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Drug Absorption

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Drug absorption is the movement of a drug into the bloodstream after administration.

Absorption affects bioavailability—how quickly and how much of a drug reaches its intended target (site) of action. Factors that affect absorption (and therefore bioavailability) include

- The way a drug product is designed and manufactured
- Its physical and chemical properties
- Other ingredients it contains
- The physiologic characteristics of the person taking the drug
- How the drug is stored

A drug product is the actual dosage form of a drug—a tablet, capsule, suppository, transdermal patch, or solution. It consists of the drug (active ingredient) and additives (inactive ingredients). The active ingredient is the chemical substance (the drug) that is taken to produce the desired effect (such as lowering blood pressure). The additives (inactive ingredients such as diluents, stabilizers, disintegrants, and lubricants) are mixed with the drug to make it easier to swallow or help break it up in the gastrointestinal tract. For example, to make tablets, the active/inactive ingredient mixture may be formed into small grains and compressed into tablet form. The type and amount of additives and the degree of compression affect how quickly the tablet disintegrates and how quickly the drug is absorbed. Drug manufacturers adjust these variables to optimize absorption.

Because drug products that contain the same drug (active ingredient) may have different inactive ingredients, absorption of the drug from different products may vary. Thus, a drug's effects, even at the same dose, may vary from one drug product to another. Drug products that not only contain the same active ingredient but also produce virtually the same blood levels at the same points in time are considered bioequivalent (see Bioequivalence and Interchangeability of Generic Drugs). Bioequivalence ensures therapeutic equivalence (that is, production of the same therapeutic effect), and bioequivalent products are interchangeable.

Tablets

If a tablet releases the drug too quickly, the blood level of the drug may become too high, causing an excessive response. If the tablet does not release the drug quickly enough, much of the drug may be eliminated in the feces without being absorbed, and blood levels may be too low. Drug manufacturers formulate the tablet to release the drug at the desired speed.

Capsules

Capsules consist of drugs and additives within a gelatin shell. The shell swells and releases its contents when it becomes wet, this usually occurs quickly. The size of the drug particles and the properties of the additives affect how quickly the drug dissolves and is absorbed. Drugs tend to be absorbed more quickly from capsules filled with liquid than from those filled with solid particles.

Enteric coatings

If an orally administered drug harms the stomach lining or decomposes in the acidic environment of the stomach, a tablet or capsule of the drug can be coated with a substance intended to prevent it from dissolving until it reaches the small intestine. These protective coatings are described as enteric coating. For these coatings to dissolve, they must come in contact with the less acidic environment of the small intestine or with the digestive enzymes there. However, the coatings do not always dissolve as intended. The tablet or capsule may be passed intact in the feces, especially in older people.

Controlled-release formulations

Some drug products are specially formulated to release their active ingredients slowly or in repeated small amounts over time—usually for a period of 12 hours or more. This dosage form is called modified-release, controlled-release, sustained-release, or extended-release.

Causes of Low Bioavailability

A number of other factors may affect the absorption and bioavailability of a drug taken by mouth. Physiologic characteristics include

- How long the stomach takes to empty
- What the acidity (pH) of the stomach is
- How quickly the drug is moved through the digestive tract

Other factors include a person's age, sex, level of physical activity, and level of stress.

Food, other drugs, and digestive disorders can affect drug absorption and bioavailability. For example, high-fiber foods and calcium supplements may bind with a drug and prevent it from being absorbed. Laxatives and diarrhea, which speed up the passage of substances through the digestive tract, may reduce drug absorption. Surgical removal of parts of the digestive tract (such as the stomach or colon) may also affect drug absorption.

Where and how long a drug product is stored can affect drug bioavailability. The drug in some products deteriorates and becomes ineffective or harmful if stored improperly or kept too long. Some products must be stored in the refrigerator or in a cool, dry, or dark place. Storage directions and expiration dates should be strictly adhered to (complied with) at all times.

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