

A Review on Pharmaceutical Dosage Form: Detailed and Recent Advancement

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Abstract: *This abstract explores the significance and evolution of dosage forms in pharmaceutical science. Dosage forms, encompassing tablets, capsules, liquids, and more, serve as crucial vehicles for drug delivery. Their development is guided by factors like drug properties, patient needs, and therapeutic goals. The diversity of dosage forms allows for personalized treatment, fostering patient compliance and efficacy. Ongoing advancements in dosage form technology aim to optimize drug delivery, ensuring precise dosing and enhanced bioavailability. This abstract highlights the integral role dosage forms play in pharmaceuticals, driving innovation and improved patient outcomes.*

Keywords: solid, liquid, gases, route of administration, dosage form

I. INTRODUCTION

In recent decades, dosage forms represent a crucial interface between pharmaceutical research and patient care. As the field continues to advance, it becomes imperative to comprehend the complication dosage forms, ranging from traditional formulations to innovative delivery systems. This review detailed into the fundamental aspects of dosage forms, emphasizing their significance in optimizing drug administration and enhancing patient outcomes. With the advancement of technology, the pharmaceutical industry has made significant strides in drug development. One of the most significant breakthroughs in the industry is the combination of multiple APIs (Active Pharmaceutical Ingredients) on a single tablet. This innovation has led to the creation of a new generation of medications that provide multiple benefits in one dose. The synergy between multiple APIs can provide a more significant therapeutic effect than any single drug alone. This means that patients can receive more effective treatment for their ailments with fewer side effects. Dosage form divided into various type on the basis of administration, Oral administration has been one of the most popular and preferred methods of drug delivery for centuries. It is a convenient and easy way to deliver drugs to patients in a variety of forms. From tablets and capsules to liquids and syrups, oral administration is the most commonly used dosage form in the world.

Definition

Dosage forms are the means by which drug molecules are delivered to the sites of action within the body to produce optimum desired effects and minimum adverse effect. Dosage forms are the combination of Active Pharmaceutical Ingredients and excipients.

DOSAGE FORM = API + EXCIPIENTS

Active Pharmaceutical Ingredients are chemical compounds intended for use in diagnosis, treatment, prevention of disease.

Excipients are inactive substance that serves as the vehicle for drug or other active substances. Examples: preservatives, colouring agents, flavouring agents etc.

Classification of dosage form

Dosage forms exhibit diversity in their structures and mechanisms of drug release. This section categorizes dosage forms based on their characteristics, including solid dosage forms (tablets, capsules), liquid dosage forms (solutions, suspensions), semisolids (ointments, creams), and novel delivery systems (liposomes, nanoparticles). Each class is explored in terms of its advantages, limitations, and suitability for different therapeutic applications.

On the basis of physical state

Classification according to physical form



Solid dosage forms



Fig: Solid dosage form

Solid dosage form famously used type of dosage form because of its easy mass production and stability, along with this it also provides protection against various factor.

Some of the affecting factors are like oxygen, light, temperature, humidity, etc.

Tablets which are popularly used in day-to-day life because of its easy ingestion. Tablets are manufactured by few methods, it can be by dry granulation, wet granulation or direct compression in which excipients may be included or not. Tablets are widely used because they are usually cheap, easy to swallow, handle and many times tablets have certain bitter taste and odour, for this we use different coating methods and flavouring agents.

Advantages

- Solid dosage form provides precise dosing, ease of administration and stability.
- Their convenient storage and transport contribute to wide spread use.
- Moreover, the controlled release formulation offers prolonged therapeutic effects.

Disadvantages

- Drugs with low solubility, poor wetting, optimum absorption high in GIT which can be problematic to formulate as a tablet but will still provide adequate drug bioavailability.
- In children and unconscious patients, tablets are difficult to swallow.
- Drugs with objectionable odour or bitter testing can be sensitive to oxygen and hence can require coating or encapsulation.

Advancement

- Solid dosage forms include the development of 3D printed pharmaceuticals, personalized medicine formulations and smart polymers of controlled release. These innovations aim to address existing limitations and enhance therapeutic efficacy.
- Key recent advancements include: 3D printing technology, Co-crystal engineering, nanosizing technology.

