SHREE H. N. SHUKLA INSTITUTE OF PHARMACEUTICAL EDUCATION AND RESEARCH

B.PHARM SEM-1

SUBJECT NAME: PHARMACEUTICS
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1.1 HISTORY OF PHARMACY

Origin and Development of Pharmacy

Pharmacy (from the Greek 'pharmakon' = drug) is the health profession that links the health sciences with the chemical sciences, and it is charged with ensuring the safe and effective use of medication.

It was in 9th century in the civilized world around Baghdad that the profession of pharmacy started acquiring shape. It slowly spread to Europe as alchemy and finally developed into chemistry. The artisans of Mesopotamia, Egypt and China carried out the first known chemical process. However, in the 19th century it completely sprouted out from medicine and started developing as a separate profession. This happened only when the role of pharmacist as a compounder of medicines were identified and differentiated from physician whose role was accepted as the therapist. The practice in those times was restricted to compounding, dispensing medication, and manufacturing medicaments in bulk lots not for general sale. The medicament commonly produced was simple elixirs, spirits, and powders in contrast to the complex pharmaceutical remedies of the present era.

1. **Before the Dawn of History:** In earliest times, medicine was based on **magic and religion.** Sumerians living around 4,000 BC believed that **demons were the cause of illness**. In many cultures, **physicians were priests**, and sometimes considered as gods.

2. **Pharmacy in Ancient Babylonia:** The earliest known record of the art of apothecary (the forerunner of the pharmacist) is in Mesopotamia at about 2600 B.C Babylonian healing practitioners combined the responsibilities of **priest, physician, and pharmacist**
3. **Pharmacy in Ancient China:** In ancient China (2000 B.C.) legend tells that Emperor Shen Nung investigated the medical properties of hundreds of herbs. He recorded 365 native herbal drugs in the first pen T'sao. (Book called "the Great Herbal")
4. **Days of the Papyrus Ebers:** One of the earliest known records written around 1500 B.C. was the Ebers Papyrus named by George Ebers. It contains 800 prescriptions using 700 drugs, of particular note in the papyrus is inclusion of quantities of substances, which were largely missing from Babylonian clay tablets.

   Many modern dosage forms are also referred to in the Ebers Papyrus as gargles, inhalations, suppositories,
5. **Greeks period:** Around 600 B.C. the Greeks integrated science into mythological thinking. They began thinking logically about disease rather than believing spiritual explanations. The Romans conquered the Greeks and the medical and pharmaceutical cultures merged, it is known as the **Greco-Roman era.**
   * Charaka and Sushruta, Indian pharmacist and physician, wrote *Charak Samhita* and *Sushruta Samhita*, respectively
6. **Roman period:** Pharmacopoeia: Maker of remedies.

   Pharmacotritae: Drug Grinders, **Unguentarii:** Makers of ointments.

   Pigmentarii: Maker of cosmetics, **Pharmacopolae:** Seller of drugs.
7. **Arabian period:** Major advances in this era are Formularies: The continuation of documentation of drug information. They also had different drug forms which are now used: Syrups, Conserves, Confections and juleps.
8. **Empiric Era:** Pharmacopoeia's were used to protect public health. Roots, Bark, Herbs Flowers etc. were used and controlled by the government. They questioned the toxicological affects on the human body. Created interest in testing of drugs and how they affected the body. In 1751 Benjamin Franklin started the first hospital.
9. **Pharmacy today and tomorrow:** Pharmacy, with its heritage of 50 centuries of service to mankind, has come to be recognized as of the great professions.
   - **Prescription** is a written paper for a drug product by a licensed prescriber to treat a patient.
   - **Prescriptions** filled increased by **27%** while the number of **pharmacists** increased by **15%.**
   - **Pharmacology:** The study of drugs (from the Greek *pharmakon* means drug).

- **Pharmacognosy:** The study of physical, chemical, biochemical and biological properties of drugs as well as drugs from natural sources.
- **Pharmacopoeia:** An official listing of drugs and issues related to their use.
- **Pharmaceutical:** study of or about drugs; also, a drug product.
- **Panacea:** A cure-all (from the Greek *panakeia*).
- **Materia Medica:** A dictionary of medicinal plants.

1.2 PHARMACY AS A CAREER

Pharmacy (from the Greek 'pharmakon' = drug) is the health profession that links the health sciences with the chemical sciences, and it is charged with ensuring the safe and effective use of medication.

Scope of Pharmacy

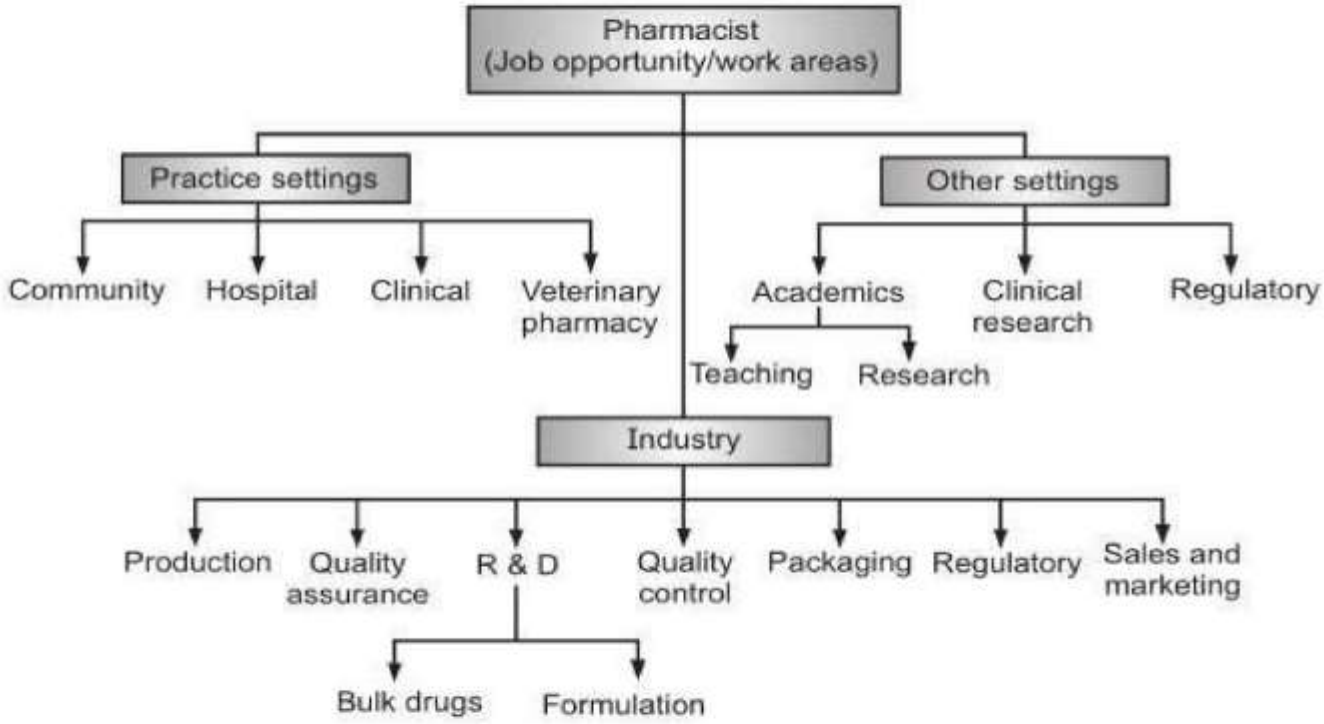


Fig. 1.1: Scope of Pharmacy

The scope of pharmacy practice includes more traditional roles such as compounding and dispensing medications, and it also includes more modern services related to patient care, including clinical services, reviewing medications for safety and efficacy, and providing drug information.

Types of Pharmacy Practice Areas

Pharmacists practice in a variety of areas including retail, hospitals, clinics, nursing homes, drug industry and regulatory agencies. Pharmacists can specialize in various areas of practice including hematology/oncology, infectious diseases, nutrition support, drug information, critical care, pediatrics, etc.

Wholesale Pharmacy

It offers opportunities to a limited number of pharmacists to run wholesale business of drugs and medicines. The wholesalers serve as an intermediary between manufacturer and retailer.

Industrial Pharmacy

Pharmaceutical industry offers opportunity to pharmacist of all educational levels. It provides job to a pharmacist in the following fields:

I. Production
II. Analytical and Quality Control
III. Research and Development and New drug discovery
IV. Medico-marketing and sales clinical trials
V. Clinical Trials.

I. Production: In production, the pharmacist works as manufacturing chemist. He has to supervise the production of various types of pharmaceutical formulations, packaging, labeling and storage. Pharmacists with bachelor degree in pharmacy are absorbed as manufacturing chemist.

II. Analytical and Quality Control: A manufacturing unit needs the service of analytical chemists in its analytical laboratory to do testing of raw materials and finished goods manufactured by it. Pharmacists with bachelor degree in pharmacy get job of analytical chemist.

III. Research and Development and New drug discovery: Mostly Pharmaceutical Industries have their own separate Research and Development unit. A pharmacist having Doctorate or master degree in pharmacy is ideally suited for Research and Development department in pharmaceutical industries.

Research and development unit engage in the following fields:-

(a) Synthesis of new compounds to be used as drugs, cosmetics, excipients, industrial chemicals etc.

(b) Isolation and purification of active principles of plant and animal tissues, determination of their chemical composition and its synthesis.

(c) Preparation of drugs in suitable dosage forms and its testing to find the bioavailability of drugs.

(d) The physical, chemical and biological standardization of drugs.

