Dosage Forms

RATIONALE / OBJECTIVES

The effectiveness of a pharmaceutical agent depends on its form and route of administration; therefore it is important to understand the various forms in which drugs are dispensed. The student will differentiate between solid, semi-solid, and liquid dosage forms, name forms in which drugs are manufactured and their subcategories, list examples of drugs for each dosage form, and define the medical terms associated with drug forms.

TEKS: 121.25 1C, 1D, 5B, 5G TAKS ELA 1, 3, 4

KEY POINTS

Dosage Forms PowerPoint Presentation

I. Basically three divisions of dosage forms: solid, semisolid, liquid
   A. solid dosage forms
      1. most commonly known dosage form is the tablet. In prescription usually abbreviated as tab or tabs - contains active drug in dried powder form as well as binders and fillers to give the tablet bulk and ensure the proper size
         a. scored tablets have indented lines, usually dividing the tablet into two equal halves, sometime three or four parts
         b. enteric coated tablets have special coating designed to allow tablet to pass through acid in stomach and not dissolve until in alkaline environment of small intestine – this avoids irritating the stomach, e.g. Ecotrin vs. regular Aspirin.
         c. slow-release tablets designed to provide continuous, sustained release of a certain drug over time
      2. caplets – coated tablets in form of tablets; elongated shape may make it easier for some to swallow, as does the coating
      3. lozenges – tablets formed from hardened base or sugar and water containing drug and other flavors; usually available in OTC medications such as Cepacol lozenges. They are designed to dissolve slowly in the mouth and release the drug topically to the tissues of mouth and throat; they are not to be swallowed.
      4. some tablets may be designed to dissolve in water before taking orally to facilitate administration; examples: Alka Seltzer, Klorvess effervescent tablets, etc.
   B. capsule: in prescription usually abbreviated as cap or caps, comes basically in two varieties
1. soft gelatin shell manufactured in one piece with drug usually in liquid form inside the shell, e.g. fat-soluble vitamins A and E, Procardia (nifidipine), etc.
2. hard shell manufactured in two pieces that fit together and hold the drug, either in powdered or granular form; may be separated and sprinkled over food.
3. Historical note: most OTC cold medications and analgesics used to be manufactured in this form until early 1980s when Tylenol was tampered with by contaminating drug with cyanide – today most manufacturers produce OTC analgesics in tablet or caplet form. Many prescription drugs, however, still are available as capsules.

C. powder: a finely ground form of an active drug
   1. can be contained in capsules for oral administration
   2. can be used for topical application
   3. can be found in glass vials as dried form of the drug where it must be reconstituted by adding sterile water or sterile NaCl for purpose of injection, e.g. i.v. ampicillin
   4. may come pre-measured in package and needs to be reconstituted with water before oral administration

D. pellet/Bead: a drug can be implanted in the body in form of pellet or bead for sustained release of the drug into surrounding tissues, e.g. Norplant for contraception, Septopal – gentamycin beads on a surgical wire to be implanted into bone to treat chronic osteomyelitis after traumatic injury

E. suppository: a solid base of glycerin or cocoa butter containing the drug
   1. manufactured in appropriate size for rectal and vaginal insertion
      a. vaginal suppositories most often used to treat vaginal infections but may also be used orally to treat yeast infections (Troche)
      b. rectal suppositories offer alternate route of administration for patients who are vomiting, e.g. Tylenol (antipyretic and analgesic), Phenergan (antiemetic)
   2. available in pediatric and adult strength

II. semi-solid dosage forms: dosage forms that are too soft in structure to qualify for solids but too thick to be considered liquid; while most creams and ointments are applied to the skin without exact measurement, nitroglycerin ointment (antianginal) is precisely measured in inches on specially marked applicator paper that is then taped to the patient’s skin.