Liquid dosage forms



Fig: Liquid dosage form

Liquid dosage forms are combination of active drugs and excipients which are dissolved in particular solvent and used as medication.

In liquid solutions based on route of administration

1. oral liquids are mainly available in non-sterile forms
2. parenteral routes are mainly available in sterile forms

Liquid dosage forms are classified:

- **Monophasic** – liquid solutions including more than one component in single phase.
- **Biphasic**–liquid solutions comprising one or more components in two different phases.
- **True solutions** – homogeneous mixtures prepared by dissolving solutes in solvents.

Other forms of liquid dosage

Syrup, Linctus, Elixirs, Gargles, Mouthwash, Lotions, Liniment, Nasal drops, Ear drop.

Advantages

- Rapid Absorption,
- Flexible Dosing,
- Ease Of Swallowing,
- Improved Palatability,

- Convenient Administration,
- Reduced Risk of Choking,
- Ease Of Transport and Storage.
- These Attributes Make Liquid Formulations a Valuable Option in Pharmaceuticals, Addressing Various Patient Needs and Improving Overall Medication Adherence.

Disadvantages

- Liquid Dosage Concerns Stability, Risk of Contamination,
- Challenges In Accurate Measurement,
- Bulky Packaging,
- Potential For Leakage or Spillage,
- Difficulties In Administration.
- These Considerations Highlight the Importance of Carefully Evaluating. The Appropriate Dosage Form Based On The Specific Characteristics Of The Drug And The Needs Of The Patient Population.

Advancement

liquid dosage forms involve nano-emulsions, liposomes, and microencapsulation techniques. These innovations aim to improve stability, enhance bioavailability, and provide novel strategies for targeted drug delivery.

Semi solid dosage form



Fig: Semi-Solid dosage form

Topical products intended for application on the skin or accessible mucous membranes to provide localized and sometimes systemic effects at the site of application. It has smooth texture, elegant in appearance, non-dehydrating, non-gritty, non-greasy and non-staining. Its physiological properties are- Non irritating, do not alter membrane, miscible with skin secretion, have low sensitization.

Semi solid are of different types

- **Ointments-** These are composed of different types of hydrocarbons like soft, meshed and fluid hydrocarbons. Ointments are usually tasteless, odourless, unctuous material with a melting range.
- **Creams-** They are viscous semisolid emulsion system with opaque appearance. Creams are regarded as elegant drug delivery system because of its appearance and feel post application.
- **Pastes-** These are basically ointments in which insoluble solids with high percent are added. Pastes are usually less penetrating than ointments, they make a good protective barrier.
- **Gels-** These are semisolid, aqueous colloidal suspensions of hydrated forms of insoluble medicaments. Some are water like transparent, others are turbid. gels are used as medications, lubrications and for various applications.

Advantages

- Contact time is more at the site of absorption so sustained release of drug as compared to conventional semisolids.
- Utilization of drug is more so dose required is less and frequency of dosing is minimized.
- More bioavailability of drug than conventional semisolids.
- Better patient compliance.
- Avoidance of first pass effect.
- Quick and better absorption.
- It may decrease the side effects.

Disadvantages

- Semi solid dosage forms such as creams and ointments, may present challenges in achieving precise dosage control.
- Measuring and dispensing exact quantities can be more difficult compared to solid or liquid forms, potentially leading to variations in drug delivery.
- Those containing active ingredients or additives, may cause skin irritation or sensitization. This can limit their application in certain patient populations and require careful consideration of formulation ingredients.
- Semisolid dosage forms are susceptible to changes in temperature and can be sensitive to environmental conditions.

Advancement

Semi solid dosage forms have brought about notable improvements in drug delivery, enhancing both therapeutic effectiveness and patient adherence. Innovations in this category primarily focus on overcoming limitations associated with traditional formulations like ointments and creams. Key advancements include: nanotechnology integration, microstructure engineering, transdermal drug delivery systems, hydrogels and mucoadhesive formulations.