(e) Research on pharmacokinetics, pharmacodynamics and toxicology of new drugs.

(f) The stability of dosage form during its storage and finding its expiry date.

IV. Medico-marketing and sales: Pharmaceutical marketing means the performance of pharmaceutical business activities that direct the flow of pharmaceutical formulations and services from producer to consumers. Sale team consists of medical representatives, sale representatives, field officers, area managers, regional managers and sales managers. Pharmacist with bachelor degree in pharmacy, having an aptitude for sale, is best fitted in this field, because there is lot of scope of promotion.

V. Clinical Trials: Now a day there is enough openings in clinical trials. India has been recognized as the best place in the world to carry out clinical trials before launch of new drug molecule in the market.

Pharmacy Education (Academics)

Due to rapid growth of pharmaceutical industry and expansion of health services in the country, there is steep increase in the number of pharmacy teaching institutions in the country. In order to fulfill the demand, there is need for qualified and experienced faculty members. So there is more scope for fresh pharmacy graduates to be absorbed as faculty members in these teaching institutions.

Community Pharmacy

A pharmacy or drug store is the place where most pharmacists practice the profession of pharmacy. A **community pharmacy** is a healthcare facility that is able to provide pharmacy services to people in a local area or community. A community pharmacy dispenses medicine and typically involves a registered pharmacist with the education, skills and competence to deliver professional services to the community.

Hospital Pharmacy

Hospital pharmacists work in a hospital pharmacy service, primarily within the public sector. They are experts in the field of medicines and are not only responsible for the dispensing of prescriptions but also the purchase, manufacture and quality testing of all medicines used in a hospital. Many hospital pharmacists are qualified to prescribe in their own right.

Hospital pharmacists are medicine experts and tasks may include:-

- Checking prescriptions to ensure that there are no errors and that they are appropriate and safe for the individual patient.
- Providing advice on the dosage of medicines and the most appropriate form of medication, for example, tablet, injection, ointment or inhaler.
- Participating in ward rounds, discussing treatments with patient's relatives.
- Ensuring medicines are stored appropriately and securely.

Clinical Pharmacy

Clinical pharmacists provide a direct patient care service that optimizes the use of medication and promotes health, wellness, and disease prevention. Clinical pharmacists care for patients in all health care settings but the clinical pharmacy movement initially began inside hospitals and clinics. Clinical pharmacists often collaborate with physicians and other healthcare professionals to improve pharmaceutical care.

Veterinary Pharmacy

Veterinary pharmacies, sometimes called animal pharmacies may fall in the category of hospital pharmacy, retail pharmacy. Veterinary pharmacies stock different varieties and different strengths of medications to fulfill the pharmaceutical needs of animals

1.3 INTRODUCTION TO PHARMACOPOEIA

1.3.1 Pharmacopoeia

Derived from Greek words **'Pharmakon'** means **drug** and **'Poeia'** means **to make**.

The books containing the standards for drugs and other related substances are known as pharmacopoeias and formularies. Collectively these books are known as **Drug Compendia**.

The pharmacopoeias contain a list of drugs and other related substance regarding their source, descriptions, tests, formulae for preparing the same, action and uses, doses, storage conditions etc.

It is a legal and official book issued by recognized authorities usually appointed by Government of each country.

These books are revised from time to time as to introduce the latest information available as early as possible after they become established.

Classification

The drug compendia are classified as:

(1) Official compendia.

(2) Non-official compendia.

(1) Official compendia: Official compendia are the compilation of drugs and other related substances which are recognized as legal standards of purity, quality and strength by government agency of respective countries of their origin. Official compendia include:

(a) British Pharmacopoeia.

(b) British Pharmaceutical Codex.

(c) Indian Pharmacopoeia.

(d) United State Pharmacopoeia.

(e) National Formulary.

(2) Non-official compendia: The books other than official drug compendia which are used as secondary reference sources for drugs and other related substances are known as non-official drug compendia. These include

(a) Merck Index.

(b) Remington's Pharmaceutical Sciences.

(c) The United States Dispensary.

1.3.2 Indian Pharmacopoeia

The development of IP was started with an aim to promote public health by bringing out authoritative and officially accepted standards for quality of drugs including active pharmaceutical ingredients, excipients, dosage forms and medical devices for use by health professionals, patients and consumers.

- In pre-independence days, British Pharmacopoeia was used in India.
- In 1946 Government of India issued one list known as 'The Indian Pharmacopoeial list' which was used as supplement to British Pharmacopoeia.
- Committee under chairmanship of Sir R. N. Chopra alongwith other nine members prepared 'The Indian Pharmacopoeial list'.
- It was prepared by Department of Health, Government of India, Delhi in 1946.
- In 1948 Government of India appointed an Indian Pharmacopoeia committee for preparing 'Pharmacopoeia of India'.
- Tenure of this committee was five years.

In 1955 first edition of Indian Pharmacopoeia committee under chairmanship of Dr. B. N. Ghosh was published.

- It is written in English and official titles of monographs given in Latin.
- 1960 - Supplement to this edition was published

In 1966 Second edition of IP was published under the chairmanship of Dr. B. Mukherji.

- Official titles of monographs given in English.
- Doses were expressed in Metric system.
- Formulations of the drugs were given immediately after the monograph of drugs.
- 1975 - Supplement to this edition was published.

In 1985, third edition of IP was published with two volumes and nine appendices.

- 261 new monographs have been added.
- Addendum I to IP was published in 1989 were 46 new monographs added and 126 amended.
- Addendum II was published in 1991 were 62 new monographs added and 110 amended.

In 1996 Fourth edition of IP was published under the chairmanship of Dr. Nityanand.

- It has been made effective from 1st December 1996.
- It covered 1149 monographs and 123 appendices.
- It includes 294 new monographs and 110 monographs have been deleted.
- Addendum I has been made effective from 31st December 2000 were 42 new monographs have been added.
- Addendum II has been made effective from 30th June 2003 were 19 new monographs have been added.
- The veterinary supplement to IP 1996 contains 208 monographs and four appendices.

In 2007, fifth edition of IP was published and addendum to this edition was published in 2008.

- IP 2007 is presented in three volumes.
- Volume one contains general notices and general chapters.
- Volume two and three contains general monographs on drug substances, dosage forms and Pharmaceutical aids.

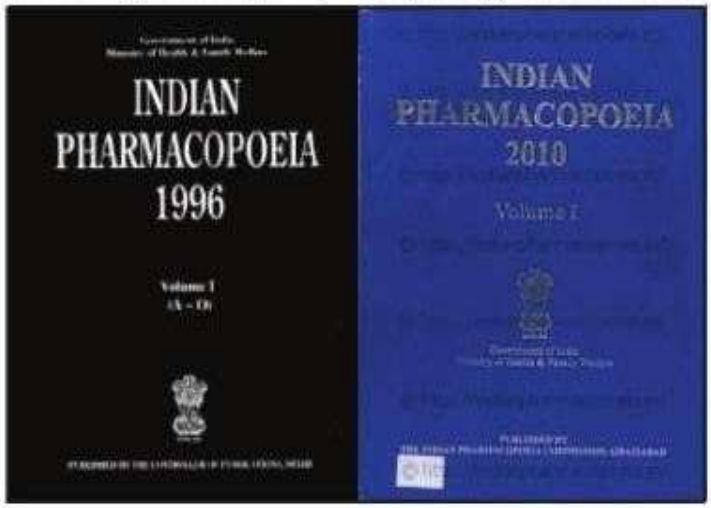
In 2010, sixth edition of IP was published.

- The 6th edition of the Indian Pharmacopoeia 2010 is published by the Indian Pharmacopoeia Commission (IPC), Ghaziabad.
- This edition was effective from 1st September, 2010.
- The Indian Pharmacopoeia 2010 is presented in three volumes.
- Volume I contains the Notices, Preface, the Structure of the IPC, Acknowledgements, Introduction, and the General Chapters.
- Volume II contains the General Notice, General Monographs on Dosage Forms and Monographs on drug substances, dosage forms and pharmaceutical aids (A to M).
- Volume III contains Monographs on drug substances, dosage forms and pharmaceutical aids (N to Z).
- Monographs on Vaccines and Immunosera for Human use, Herbs and Herbal products, Blood and blood-related products, Biotechnology products and Veterinary products.
- The number of monographs of Excipients, Anticancer drugs, Herbal products and antiretroviral drugs has been increased in this edition.
- A chapter on NMR and chapter on microbial contamination also updated.

In 2014, seventh edition of Indian Pharmacopoeia was published.

- The seventh edition of the Indian Pharmacopoeia (IP 2014) is published by the Indian Pharmacopoeia Commission (IPC) on behalf of the Government of India, Ministry of Health and Family Welfare by Ghulam Nabi Azad.

- The Indian Pharmacopoeia 2014 is presented in four volumes.
- The scope of the Pharmacopoeia has been extended to include additional anticancer drugs and antiretroviral drugs and formulations, products of biotechnology, indigenous herbs and herbal products, veterinary vaccines.
- The IP 2014 incorporates 2550 monographs of drugs out of which 577 are new monographs consisting of APIs, excipients, dosage forms and herbal products etc.