A. cream – a semisolid emulsion of oil, e.g. lanolin or petrolatum, and water, the main ingredient being water
   1. oil and water remain well mixed by adding emulsifying agents
   2. a large number of topical drugs are manufactured in a cream base, e.g. hydrocortisone cream

B. ointment – a semisolid emulsion of oil and water, the main ingredient being oil
   1. many topical drugs are produced in ointment form
   2. specially formulated ophthalmic ointments are made to be applied topically to the eye without causing irritation
III. liquid dosage forms: come in solutions and suspensions; generally described as either
• *aqueous* from the Latin meaning watery consistency
• *viscous* designating a non-watery or thick liquid
A. solution: never need to be mixed as the drug-to-water concentration remains the same in every part of the solution, even after prolonged standing.
   1. elixirs: solutions that contain an alcohol and water base, added sugar and flavorings, e.g. Tylenol; commonly used for pediatric and elderly patients who have difficulty swallowing tablets or capsules
   2. syrups: do not contain alcohol and are concentrated solutions of sugar, water, and flavorings. They are sweeter and more viscous than elixirs. Most OTC cough medications are syrup based and don’t only carry the drug but also act to soothe the inflamed mucous membranes of the throat.
   3. tinctures: solutions that have an alcohol and water base and are applied topically, e.g. tincture of iodine
   4. liquid sprays: solutions of a drug combined with water or alcohol
      a. sprayed by pump or aerosol propellant
      b. commonly used for topical application
   5. foams: another form of liquid medication propelled by spraying, e.g. certain OTC contraceptives and Proctofoam
B. suspensions: contain fine, undissolved particles of drug suspended in a liquid base. These particles will settle to the bottom of the container after prolonged standing, making it necessary to shake the suspension well before use to evenly distribute the drug particles. This should be noted on an auxiliary label on the bottle, e.g. Maalox and other antacids.
   1. emulsion: a suspension of fat particles in a watery base, e.g. intralipid intravenous fat solution
   2. lotion: topically applied suspension of an active drug in a water base, usually some skin-moisturizing agent added, e.g. Keri lotion; sometimes may be without moisturizer, e.g. Calamine lotion
   3. gel: a suspension in which the drug particles are suspended in a thickened water medium, e.g. MetroGel for acne rosacea

### ACTIVITIES

I. Survey home medicine cabinet to identify forms of pharmaceuticals.
II. Design posters depicting various dosage forms or create three-dimensional models of them.

### MATERIALS NEEDED

Examples of drug forms
Drug references, e.g. PDR, etc.
Crafts supplies to make 3-D models of drugs
Key: Unit Quiz-Dosage Forms
Routes of Drug Administration

*Teachers Note*
*Pharmacy will give samples; close supervision of students!*

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**ASSESSMENT**

**Unit Quiz – Dosage Forms**

**Project Rubric**
Identify sample drugs as to dosage form

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**ACCOMMODATIONS**

For reinforcement, the student will visit a pharmacy and list ten OTC drugs, identify all available dosage forms for each.

For enrichment, the student will discuss in small groups (3-4) the advantages and disadvantages of each dosage form considering the perspective of the prescriber, e.g. physician, dispenser, e.g. pharmacist, administrator, e.g. nurse, and consumer, e.g. patient and then create an informative pamphlet for the consumer describing the results of the discussion.