Gases dosage form



Fig: Gaseous dosage form

Gaseous dosage forms include aerosols, vapours, gases, and powders that can be inhaled, providing a rapid and targeted approach for delivering medications, particularly to the respiratory tract. These formulations are commonly employed in treatment of respiratory conditions, but their applications extend to various therapeutic areas, offering advantages such as rapid onset of action and localized drug delivery.

- **Aerosols-** MDIs are pressurized containers that release a fixed dose of medication with each actuation, allowing precise inhalation therapy for conditions like asthma.
- **Vaporized agents-** volatile anaesthetic are inhalation agents used in anaesthesia.
- **Nebulized solutions-** Devices that convert liquid medications into a fine mist for inhalation. Nebulized solutions are often used for respiratory conditions and can deliver a broader range of drugs compared to traditional inhalers.

Advantages

- Rapid onset of action: gaseous dosage forms often lead to quicker therapeutic effects compared to traditional oral routes, making them suitable for the treatment of acute conditions.
- Targeted delivery: inhalation allows for precise targeting of the drug to the lungs, particularly beneficial for respiratory conditions.
- Reduced systemic side effects: by directly delivering drugs to the site of action, gaseous dosage forms can minimize systemic side effects associated with other administration routes.
- Patient convenience: inhalation therapies are generally more convenient for patients, promoting better compliance.

Disadvantages

- Complex formulation: designing stable gaseous dosage forms can be challenging due to the need for propellants, stabilizers, and appropriate container materials.
- Device Dependency: effective administration often relies on specialized devices, and patient adherence may be compromised if these devices are not user friendly.
- Limited dosage control: achieving precise dosage control can be challenging with some gaseous formulations, potentially leading to variations in therapeutic outcomes.
- Environmental concerns: certain propellants used in gaseous dosage forms may have environmental implications, necessitating the exploration of eco-friendly alternatives.

Advancement

Inhalable nanoparticles, smart inhalers, and personalized aerosol therapies represent recent advancements in gaseous dosage forms. These innovations focus on improving drug targeting, optimizing dosing regimens, and enhancing overall therapeutic outcomes.

On the basis of administration

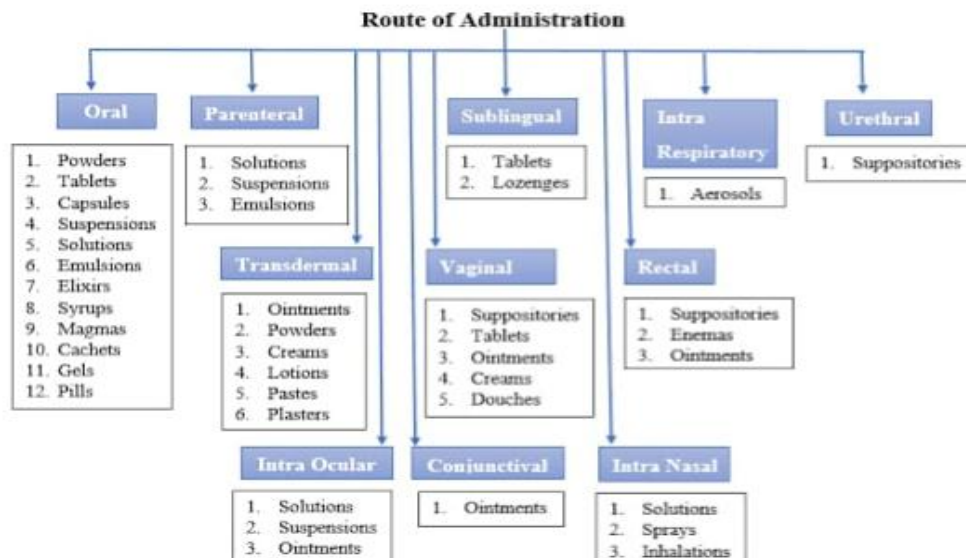


Fig: Route of Administration

- **Oral-**A route of administration where by a substance is taken through the mouth, swallowed and then processed via the digestive system.
- **Examples-** tablets, capsules, pills, etc

- **Parenteral-** This administration refers to drugs given routes other than digestive tract, mainly for drugs given by injection or infusion.
- **Examples-** insulin, opioid analgesics, antibiotics, vaccine, etc.
- **Topical-** This administration refers mainly the external use for treatment of skin, transdermal delivery of therapeutic agents, control of external and internal parasites.