1.3.3 British Pharmacopeia

- First edition of BP was published in 1864.
- It consists of two sections:
  Part I: Materia Medica and
  Part II: Preparation and compounding.
- Second edition of BP was published in 1867.
- Third edition of BP was published in 1884.
- Fourth edition of BP was published in 1898.
- Next edition of BP was published in 1914.
- Next edition of BP was published in 1953.
- In this edition titles of drugs and preparations were in English instead of Latin and metric system.
- It has been published annually.
- In BP 2007 monographs has been introduced for material specifically used in preparation of Traditional chinese medicines.
- BP 2008 contains approximately 3100 monographs for substances, preparations and articles used in practice.
- It has been made effective from 1st January 2008.
- BP 2007, 2008, 2009 were given in six volumes i.e. volume I to volume VI.
- Volume I and II contains medicinal substances.

- Volume III contains formulated preparations, blood related products, immunological products, radiopharmaceutical preparations, surgical materials and homoeopathic preparations.
- Volume IV contains supplementary chapters, IR spectra etc.
- Volume V contains veterinary.
- Volume VI contains CD ROM version.

The British Pharmacopoeia 2010

- Medicines and Healthcare products Regulatory Agency (MHRA), has published the British Pharmacopoeia (BP) 2010.
- The British Pharmacopoeia (BP) is the official collection of standards for UK medicinal products and pharmaceutical substances. Published annually the BP contains monographs for pharmaceutical substances, formulated preparations and other articles used in the practice of medicine.
- The standards in the BP 2010 are legally effective in the UK from 1st January 2010.
- The BP has been providing authoritative, official standards for pharmaceutical substances and medicinal products since 1864. Today, it is used in almost 100 countries worldwide and remains an essential reference.

New to the British Pharmacopoeia 2010

- 40 monographs for formulated preparations, including veterinary medicines and standards used for unlicensed formulations.
- BP contains new and revised monographs for herbal medicinal products and for homeopathic stocks and mother tinctures.
- The BP 2010 comprises four volumes of the BP 2010 and a single volume of the BP (Veterinary) 2010.

The British Pharmacopoeia 2013

- Six volume printed edition including the BP (Veterinary) 2013.

New for British Pharmacopoeia 2013

- 41 new BP monographs.
- 40 new European Pharmacopoeia monographs.
- 619 amended monographs.
- 6 new and 1 amended Infrared Reference Spectra.

The British Pharmacopoeia 2014

- The only official source of British pharmaceutical standards.
- Produced by the British Pharmacopoeia Commission Secretariat of the Medicines and Healthcare Products Regulatory Agency (MHRA), and updated annually.
- The 2014 edition includes almost 3500 monographs which are legally enforced by the Human Medicines Regulations 2012.

- The BP 2014 has five volumes of the British Pharmacopoeia 2014 and a single volume of the British Pharmacopoeia (Veterinary) 2014, along with a fully searchable CD-ROM and online access.

New for British Pharmacopoeia 2014

- Legally effective from 1 January 2014.
- 40 new BP monographs.
- 272 amended monographs.
- Three new Supplementary Chapters.
- Four new BP (Vet) monographs.
- One new BP (Vet) Supplementary Chapter.

1.3.4 United State Pharmacopoeia

The United States Pharmacopoeia and National Formulary (USP-NF) is an official public standards–setting authority for all prescription and over–the–counter medicines and other health care products manufactured or sold in the United States.

USP also sets recognized standards for food ingredients and dietary supplements. These standards help to ensure the **quality, purity, strength,** and **consistency** of products made for public consumption.

USP's standards are recognized and used in more than 130 countries around the globe. USP's work is aided by the participation and oversight of volunteers representing pharmacy, medicine, and other health care professions as well as academia, government, the pharmaceutical and food industries, health plans, and consumer organizations.

The United States Pharmacopoeia was originally published in 1820 under the authority of the United States Pharmacopoeial Convention and the National Formulary was published in 1888 under the guidance of American Pharmaceutical Association.

In 1974 the National Formulary was purchased by the United States Pharmacopoeial Convention and from 1980 onwards only one official book of drug standards was published under the heading, The United States Pharmacopoeia and The National Formulary (USP-NF).

The United States Pharmacopoeia–National Formulary (USP–NF) 2009 is a book of public pharmacopoeial standards.

It contains standards for medicines, dosage forms, drug substances, excipients, medical devices, and dietary supplements.

USP–NF in English is available in print, online, and CD formats.

The USP–NF is a three volume combination of two official compendia, the United States **Pharmacopoeia (USP) and the National Formulary (NF)**

Monographs for drug substances and preparations are featured in the USP.

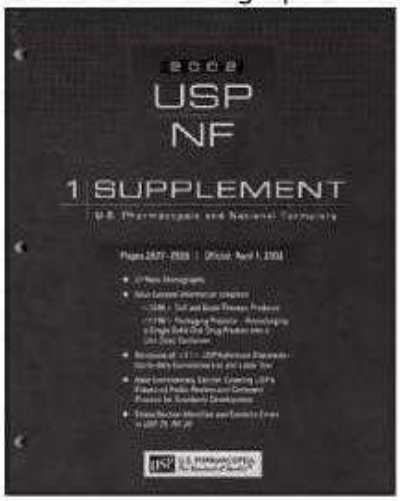
Monographs for dietary supplements and ingredients appear in a separate section of the USP.

Excipient monographs are in the NF.

A monograph includes the name of the ingredient or preparation; the definition; packaging, storage, and labeling requirements; and the specification.

The specification consists of a series of tests, procedures for the tests, and acceptance criteria. These tests and procedures require the use of official USP Reference Standards.

Medicinal ingredients and products will have the stipulated strength, quality, and purity if they conform to the requirements of the monograph and relevant general chapters.



1.3.5 Extra Pharmacopoeia

The Extra Pharmacopoeia was first produced in 1883 by William Martindale and is still known as "Martindale".

This is an authorized reference book on drugs and is used throughout the world.

It provides all sorts of latest information on drugs and medicines.

The Extra Pharmacopoeia is prepared by consulting the pharmacopoeias of other countries.

The twenty-eighth edition was published in December 1982.

The twenty-ninth edition was published in January 1989, by direction of the council of The Royal Pharmaceutical Society of Great Britain and prepared in the Society's Department of Pharmaceutical Sciences.

Martindale contains information on drugs in clinical use worldwide, as well as selected investigational and veterinary drugs, herbal and complementary medicines, pharmaceutical excipients, vitamins and nutritional agents, vaccines, radiopharmaceuticals, contrast media and diagnostic agents, medicinal gases, drugs of abuse and recreational drugs, toxic substances, disinfectants and pesticides.

1.4 INTRODUCTION TO PHARMACEUTICAL DOSAGE FORM

Dosage forms are the safe, effective and stable terms in which medication will be delivered into the body. Dosage forms are essentially pharmaceutical product which are marketed for use typically involving a mixture of active drug components and excipients (non-drug components). These dosage forms are classified in a number of ways as mentioned below by which drug molecules are delivered to the site of action.

1. Form wise:
   (i) Solid dosage form
   (ii) Liquid dosage form
   (iii) Semi-solid dosage form
2. Route wise:
   (i) Oral dosage form
   (ii) Topical dosage form
   (iii) Parenteral dosage form
3. Release rate:
   (i) Sustained release
   (ii) Prolonged release
   (iii) Controlled release
   (iv) Targetted drug delivery

