 mg in drug content. Assuming a whole tablet was uniform in drug content, calculate the amount of drug in each ‘‘half tablet.’’

If L = larger “half” and S = smaller “half,”

$$\begin{aligned} \text{then } L + S &= 20 \text{ mg} \\ L - S &= 1.5 \text{ mg} \\ \hline 2L &= 21.5 \text{ mg} \end{aligned}$$

$L = 10.75$ mg and

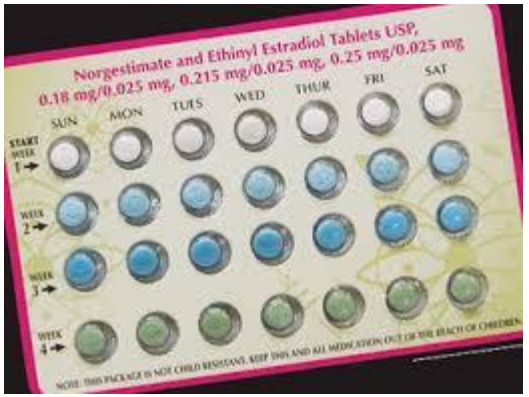
$S = 20 \text{ mg} - 10.75 \text{ mg} = 9.25$ mg, *answers.*

Proof: $10.75 \text{ mg} - 9.25 \text{ mg} = 1.5$ mg difference in drug content and

$10.75 \text{ mg} + 9.25 \text{ mg} = 20$ mg total drug content

Special Dosing Regimens

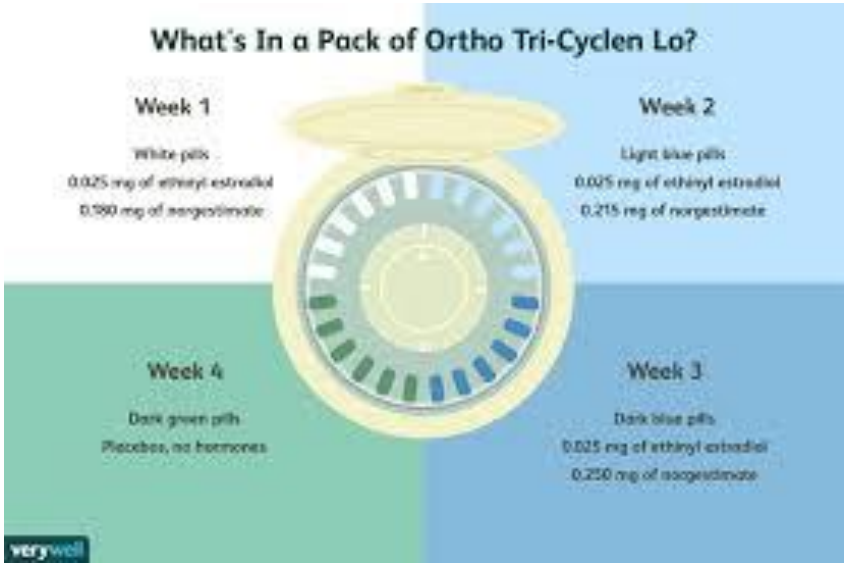
Certain drugs have unique dosing regimens. Among them are chemotherapeutic agents and oral contraceptives. In the case of the latter, the prescribed regimen is based on a 28-day dosing cycle of 21 consecutive days of tablets containing a combination of estrogenic and progestational drugs followed by 7 consecutive days of tablets containing nondrug material. One tablet is taken daily, preferably at approximately the same time. The tablets generally are color coded and packaged in special dispensers to facilitate compliance



Example Calculation Based on Special Dosing Regimen

The ORTHO TRI-CYCLEN LO 28-day regimen consists of norgestimate (N), ethinyl estradiol (EE), and non medicated tablets as follows

7 white tablets containing 0.18 mg (N) + 0.025 mg (EE);
7 light blue tablets containing 0.215 mg (N) + 0.025 mg (EE);
7 dark blue tablets containing 0.25 mg (N) + 0.025 mg (EE);
7 green tablets containing 0 mg (N) + 0 mg (EE).



- How many milligrams each of norgestimate and ethinyl estradiol are taken during each 28-day cycle?

Norgestimate: 0.18 mg × 7 = 1.26 mg
0.215 mg × 7 = 1.505 mg
0.25 mg × 7 = 1.75 mg
4.515 mg norgestimate and

Ethinyl estradiol: 0.025 mg × 7 = 0.175 mg
0.025 mg × 7 = 0.175 mg
0.025 mg × 7 = 0.175 mg
0.525 mg ethinyl estradiol, *answers.*


Thank you!