Examples Antifungals, anti-inflammatory agents, antiseptics, creams, ointment, lotion.

- **Transdermal-** This administration is referred to as the painless method of delivering drugs systemically by applying a drug formulation onto intact and healthy skin.
- **Examples-** nicotine patches that contain painkillers, androderm, habitraol, etc
- **Inhaled-** This route of administration provides greater surface area for absorption of the inhaled substances.
- **Examples-** corticosteroids like fluticasone and inhaled anaesthetics to patients.
- **Ophthalmic-** This is the administration of drug to eyes.

Examples eye drop formulation, eye ointments, etc.

- **Rectal-** this administration uses rectum as the route of administration for medication. Mostly drugs that are administered orally can also be administered rectally as a suppository.
- Examples Solid- suppositories, capsules. Semisolid – gels, foams, ointments, creams. Liquids-enemas
- **Vaginal-** This route of administration is usually used to administer a solution vaginally to a woman. This route is often used to give estrogen to women during menopause to relieve vaginal symptoms as dryness, soreness, and redness.
- **Examples-** tablet, cream, gel, suppository, pessaries.

II. CONCLUSION

Dosage forms play pivotal role in pharmaceuticals by providing a means to deliver medications effectively and safely. The selection of a particulate dosage form is influenced by various factors, including physiochemical properties of the drug, patient characteristics and desired therapeutic outcome. Whether its tablet, capsules, injection or topical formulation, each dosage form serves as specific purpose, contributing to patient convenience, compliance and overall treatment success. The continuous evolution of dosage form technology aims to improve drug delivery, ensuring optimal bioavailability and minimizing adverse effect. As pharmaceutical research advances, innovative dosage forms will likely continue to emerge, offering new possibilities for enhanced drug administration and patient care.

REFERENCES

- [1]. NyolS, Gupta M, Immediate Drug Release Dosage Form: A Review, Journal of Drug Delivery & Therapeutics, Volume 3, Issue 2, 2013, 155-161.
- [2]. Himanshu, A Comprehensive Review on Pharmaceutical Liquid Dosage Form, Acta Scientific Pharmaceutical Sciences, Volume 6, Issue 4, 2022, 1-5.
- [3]. Sharma N, Pahuja S, Sharma N, Review Article on Solid Dosage Form: TABLET, World Journal of Pharmacy and Pharmaceutical Sciences, Volume 10, Issue 10, 722-728.
- [4]. Sharma R, Garg A, Sharma R, A Brief Review on Tablet as A Dosage Form with Special Reference to Fast Dissolving Tablets (FDTs), World Journal of Pharmaceutical and Life Sciences WJPLS, Volume 8, Issue 8, 58-62.
- [5]. Kumar V, Bharadwaj A, Singh N, Goyal K, Jindal S, A Review on Tablet Dosage Form: Recent Advancements with Special Emphasis on Rapid Disintegrating Tablet, Asian Journal of Research in Pharmaceutical Sciences, Volume 11, Issue 03, 2021, 237-246.
- [6]. Lachman I, Herbert A, Lieberman, Joseph L. Kanig: The theory and Practice of Industrial Pharmacy, Varghese publication house, 1990, 293-373.
- [7]. Herbert A. Lieberman, Martin M. Rieger and Gilbert S. Banker, Pharmaceutical Dosage Forms: Tablets.

- [8]. Keerthi M, Kiran R, Rao V, Sannapu A, Dutt AG, et al. (2014) Pharmaceutical Mini-Tablets, its Advantages, Formulation Possibilities and General Evaluation Aspects: A Review. Int. J. Pharm. Sci. Rev. Res. 28: 214-221.
- [9]. <https://www.pharmapproach.com/solid-dosage-forms-tablets/>
- [10]. R Anathakumar Types of Dosage Forms and Their Definitions. Vels Institute of Science, Technology and Advanced Studies.
- [11]. https://www.researchgate.net/publication/320923384_Recent_Advances_in_Semisolid_Dosage_Forms, Recent Advances in Solid Dosage Forms, Gill Shukla-2017.