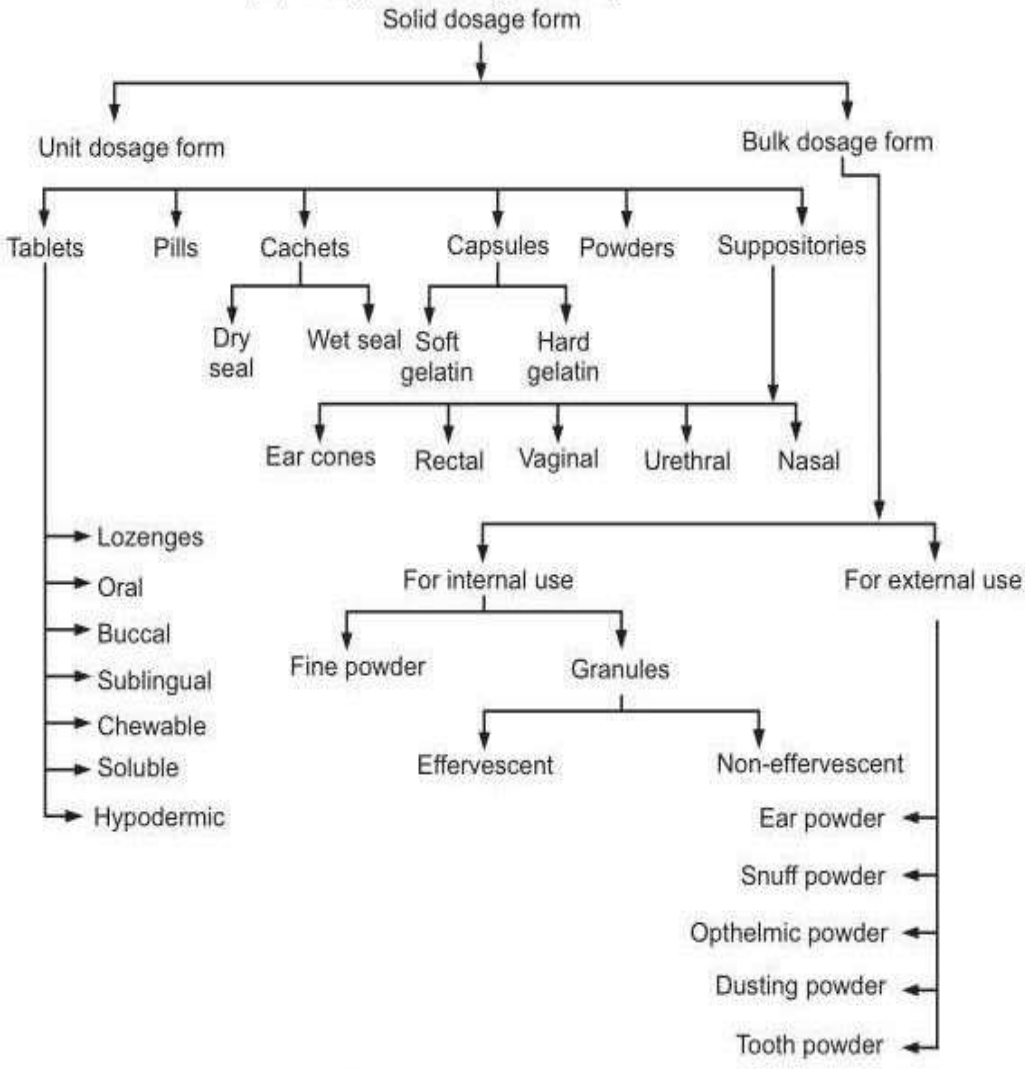


Fig. 1.2: Solid dosage form

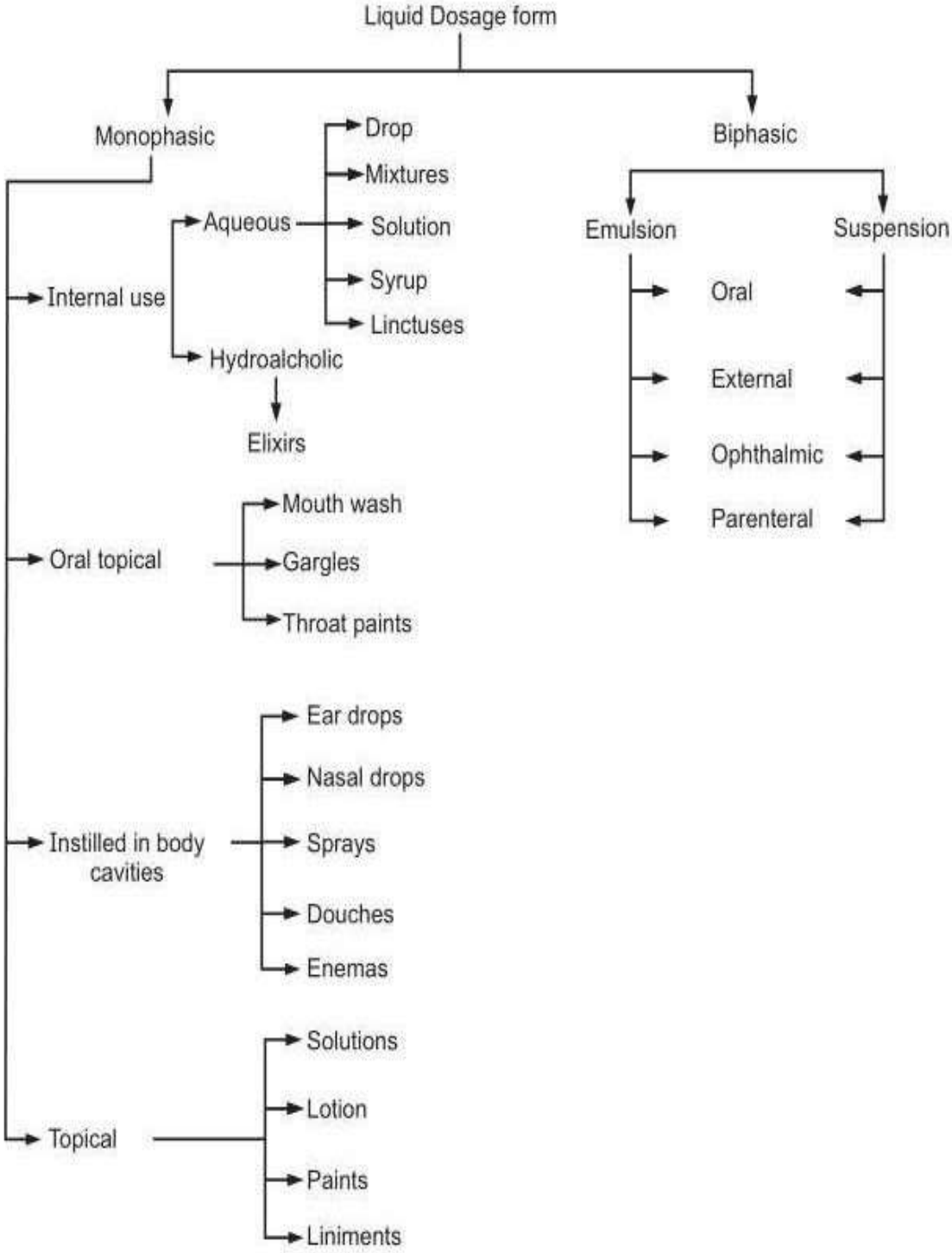


Fig. 1.3: Liquid dosage form

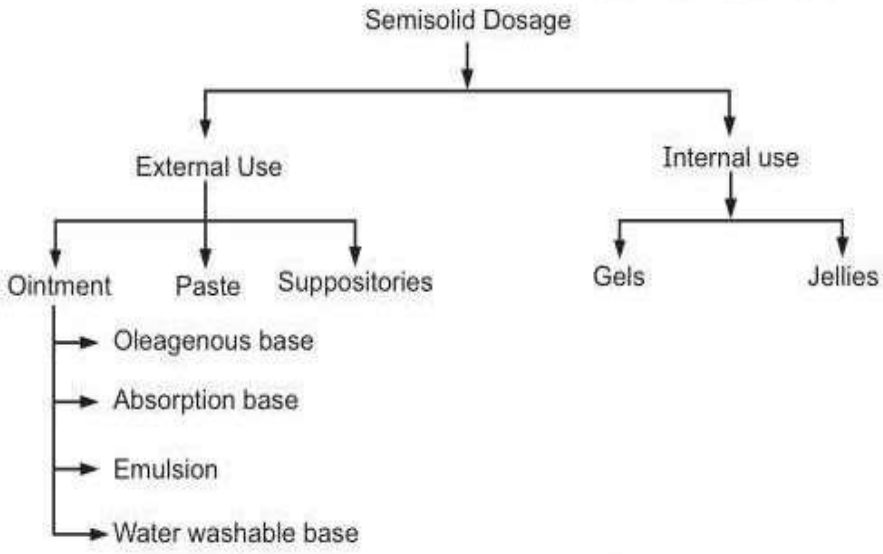


Fig. 1.4: Semi-solid dosage form

1. Aromatic water: They are saturated aqueous solution of volatile oils or other aromatic or volatile substances. e.g. Camphor water, concentrated Peppermint water.

Mainly used as flavouring agent. They are prepared by:-

A. Distillation. e.g. Strong rose water, orange flower water.

B. Solution method. e.g. Dill water, pepper water, camphor water.

C. Alternate solution method. e.g. Volatile oil is thoroughly mixed with an inert adsorptive agent (talc, kiesulguhr), then one litre of purified water is added and agitated for 10 minutes. The solution is filtered until a clear filtrate is obtained.

e.g. Concentrated peppermint water.

2. Cachets: They are solid dosage form meant for oral administration of nauseous and disagreeable drug substances. These are moulded from rice paper, a material made by pouring a mixture of rice flour and water between two hot polished revolving cylinders upon which water evaporates and a sheet of wafer is formed. In the filling of cachet, the medicament is placed between two pieces of a cachet which are then either wet sealed or dry sealed. Cachets are made in a variety of size holding from 0.2 to 2 grams of powder of medium density. Before administration they are softened by immersion in water for a few seconds and then taken with a draught of water.

3. Tinctures: Tinctures are sweet viscous liquid oral preparation containing medical substances which have demulcent, sedative or expectorant preparation. The simple solution or administrations containing a high proportion of syrup and glycerin have demulcent effect on the mucous membrane of the throat e.g. Codeine tincture. They are alcoholic or hydro alcoholic solution of chemicals or soluble constituents of crude drugs. e.g., orange tinctures, ipecacuanha tincture, cardamom tincture. Tincture contains 20-90% alcohol and spirits, containing volatile substances only.

They are prepared by

(a) Simple dilution of stronger preparation

(b) Maceration

(c) Percolation

4. Spirits: Spirits are alcoholic or hydro alcoholic solution of volatile oils which are used internally for their medicinal values and flavoring agent. Spirit may also applied externally or used by inhalation. e.g., Aromatic spirit of ammonia. They are prepared by

(a) Simple dissolution

(b) Maceration

(c) Chemical reaction

(d) Distillation

5. Proof spirits: They are defined as mixture of alcohol and water which is 51°F weight $12/13^{th}$ of an equal volume of water. The strength of alcoholic preparation are medicated by degrees, over proof (o/p) or under proof (u/p). Any alcoholic solution which contain 57.1% v/v alcohol is a proof spirit and said to be 100 proof.

6. Elixirs: Elixirs are clean liquid, oral alcoholic preparation contain potent and nauseous drugs which are plenty flavoured and usually attractive coloured. They are more stables than mixture.

Classification

(a) Non medicated elixir e.g. Compound benzaldehyde elixir.

(b) Medicated elixir e.g. Chlorpheniramine, Chloral hydrate

7. Syrups: Syrups are concentration aqueous preparation of sugar or sugar substances with or without flavoring agent and medical substances.

(a) Medicated Syrup

(b) Flavoured Syrup

Syrup IP is 66.7% w/w solution of sucrose where as syrup USP is 85% w/v or 64.74% w/w solution of sucrose in purified water.

