Toxicology Lec 1. Dr. Siham

Concepts and Terminology of toxicology .

Toxicology :-Is the science of poisons and study the toxicities effects of chemicals or physical agents on living organisms under specific condition.

Clinical toxicology :-It studies the diseases induced or associated with toxicants. It is also concerned with the chemical properties of toxicants and their biological effects, diagnosis & treatment.

A poison Or Toxicant :-any substance solid, liquid, or gas that interferes with the life processes of cells of the organism.

Toxicity:- The quantity or amount of a poison that causes a toxic effect.

Toxicosis:- A disease state that results from exposure to a poison.

Toxin A poison:- That originates from biological processes or a **biotoxin**.

Zootoxins ,toxine from animals. **Phytotoxins** ,toxine from plant toxins. **Mycotoxins**, fungal toxins.

Toxic dose:- The amount of poison(toxicant) that received by animal.

Mechanism of toxic action: The necessary biologic interactions by which a toxicant exerts its toxic effects on an organism. e.g. CO poisoning due to the binding of Co to Hb thus preventing the transport of O2 within the blood.

Dosage:-

The dose is dependent upon

1-The concentration.

2- The properties of the toxicant.

3-The timing and frequency of exposure.

4- The length of exposure.

5- The exposure pathway.

The effective dose:- Is the dose of drug or toxicant that produces desired effect in a population.

Safety The probability that adverse effects will not happen. Or will not produce toxic effects.

Side effects The undesirable effects that results from therapeutic doses of chemicals. It will not happen or will not produce toxic effects.

Lethal dose (LD):- Is the lowest dose of compound that causes death**.**

Median Lethal dose 50 or(LD50) : It is a dose of compound or chemical that kill 50% percent of the animals,LD50 is measure of toxicity .

Threshold dose:- The highest dose of a toxicant at which toxic effects are not observed.

The lethal concentration :- Is the lowest concentration of a chemical or drug (in feed or water) that causes death.

Xenobiotics: Is a general term referring to any chemical foreign to an organism or, in other words, any compound not occurring within the normal metabolic pathways of a biological system

Exposure period :-It's the length of time an animal is exposed to a drug or chemical .

Toxicity can be classified according to duration of exposure into four main types:-

1-Acute :-Exposure to a single or multiple dose of toxicant during of 24 hr of period **.**

2-subacute:- Exposure to multiple dose of toxicant greater than 24 hr of but for as long as 30 days.

3-subchronic:- Exposure to toxicant greater from 1-3 month .

4-chronic:- Exposure to toxicant for 3 months or longer. Chronic duration carcinogenicity studies in rats can last up to 2 years (104 weeks), whereas chronic duration (life span) studies in dogs can last several years.

Route of exposure:- The route of exposure is an important component of assessing the toxicity of a chemical or drug.

The most common routes of exposure are **inhalation**, **oral**, and **dermal** .Less frequently routes of exposure include **rectal**, sublingual **subcutaneous**, and **intra muscular**.

Types of toxicologic effects:

1.Graded toxic effects.

2.Quantal toxic effects.

3.Immediate toxic effects.

4.Delayed toxic effects.

5.Local toxic effects.

6.Systemic effects.

7. Target organ effects.

Types of toxicology :-

Mechanistic toxicology: The study of how a chemical causes toxic effects by investigating its absorption, distribution,metabolism and excretion.

Descriptive toxicology: The toxic properties of chemical agents are systematically studied for various endpoints using a variety of different organisms.

Clinical toxicology: They study of toxic effects of various drugs in the body, and are also concerned with the treatment and prevention of drug toxicity in the population.

Forensic toxicology: A branch of medicine that focuses on medical evidence of poisoning, and tries to establish the extent to which poisons were involved in human deaths.

Environmental toxicology: The study of the effects of pollutants on organisms, populations, ecosystems, and the biosphere.

Regulatory toxicology: The use scientific data to decide how to protect humans and animals from excessive risk.

Therapeutic index (TI):-Is defined by the ratio of the LD50 to the Ed50. (TI) = LD50/ED50, the TI is a unitless estimate that characterizes the relative safety of a drug or chemical .The larger the TI, the more "safe" a chemical is relative to another with a smaller TI.

For example, if chemical X has an LD50 of 1000 mg/kg and an ED50 of 10 mg/kg, the TI would be 100 (the mg/kg units cancel). Compare this to chemical Y, which has an ED50 of 40 mg/kg. The TI of chemical Y is 1.25, a much less safe chemical when compared with chemical X.

Standard safety margin (SSM) or margin of safety (MoS) :- Is defined by the ratio of the LD1 to the ED99 . SSM = LD1/ED99, the SSM, like the TI, is a unitless estimate that characterizes the relative safety of a drug or chemical, but much more conservative data are used. The larger the SSM, the more safe the chemical tends to be relative to other chemicals with smaller SSMs Hazard (risk).

Hazard, or risk:- is the likelihood that a chemical or drug will cause harm under certain conditions.

Risk assessment is a specialized area of toxicology that is of great importance to health assessors and government regulators.

Carcinogenicity:- It's the ability of

a compound or chemical to transform normal cells into progressively & uncontrollably proliferating ones & resulting into neoplasms or cancer.

Generally , any substance shown to induce cancer or neoplasm is termed as carcinogen e.g.(cadmium,benzene, vinyl chlorid)..

Teratogenicity:- is the ability of an agent to induce gross structural (anatomical) or and physiological malformations in a developing fetus during gestation(rubella, thalidomide, PCBs, Dioxins).

Mutagenicity :- may induce hereditary genetic defects or increase their incidence and effect on the germ cells (gonads). (radiation, nitrosoami nes).