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**REFLECTIONS**
<table>
<thead>
<tr>
<th>ROUTE</th>
<th>APPROXIMATE ONSET OF ACTION</th>
<th>INDICATIONS</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>oral (PO, p.o.)</td>
<td>30 - 60 minutes</td>
<td>whenever possible, safest and most convenient route</td>
<td>most medications, e.g. analgesics, sedatives, hypnotics, antibiotics</td>
</tr>
<tr>
<td>sublingual (s.l.)</td>
<td>several minutes</td>
<td>when rapid effect is desired</td>
<td>NTG (nitroglycerin) in angina pectoris</td>
</tr>
<tr>
<td>buccal (bucc.)</td>
<td>several minutes</td>
<td>convenient dosage form for certain drugs; may be used in unconscious patients</td>
<td>androgenic drugs</td>
</tr>
<tr>
<td>rectal (p.r.)</td>
<td>15 - 30 minutes</td>
<td>when patients are unable to take oral medications and parenteral route is not indicated, also for local effect</td>
<td>analgesics, antiemetics, laxatives</td>
</tr>
<tr>
<td>transdermal</td>
<td>30 - 60 minutes</td>
<td>convenient dosage form, provides continuous absorption and systemic effects over extended time (hours, days, etc.)</td>
<td>nitroglycerin, estrogen, morphine</td>
</tr>
<tr>
<td>subcutaneous (sq, s.c., subq., subcu)</td>
<td>several minutes</td>
<td>for drugs that are inactivated in gastrointestinal tract</td>
<td>insulin</td>
</tr>
<tr>
<td>intramuscular (i.m., IM)</td>
<td>several minutes</td>
<td>for drugs with poor oral absorption, when high blood levels are required, when rapid effect is desired</td>
<td>narcotic analgesics antibiotics</td>
</tr>
<tr>
<td>Route</td>
<td>Time</td>
<td>Description</td>
<td>Examples</td>
</tr>
<tr>
<td>------------------------------</td>
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</tr>
<tr>
<td>intravenous (i.v., IV)</td>
<td>within 1 minute</td>
<td>in emergency situations, when immediate effect is desired, when large volumes need to be administered, e.g. infusion</td>
<td>IV fluids, nutrient supplementation, antibiotics, resuscitative drugs</td>
</tr>
<tr>
<td>intraarterial (i.a.)</td>
<td>within 1 minute</td>
<td>for local effects within specific target organ</td>
<td>cancer drugs</td>
</tr>
<tr>
<td>intrathecal</td>
<td>several minutes</td>
<td>for local effects within the spinal cord</td>
<td>spinal anesthesia</td>
</tr>
<tr>
<td>inhalation</td>
<td>within 1 minute</td>
<td>for local effects within the respiratory tract</td>
<td>antiasthmatics, bronchodilators</td>
</tr>
<tr>
<td>topical</td>
<td>within 1 hour</td>
<td>for local effects on skin and mucous membrane of eye, ear, nose, mouth</td>
<td>creams, ointments, sprays, tinctures, lozenges</td>
</tr>
<tr>
<td>vaginal</td>
<td>15 - 30 minutes</td>
<td>for local effect</td>
<td>creams, foams, suppositories</td>
</tr>
</tbody>
</table>
Unit Quiz: DOSAGE FORMS

1. The three basic divisions of dosage forms are:

_____________________
_____________________
_____________________

2. Complete the sentence: The purpose of enteric coating on tablets is

_____________________

3. Match the following (not all apply):

A. scored tablet   _____
B. slow release tablet   _____
C. caplet   _____
D. lozenge   _____
E. capsule   _____
F. powder   _____
G. cream   _____
H. ointment   _____
I. solution   _____
J. elixir   _____
K. syrup   _____
L. tincture   _____
M. suspension   _____
N. emulsion   _____
O. lotion   _____
P. gel   _____

1. has indented lines that facilitate dividing into two equal parts, sometimes three of four parts
2. has special coating designed to allow tablet to pass through acid in stomach and not dissolve until in alkaline environment of small intestines; avoids irritating the stomach
3. coated tablets in form of capsules; elongated form and coating makes easier to swallow for some
4. solution of alcohol and water base; usually applied topically
5. concentrated solution of sugar, water, and flavoring; does not contain alcohol
6. designed to promote continuous, sustained release of a certain drug over time
7. tablets formed of hardened base of sugar and water containing drug and other flavors
8. contains fine, undissolved particles of drug suspended in liquid base
9. solid base of glycerin or cocoa butter containing the drug
10. semisolid emulsion of oil and water, the main ingredient being water
11. semisolid emulsion of oil and water, the main ingredient being oil
12. topically applied suspension of active drug in watery base
13. comes in two varieties: soft gelatin shell in one piece with drug usually in liquid form, and hard shell in two pieces with drug in wither granular or powdered form
14. drug that can be implanted in the body for sustained release or drug into surrounding tissue
15. solution containing alcohol and water base, added sugar, and flavoring
16. never needs mixing as drug-to-water concentration remains the same in every part, even after prolonged standing
17. suspension of fat particles in watery base
18. designed to dissolve in water before taking orally to facilitate administration
19. finely ground form of an active drug
20. suspension in which drug particles are suspended in thickened water medium
Answer Key to Unit Quiz:

**DOSAGE FORMS**

1. solid
   semisolid
   liquid

2. to allow the tablet to pass through acid in stomach and not dissolve until in alkaline environment of small intestine; this avoids irritating the stomach.

3. 
   A  1
   B  6
   C  3
   D  7
   E 13
   F 19
   G 10
   H 11
   I 16
   J 15
   K  5
   L  4
   M  8
   N 17
   O 12
   P 20