8. Droughts: Droughts are oral liquid preparation meant to take as a single dose. A single dose of mixture is usually known as draught.

(a) Male fern drought

(b) Paraldehyde drought: oxidizes to acetic acid on storage leads to death.

9. Drops: Drops are liquid oral preparation of potent drugs or vitamin which are given in to original form without dilution.

10. Ear drops: They are liquid preparations meant for instillation in to ear. In these preparations, the drug is usually dissolved or suspended in a suitable solvent such as propylene glycol, polyethylene glycol, glycerol, alcohol and water or a mixture of these. Aqueous vehicle is generally not preferred because the secretions in the ear are fatty in nature and as such these do not mix with water.

11. Eye drops: They are aqueous and oily solutions or suspensions of one or more active ingredients for instillation in to the eye sac. These are sterile free from foreign particles and irritating effect. They contain auxiliary substance such as isotonicity agent, buffers, antioxidant, stabilisers and preservatives.

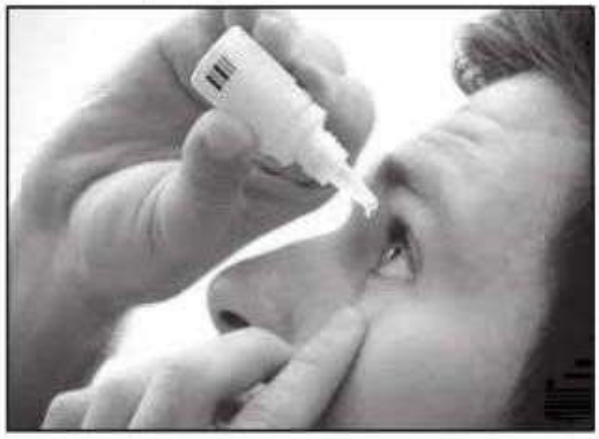


Fig. 1.5

They are Categorised in to number of various types:

1. Liquid preparation for application to the surface of eye. e.g., Eye drops, lotions.
2. Semisolid dosage forms eg., Ointment, Cream, gels.
3. Parenteral products for sub-conjunctival or Intraocular injection.
4. Solid dosage form intended to be placed in contact with surface of eye e.g., ocusert.

12. Ointments: Ointments are semisolid preparation indented to adhere to the skin or certain mucous membranes. They are usually solutions or dispersions of one or more medicaments in non-aqueous bases.

Ointment bases are often anhydrous and include fats, oils and waxes of animal vegetable or mineral origin.

Fig. 1.6

13. Eye Ointment: These are sterile semi-solid preparations of homogeneous appearance intended for application to the conjunctiva or margins of eyelids. They contain one or more active ingredients dissolved and dispersed in a suitable base like soft paraffin, liquid paraffin and wool fat. They contain suitable amount of antioxidant, stabilizers and antimicrobial preservatives.

14. Gargles: Gargles are aqueous solution used to prevent or treat infection. They are usually available in concentrated form with direction for dilution with warm water before use. They are brought into intimate contact with mucous membrane of throat and are allowed to remain in contact with it for few second, before they are thrown out of mouth. Phenol or thymol may be present in low concentrations which exert mild anaesthetic effect. KCl is included in gargle preparation for its weak astringent effect. Gargle differs from mouth washes because they are light medicated oral mixture which is to be diluted with water before use.

e.g. Phenol gargle, $KClO_3$ gargles.

(a) (b)

Fig. 1.7

15. Creams: Creams are viscous semisolids are usually o/w emulsions (aqueous Creams) or w/o emulsions (oily creams). Creams are usually pseudoplastic and exhibit low yield values. The microstructure of o/w cream may comprise several phases, such as viscoelastic gel with fixed water, dispersed oil, free water and crystalline material from fatty alcohol. Rigidity can be increased by incision of higher concentration of agent which is usually admixture to acetyl and stearyl alcohol and a surfactant.

(a) (b)

Fig. 1.8

16. Gels: Gels are transparent or translucent semisolid or solid preparations, consisting of solution of one or more active ingredients in suitable hydrophilic or hydrophobic bases. They are made with aid of suitable gelling agent. Usually gel exhibit pseudo plastic flow properties and those made with synthetic or semi-synthetic polymers with a high degree of cross have relatively high yield value and low viscosity.

17 Pastes: They are semi-solid preparations for topical application that differ from similar product in containing higher proportions of finely divided medicaments. They are much stiffen than ointment and are used principally as absorbents, antiseptics properties or to smooth broken skin surfaces. Pastes usually consist of finely ground insoluble powder dispersed in hydrocarbon or water miscible bases. Bases used are liquid paraffin/glycerol. They show dilatant properties and has high yield value.

18. Poultices: It consists of moistened masses of vegetable materials or clay that are sometimes heated before application.

Penetration enhancers: e.g. Sulphoxides, amides, surfactants, pyrrrolidones, calcium thioglycerate, propylene glycol.

19. Tablets: Solid unit dosage from intended to be administered in to the oral cavity. They are prepared either by moulding or by compression methods. Tablets are swallowed whole and some after being chewed, some are dissolved or dispersed in water before administration and some are retained in the mouth where the active ingredients are liberated.

Fig. 1.9

20. Capsules: Capsules are solid dosage form usually containing one dose of drug enclosed within a small water soluble shell of a suitable form of gelatin. They are of two types hard gelatin and soft gelatin capsules. Hard gelatin capsules are generally used for filling solid medicaments although liquid can also be filled by incorporating suitable excipients in the formulation. They contain a body and a cap made up of gelatin, water plasticizer and preservatives.

Soft gelatin capsules are used for filling solids, liquids as well as semisolids. The shell of soft gelatin capsules are formed, filled and sealed. They contain large amount of plasticizers as compared to hard gelatin capsules which provide flexibility to the shell.

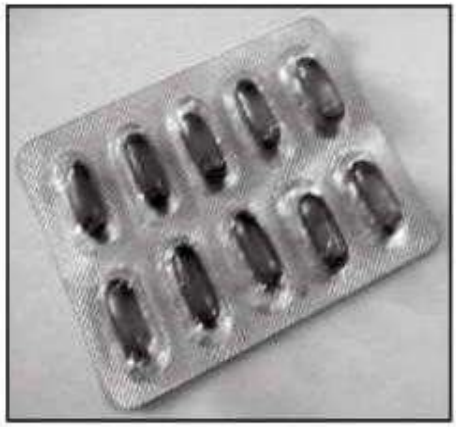


Fig. 1.10

21. Pastilles: Pastilles are solid medicated preparations intended to dissolve slowly in the mouth similar to troches and lozenges. The main difference being that pastilles are comparatively softer. These generally consists of a glycerol and gelatin containing the medicament in solution or suspension. Acacia and sugar are sometimes used when hard pastilles are desired. e.g. Squill pastilles, Menthol and Eucalyptus pastilles.

22. Pessaries: Pessaries are solid dosage forms meant for introduction in to the vagina where they melt or dissolve and exert a local action. Pessaries are prepared either by moulding or by compression. Moulded pessaries are usually cone shaped and prepared in a manner similar to suppositories and hence are also known as vaginal suppositories. Compressed suppositories prepared by compression are available in a variety of shapes and sizes and are also known as vaginal tablets. e.g. Pessaries of Clotrimazole, Nystatin, Ichthammol.

23. Pills: Pills are small, round solid dosage forms containing one or more active ingredients meant for oral administration. Pills are formerly the most extensively used oral dosage form but they have been largely replaced by compressed tablets and capsules.

e.g. Phenolphthalein pills, hexylresorcinol pills.

24. Paints: Paints are solutions or dispersions of one or more active ingredients intended for application to the skin or mucosa of mouth and throat usually with the help of a soft brush or a cotton swab. Skin paints often have a volatile solvent such as alcohol that evaporates quickly to leave a dry or resinous film of medicament. Throat paints are generally more viscous due to a high content of glycerine which being sticky, adheres to the affected area and prolongs the contact time and hence action of the medicament. For example, compound paint of iodine also known as Mandl's paint, crystal violet paint etc.

25. Linctuses: They are viscous, sweet, liquid oral preparations that are usually prescribed for the relief of cold. They consist of simple solutions or admixture containing a high amount of syrup and sometimes, glycerine which in addition to give sweet taste to the preparation have a demulcent action on the mucous membranes of the throat. For best results, linctuses should be used without dilution and sipped and swallowed slowly to ensure prolonged contact with the mucous membrane of the throat. E.g. Codeine linctus, tolu linctus.

26. Liniments: They are liquid or semi-liquid preparations meant for application to unbroken skin by friction or applied on lint or other suitable material and placed on the affected part. They may be alcoholic or oily or soapy solutions or emulsions. Alcoholic liniments are used generally for their rubefacient, counterirritant, mildly astringent, and penetrating effects. The oily or soapy liniments are milder in their action but are more useful when massage is required. Liniments should never be applied to the skin areas that are broken or bruised. E.g. camphor liniment, turpentine liniment.

Fig. 1.11

27. Lotions: Lotions are liquid or semi-liquid preparations meant for application to unbroken skin without friction. They are either dabbed on the skin or applied on a suitable dressing and covered with water proof material to reduce evaporation. An evaporating vehicle like alcohol may be used when a cooling effect is desired on application to the skin. Lotions generally contain antiseptic, astringent, anaesthetics, germicides, protectives or screening agent for prevention or treatment of various skin diseases. e.g. calamine lotion, hydrocortisone lotion.

28. Lozenges: Lozenges are solid dosage forms containing medicaments in a sweetened and flavoured base intended to dissolve slowly in the mouth. The base may be a hard sugar candy, glycerinated gelatins or a combination of sugar with sufficient gum to give it form. Lozenges do not disintegrate in the mouth but dissolve slowly liberating the active ingredients which may be an antiseptic, local anaesthetic, antibiotic, antihistaminic, antitussive, analgesic or a decongestant. They are also known as Troches.

Fig. 1.12

29. Mouth washes: Mouth washes are aqueous solutions containing one or more active ingredients for use in contact with the mucous membrane of the oral cavity usually after dilution with warm water. They contain additives such as alcohol, glycerine, synthetic sweeteners, surfactant, flavouring and colouring agents. They are used for cleansing, refreshing, deodorising, and antiseptic action. They may be either acidic or basic in their reaction and in some instances are fairly effective in reducing bacterial concentration and odours in the mouth for short periods of time.

Fig. 1.13

30. Nasal drops: They are solutions, suspensions or emulsions containing active ingredients intended for instillation in to the nostrils usually with the help of a dropper. Nasal drops are mostly based on aqueous vehicles although oily drops are not common. Oily vehicles are usually not preferred since the oil may retard the ciliary action of the mucosa and may even cause lipoid pneumonia if drops of the oil enter the lungs.

Fig. 1.14

31. Nasal sprays: They are suspensions or solution of drugs intended for spraying in to the nostrils. The chief uses of nasal sprays are to relieve nasal congestion and inflammation and to treat infections. They are intended to be retained in the nasal tract, they are usually viscous and coarse since fine droplets tend to penetrate further in to the respiratory tract. These preparations are usually supplied in pressurized containers or plastic squeeze bottles.

1.5 PRESCRIPTION

What is a Prescription?

A prescription is a legal document or order written by a qualified health care professional for diagnosis, prevention or treatment of a specific patient's disease.

- Is written by a licensed practitioner
- Is written as part of a proper physician-patient relationship
- Is a legal document, "prima facie" evidence in a court of law.

(**Note:** A prima-facie case is a lawsuit that alleges facts adequate to prove the underlying conduct supporting the cause of action and thereby prevail.)

Definition

Literally, "Recipe" means simply "Take...." and when a medical practitioner writes a prescription beginning with "R_x", he or she is completing the command.

It is probably originally directed at the pharmacist who needed to take a certain amount of each ingredient to compound the medicine (rather than at the patient who must "take/consume" it).

Types of Prescription forms

1. **Private prescription form:** This type of prescription generally written on a form that includes name, address and qualification of prescriber. R_x is written to indicate this is prescription form. This is issued by private prescribers.
2. **National Health Service (NHS) prescription form:** It is only issued for NHS patients i.e. patient suffering from certain disease and is issued by Government Prescribers.

1.5.1 Parts of the Prescription

1. Date
2. Patient Information
3. Superscription
4. Inscription
5. Subscription
6. Signa
7. Signature lines, signature, degree, brand name indication
8. Prescriber information
9. DEA (Drug enforcement administration) if required
10. Refills
11. Warnings/label

1. Date

- All prescriptions expire after one year. In case of narcotics and other habit forming drugs the date prevents the misuse of the drugs by the patient. It helps a pharmacist to know when the medicine were last dispensed if the prescription is brought for redispensing.

2. Patient Information

- Name
- Address
- Age
- Weight (optional, but useful – especially in paediatrics)
- Time (used only with inpatient medication orders)

3. Superscription

Represented by symbol R_x, traditional symbol for prescription which is always written before writing prescription. This is derived from latin word 'recipe' which means to take. Instruction given to pharmacist as well as patient to take the medicine as prescribed. Another theory proposed by some scholars is that it drives from the symbol for the god Jupiter. The connection to healing was via prayers that a specific treatment would be effective and the individual would get better.

4. Inscription

This is the main body of prescription which includes the name and quantity of medicine which are prescribed. This is written in English language. All medicines are written in separate line along with their required quantity needed to treat the disease.

What is the pharmacist to take off the shelf?

Drug Name
Dose = Quantity of drug per dose form
Dose Form = The physical entity needed, i.e. tablet, suspension, capsule
Simple versus compound prescriptions
Manufactured versus compounded prescriptions
Clarity of number forms 0.2, 20 not 2.0 (Zeros lead but do not follow!)

5. Subscription

These are instructions given to the pharmacist for dispensing the number of doses to the patient and how the medicine has to be taken before meal or after meal.

What is the pharmacist to do with the ingredients?

Quantity to be dispensed (determines amount in bottle) Dispense # 24.
For controlled substances write in numbers and letters (like a bank cheque)
i.e., 24 (twenty four)
Any special compounding instructions.

6. Signa, Signatura or Transcription

Sig – write, or let it be labelled (Latin terms: Signa or signatura)
Instructions for the patient

- Route of administration
  Oral, nasally, rectally, etc
  Take by mouth …, Give, Chew, Swallow whole, etc.
- Number of dosage units per dose
  Take one tablet, Give two teaspoonfuls, etc.
- Frequency of dosing
  every six hours, once a day …

- Duration of dosing
  for seven days, … until gone,...if needed for pain.
- Purpose of medication
  for pain, for asthma, for headache, etc.
  VERY IMPORTANT to include purpose as this reduces errors!
  "As directed by physician"
- Special instructions (shake well, refrigerate etc.)
- Warnings

7. Refills or renewal Instruction

Indicate either no refills or the number of refills you want (do not leave it blank). Determines maximum duration of therapy.

8. Signature, address and registration of Prescriber

This makes the prescription a legal document. Signature, prescriber registration number is necessary especially in case of habit forming drugs. Prescriber must write "brand necessary," "brand medically necessary," or "DAW" (Dispense as Written) to get non-generics.

Doctor's Name
Qualification (e.g MBBS, MD)
Regn. No. ..... (ALLOPATHY)
Full Address, Contact : (Telephone No., E-mail etc.)
Date

Name of the Patient _____
Address _____
Age & Sex _____ Weight _____
R_X
(1) Name of Medicine _____
Strength, dosage instruction, duration & total quantity _____

(2) - do -
(3) - do –

Doctor's signature
Stamp

DISPENSED
Date : _____ Pharmacist : _____
Name of Pharmacy : _____
City

Postal Address/E-mail/Mobile

1.5.2 Handling of Prescription

The following procedures should be adopted by the pharmacist while handling the prescription for compounding and dispensing:

(i) Receiving.
(ii) Reading and checking.
(iii) Collecting and weighing the materials.
(iv) Compounding, labelling and packaging.

I. **Receiving:** The prescription should be received by the pharmacist himself /herself. While receiving a prescription from a patient, a pharmacist should not change his/her facial expression that gives an impression to the patient that he/she is confused or surprised after seeing the prescription.

II. **Reading and checking:** Reading the prescription and checking for -

(a) Legality

(b) Legibility

(c) Completeness and correctness

(a) Legality: A prescription is legal when:

- It is written (can also be typed) by a R.M.P (Registered medical practitioner).
- Signed by the R.M.P.
- It has all the information required to be contained with respect to parts of prescription.

(b) Legibility: Legibility is a problem requiring alertness and critical judgment on the part of the pharmacist. Careless handwriting and similarity in spelling of names of different drugs add to the difficulty.

e.g. Prednisone and Prednisolone, Digoxin and Digitoxin. When handwriting is illegible, the best thing to do is to contact the physician over the phone and confirm.

(c) Completeness and correctness: The prescription serves as a vehicle for communication from the licensed practitioner to the pharmacist about the pharmaceutical care of the patient. Details to be checked are (i) Physician's details. (ii) Patient's details. (iii) Product details.

Checking the product details will include checking Name of the product, Dosage form, Strength/potency of the medicine, Total amount to be dispensed and its availability Dosage and directions for use, Frequency of administration.

III. **Collecting and weighing the material:** Before compounding a prescription all the materials required for it should be collected from the shelves or drawers and kept in the left hand side of the balance. After measuring each material should be kept on the right hand side of the balance. After compounding the prescription the materials are replaced back to the shelves / drawers where from they were collected. While compounding the label of every container of material should be checked thrice in the following manner:

- When collected from the shelves/drawers.
- When the materials are measured.
- When the containers are replaced back to the shelves/drawers.

IV. **Compounding, labeling and packaging:** Only one prescription should be compounded at a time. Compounding should be done on a clean table. All equipment required should be cleaned and dried. The preparation should be prepared according to the direction of the prescriber or as per methods given in pharmacopoeia or formulary and are according to established pharmaceutical art of compounding. The compounded medicament should be filled in a suitable container with appropriate label depending upon the quantity and use. While delivering the prescription to the patient, the pharmacist should explain the mode of administration, direction for use and storage.

1.5.3 Sources of Errors in Prescriptions

1. **Abbreviation:** In most of the prescriptions abbreviated terms are used by the prescriber that leads to major errors during interpretation by the pharmacists. For example: 'SSKI' is the abbreviated term of 'Saturated Solution of Potassium Iodide'. It is preferable to avoid this types of misleading abbreviations.
2. **Name of the drugs:** Names of some drugs (especially the brand names) either looks or sounds alike. So any error in the name of a drug will lead to major danger to the patient. e.g. Althrocin – Eltroxin, Acidin – Apidin etc
3. **Strength of the preparation:** Drugs are available in the market in various strengths. So a drug must not be dispensed if the strength is not written in the prescription. For example, Paracetamol tablet 500 mg should not be dispensed when no strength is mentioned in the prescription.
4. **Dosage form of the drug prescribed:** Many drugs are available in more than one dosage forms e.g. liquid, tablets, injections or suppositories. The dosage form intended for the patient must be mentioned in the prescription to reduce ambiguity.
5. **Dose:** If unusually high or low dose is mentioned in the prescription then it must be consulted with the prescriber. Some time a sustained release (SR) dosage form is prescribed thrice or more times daily. Actually Sustained Release dosage forms should be given once or twice a day.
6. **Instructions to the patient:** Sometimes the instruction for a certain preparation is either omitted or mentioned partially. The quantity of the drug to be taken, the frequency and timing of administration and route of administration should be mentioned clearly so that it is easy for patients to take medicine.
7. **Incompatibilities:** It is essential to check that there is no pharmaceutical or therapeutic incompatibilities in the prescription. If more than two medicines are prescribed then it is the duty of the pharmacist to see whether their interactions will produce any harm to the patient or not. Certain drugs has interactions with food. The pharmacist has to advise the patient about it. For example: Tetracycline should not be taken with milk or antacid.

1.5.4 Abbreviation used in Prescription

Abbreviation	Latin	English
tsp		teaspoon
troch.	trochiscus	lozenge
trit.	triturate	grind to a powder
tr, tinc., tinct.	tinctura	tincture
TPN		total parenteral nutrition
top.		topical
tinct.	tinctura	tincture
Tbsp		tablespoon
tal., t.	talus	such
tab.	tabella	tablet
t.i.w.		3 times a week
t.i.d., t.d.	ter in die	3 times a day
t.d.s., TDS	ter die sumendum	3 times a day
syr.	syrupus	syrup
susp.	suspensio	suspension
supp.	suppositorium	suppository
sum.	sumat [or] sumendum	let him take [or] let it be taken
subQ		subcutaneously
stat	statim	immediately
st.	stet	let it stand (for example, for settling)
SSRI		selective serotonin reuptake inhibitor [or] sliding scale regular insulin
SSI		sliding scale insulin or sliding scale regular insulin
SQ		subcutaneously
sol.	solutio	solution

... Contd.

SOB		shortness of breath
SL, s.l.	sub lingua	sublingually, under the tongue
sing.	singulorum	of each
sig.	signa, signetur	write (write on the label)
sem.	semen	seed
SC		subcutaneous
s.s., SS	semisse	one-half [or] sliding scale
s.o.s., si op. sit	si opus sit	if there is a need
s.i.d.	semel in die	once a day
s.a.	secundum artem	according to the art (accepted practice or best practice)
s.	signa	write (write on the label)
S	sine	without (usually written with a bar on top of the "s")
Rx, R_{x}, RX, ℞, ℟	recipe	take (often effectively a noun meaning "prescription"—medical prescription or prescription drug)
RL, R/L		Ringer's lactate
rep., rept.	repetatur	repeats
rep.	repetatur	let it be repeated
QWK		every week
q4PM		at 4 pm (can replace "4" with other numbers)
q.v.	quantum volueris [or] quod vide	at will [or] which see
q.s.	quantum sufficiat (subjunctive), quantum sufficit (indicative)	as much as suffices; a sufficient quantity
q.q.h.	quater quaque hora	every 4 hours
q.q.	quaque	every, each

... Contd.

q.p.m.	quaque die post meridiem	every evening (every day after noon)
q.o.d.	quaque altera die	every other day
q.n.	quaque nocte	every night
q.l.	quantum libet	as much as is requisite
q.i.d.	quater in die	4 times a day
q.h.s.	quaque hora somni	every night at bedtime
q.h.	quaque hora	every hour
q.d.s.	quater die sumendus	4 times a day
q.d.p.m.	quaque die post meridiem	once daily in the evening
q.d.a.m.	quaque die ante meridiem	once daily in the morning
q.d./q.1.d.	quaque die	every day
q.a.m.	quaque die ante meridiem	every morning (every day before noon)
q.a.d.	quaque alternis die	every other day
q.1 h, q.1°	quaque 1 hora	every 1 hour (can replace "1" with other numbers)
Q	quaque	every, per
pulv.	pulvis	powder
pt.	perstetur	continue
ppt.	præparata	prepared
pig./pigm.	pigmentum	paint
Ph.Int.	Pharmacopoeia Internationalis	International Pharmacopoeia
Ph.Eur.	Pharmacopoeia Europaea	European Pharmacopoeia
Ph.Br., BP	Pharmacopoeia Britannica	British Pharmacopoeia
Per	per	by or through
part. æq.	partes æquales	equal parts
p.v., PV	per vaginam	vaginally
p.r.n., PRN	pro re nata	as needed
p.r., PR	per rectum	rectally
p.o.	per os	by mouth *or* orally
p.m.	post meridiem	evening or afternoon

… *Contd.*

p.c.h.s., pc&hs	post cibum et hora somni	after meals and at bedtime
p.c.	post cibum	after meals
p.	perstetur	continue
o 2, o_2		both eyes
Oz		ounce
OPD		once per day
omn. hor.	omni hora	every hour
omn. bih.	omni bihora	every 2 hours
o.u.	oculus uterque	both eyes
o.s.	oculus sinister	left eye
o.n.	omni nocte	every night
o.m.	omni mane	every morning
o.d.	omni die	every day (once daily) (preferred to "qd" in the UK)
o.d.	oculus dexter	right eye
NTE		not to exceed
NS		normal saline (0.9%)
NPO, n.p.o.	nil per os	nothing by mouth
non rep.	non repetatur	no repeats (no refills)
noct.	nocte	at night
NMT		not more than
nebul, neb.	nebula	a spray (such as for insufflation)- nebulizer
MSO_4		morphine sulfate
MS		morphine sulfate or magnesium sulfate
mod. præscript.	modo præscripto	in the manner directed
mL		millilitre
mit., mitt.	mitte	send
mist.	mistura	mixture

... Contd.

min.	minimum [or] minim [or] minutum	minimum [or] minim [or] minute
$MgSO_4$		magnesium sulfate
mg/dL		milligrams per deciliter
mg		milligram
mEq		milliequivalent
mcg		microgram
max.	maximum	maximum
mane	mane	in the morning
m.d.u.	more dicto utendus	to be used as directed
M., m.	misce	mix
lot.	lotio	lotion
liq.	liquor	solution
lin	linimentum	liniment
lb.	libra	pound
lat. dol.	lateri dolenti	to the painful side
LAS		label as such
l.c.d.	liquor carbonis detergens	coal tar solution
kg		kilogram
IVPB		intravenous piggyback
IU		international unit
IT		intrathecal
IP		intraperitoneal
inf.	infusum	infusion (extraction) / intravenous infusion
ind.	indies	daily
IN		intranasal
IJ, inj.	injectio	injection
iii	tres tabuletta	three tablets
ii	duo tabuletta	two tablets
ID		intradermal

... Contd.

IBW		ideal body weight (for dosing based on clearance estimation)
i.v.p., IVP		intravenous push
i.v., IV		intravenous
i.m., IM		intramuscular
i	unus tabuletta	one tablet
hor. tert.	horis tertiis	every third hour
hor. intermed.	horis intermediis	at intermediate hours
hor. decub.	hora decubitus	at bedtime
hor. alt.	hora alternis	every other hour (every second hour; at alternate hours)
habt.	habeat	let him have
h.s.	hora somni (at the hour of sleep)	at bedtime [or] half-strength
h, hr, hor.	hora	hour
H		hypodermic
gutt.	gutta(e)	drop(s)
gtt(s)	gutta(e)	drop(s)
gr.	granum	grain
garg.	gargarisma	gargle
g, gm		gram (modern SI symbol is g, not gm)
ft.	fiat	make; let it be made
fl., fld.	fluidus	fluid (usually meaning specifically liquidin health care)
f.s.a.	fiat secundum artem	make according to art
f.m.	fiat mistura	make a mixture
f.h.	fiat haustus	make a draught
f. pil.	fiat pilula	make a pill
f.	fiat	make; let it be made
exhib.	exhibiatur	let it be given

… Contd.

ex aq.	ex aqua	in water
et	et	and
EOD		every other day
emuls.	emulsum	emulsion
elix.	elixir	elixir
e.m.p.	ex modo prescripto	as directed (in the manner prescribed)
DW		distilled water [or] dextrose in water (intravenous sugar solution)
DTO		deodorized tincture of opium
DS		double strength
dL		deciliter
div.	divide	divide
disp.		dispersible [or] dispense
dim.	dimidius	one-half
dil.		dilute
dieb. alt.	diebus alternis	every other day; on alternate days
det.	detur	let it be given
decoct.	decoctum	decoction
DC, dc, D/C, disc		discontinue [or] discharge
DAW		dispense as written (i.e., no generic substitution)
da	da	give
D5W, D_5W		dextrose 5% in water (intravenous sugar solution)
D5NS		dextrose 5% in normal saline (0.9%) (intravenous sugar solution)
D5LR		dextrose 5% in lactated Ringer's solution(intravenous sugar solution)
D10W, $D_{10}W$		dextrose 10% in water (intravenous sugar solution)

... Contd.

d.t.d.	dentur tales doses	give of such doses
d. in p. æ.	divide in partes æquales	divide into equal parts
D, d.	die [or] dosis	days [or] doses
cyath. vinos.	cyathus vinosus	a wine-glassful
cyath.	cyathus	a glassful
cuj.	cujus	of which
CST		continue same treatment
cr., crm		cream
cpt.	capiat	let him take (let the patient take)
contin.	continuetur	let it be continued
comp.	compositus	compound
colet.	coletur	let it be strained
cochl. parv.	cochleare parvum	a scant spoonful (a teaspoonful)
cochl. mod.	cochleare modicum	a modest spoonful (a dessert-spoonful)
cochl. mag.	cochleare magnum	a large spoonful (a tablespoonful)
cochl. infant.	cochleare infantis	a small spoonful (a teaspoonful)
cochl. ampl.	cochleare amplum	an ample spoonful (a tablespoonful)
cochl.	cochleare	spoonful
cib.	cibus	food
cf.	confer	compare
cap., caps.	capsula	capsule
cap.	capiat	let him take (let the patient take)
c.v.	cras vespere	tomorrow evening
c.n.	cras nocte	tomorrow night
c.m.s.	cras mane sumendus	to be taken tomorrow morning
c.m.	cras mane	tomorrow morning
c.c.	cum cibo	with food [or] cubic centimetre
c, c.	cum	with (usually written with a bar on top of the "c")

... Contd.

bucc.	bucca	buccal (inside cheek)
BSA		body surface area
BS		blood sugar
BP, Ph.Br.	Pharmacopoeia Britannica	British Pharmacopoeia
bol.	bolus	as a large single dose (usually intravenously)
BNF		British National Formulary
BM		bowel movement
bis ind.	bis indies	twice a day
bis in 7 d.	bis in septem diebus	twice a week
bis	bis	twice
bib.	bibe	drink
BDS, b.d.s.	bis die sumendum	twice daily
b.t.		bedtime
b.i.d., b.d.	bis in die	twice daily
ATC		around the clock
aq. ferv.	aqua fervens	hot water
aq. dest.	aqua destillata	distilled water
aq. com.	aqua communis	common water
aq. bull.	aqua bulliens	boiling water
aq.	aqua	water
amt		amount
amp.	ampulla	ampule (ampul, ampoule)
alt. h., alt. hor.	alternis horis	every other hour; at alternate hours
alt. d., alt. dieb.	alternis diebus	every other day; on alternate days
agit.	agita	agitate (stir or shake)
admov.	admove admoveatur	apply [or] add add; let there be added
add.	adde addatur	add let there be added
ad.	adde addatur	add let there be added

... Contd.

ad us.	ad usum	according to custom
ad lib.	ad libitum	Latin, "at one's pleasure"; as much as one desires; freely
AAA		apply to affected area
aa, āā, ĀĀ	ana	of each
a.u.	auris utraque	both ears
a.m.	ante meridiem	morning, before noon
a.l., a.s.	auris laeva, auris sinistra	left ear
a.d.	auris dextra	right ear
a.c.h.s., ac & hs	ante cibum et hora somni	before meals and at bedtime
a.c.	ante cibum	before meals
@		at
>		greater than
<		less than

1.6 POSOLOGY

The word posology is derived from the Greek words **'posos'** meaning how much and **'logos'** meaning science**.** So **posology** is a branch of medical science which deals with dose or quantity of drugs which can be administered to a patient to get the desired pharmacological actions.

1.6.1 Factors Affecting Posology

The following are some of the factors which influence the dose.

1. Age: The pharmacokinetics of many drugs changes with age. So while determining the dose of a drug, the age of an individual is of great significance. Children and old people need lesser amount of drug than the normal adult dose, because they are unable to excrete drugs to that extent as adults. Children can tolerate relatively larger amounts of belladonna, digitalis and ethanol, whereas elderly patients are more sensitive to some drug effects. For example, hypnotics and tranquillizers which may produce confusion states in them.

2. Gender: Women do not always respond to the action of drugs in the same manner as it is done in men. Morphine and barbiturates may produce more excitement before sedation in women. Special care should be taken when drugs are administered during menstruation, pregnancy and lactation. There are certain drugs which on administration to the mother are capable of crossing the placenta and affecting the foetus e.g. alcohol, barbiturates, narcotic and non-narcotic analgesics etc.

3. Body weight: The average dose is mentioned either in terms of mg per kg body weight or as a total single dose for an adult weighing between 50-100 kg. However, the dose expressed in this fashion may not apply in cases of obese patients, children and malnourished patients. It should be calculated according to body weight.

4. Route of administration: Intravenous doses of drugs are usually smaller than the oral doses, because the drugs administered intravenously enter the blood stream directly. Due to this reason the onset of drug action is quick with intravenous route and this might enhance the chances of drug toxicity. The effectiveness of drug formulation is generally controlled by the route of administration,

5. Time of administration: The presence of food in the stomach delays the absorption of drugs. The drugs are more rapidly absorbed from the empty stomach. So the amount of drug which is very effective when taken before a meal may not be that much effective when taken during or after meals. The irritating drugs are better tolerated if administered after meals for example, iron, arsenic and cod-liver oil should always be given after meals.

6. Environmental factors: Daylight is stimulant, enhancing the effect of stimulating drugs and diminishing the effect of hypnotics. Darkness is sedative. Hypnotics are more effective at night. The amount of barbiturate required to produce sleep during day time is much higher than the dose required to produce sleep at night. Alcohol is better tolerated in cold environments than in summer.

7. Emotional factors: The personality and behaviour of a physician may influence the effect of drug especially the drugs which are intended for use in a psychosomatic disorder. The females are more emotional than males and requires less dose of certain drugs.

8. Presence of disease: Drugs like barbiturates may produce unusually prolonged effect in patients having liver cirrhosis. Streptomycin is excreted mainly by the kidney may prove toxic if the kidney of the patient is not working properly.

9. Accumulation: The drugs which are slowly excreted may built up a sufficient high concentration in the body and produce toxic symptoms if it is repeatedly administered for a long time e.g. digitalis, emetine and heavy metals. This occurs due to accumulative effect of the drug.

10. Additive effect: When the total pharmacological action of two or more drugs administered together is equivalent to sum of their individual pharmacological action, the phenomena is called as an additive effect. For example, combination of ephedrine and aminophylline in the treatment of bronchial asthma.

11. Synergism: When two or more drugs are used in the combination their action is increased. The phenomena is called synergism.

12. Antagonism: When the action of one drug is opposed by the other drug on the same physiological system is known as drug antagonism. The use of antagonistic responses to drugs is valuable in the treatment of poisoning e.g. milk of magnesia is given in acid poisoning where alkaline effect of milk of magnesia neutralise the effect of acid poisoning.

13. Idiosyncrasy: An extraordinary response to a drug which is different from its characteristic pharmacological action is called idiosyncrasy. The word idiosyncrasy has now been replaced by the term drug allergy. For example, small quantity of aspirin may cause gastric haemorrhage and a small dose of quinine may produce ringing in the ears.

14. Tolerance: When an unusually large dose of a drug is required to elicit an affect ordinarily produced by the normal therapeutic dose of the drug, the phenomenon is termed as drug tolerance. e.g., smokers can tolerate nicotine, alcoholic can tolerate large quantity of alcohol.

15. Metabolic disturbances: Changes in water electrolyte balance and acid base balance, body temperature and other physiological factor may modify the effects of drugs. Salicylates reduce body temperature only in case an individual has rise in body temperature. They have no antipyretic effect if the body temperature is normal.

1.6.2 Formulae used in Calculations of Pediatric Dose

1. **Clark's formula:**

   Child's dose = weight in (lbs)/150 × Adult dose

   Child's dose = weight in (kg)/70 × Adult dose

2. **Dilling's formula:** Used for calculating dose of child from 12-20 years of age.

   Child's dose = Age in years /20 × Adult dose

3. **Fried's formula:** Used for calculating dose of an infant upto 24 months of age.

   Child dose = Age in months /150 × Adult dose

4. **Young's formula:** Used for calculating dose of child from 1-12 years of age.

   Child dose = Age in years/Age + 12 × Adult dose

5. **Cowling's formula:** Child's dose = Age at next birthday/24 × Adult dose

6. **Bastedo's Formula:** Child's dose = Age in Years/ 30 × Adult dose

7. **Calculation based on body surface area:**

   Child's dose = body surface area of the child/1.73 sq. m × Adult dose

Example 1.1: Calculate the dose for a child of 6 years old for olanzapine by young's formula when adult dose of the drug is 150 mg.

Solution: Child dose = A/A + 12 × Adult dose

6/6 + 12 × 150 = 50 mg

Example 1.2: How will you calculate a dose for a child of 5 years old by Dilling's formula when adult dose of the drug is 1 gm.

Solution: Child Dose = A/20 × Adult dose

= 5/20 × 1 = 0.25 gm

Example 1.3: Calculate the dose of a child of 18 month old by Fried's formula when the adult dose is 500 mg.

Solution: Child Dose = Am/150 × Adult dose where Am is the age of child in month.

= 18/50 × 500 = 60 mg.

Example 1.4: How will you calculate a dose for a child 7 years old by Cowling's formula when the adult dose is 300 mg.

Solution: Child Dose = A/24 × Adult dose

where A = age of child at next birthday in years

8/24 x 300 = 100 mg.

Example 1.5: Calculate the dose for a child of 5 years old whose weight is 22 pounds and adult dose is 600 mg.

Solution: Child Dose = W/150 × Adult dose

where, W is the weight of child in pound.

= 22/150 × 600 = 88 mg.

Example 1.6: Calculate a dose for a child of 5 years old whose surface area is 1.5 m^2 whose adult dose is 40 mg.

Solution: Child Dose = S.A /1.73 × Adult dose

where, S.A. = Body surface area of child in m^2

= 1.5/1.73 × 40 = 34.7 mg