Welcome students to this session for Bachelor of Science, 3rd year of Zoology for semester six, in the course of environmental biology and toxicology with the course code Z0C109.

The title of the unit is Environmental toxicology. Module is on poisons and classification of poisons.

Myself, I'm Rita Sharma, Associate professor from Government College of Arts, Science and Commerce, Quepem, Goa.

The outline of this topic includes- Poison: introduction and definition, classification of poisons- corrosives, irritants, neurotics, cardiac poisons and special poison.

On completion of this module, the student will be able to know about poisons, classify poisons based on the mode of action. Understand the difference between corrosive irritants, nerve and heart poisons. Will be able to identify the symptoms of poisoning to decide their treatment.

Introduction: A poison is a substance capable of producing adverse effects on an individual under appropriate conditions. The term substance is synonymous with chemical and includes drugs, vitamins, Pesticides, pollutants and proteins. Radiation is also a toxic substance. The term adverse effect refers to the injury such as structural damage to the tissues. Appropriate condition refers to the dosage of the substance that is sufficient to cause these adverse effects. The dose concept is important because according to it, even a substance such as water or even food is poisonous if too much is ingested. Whether a drug acts as a therapy or as a poison depends on the dose.

To initiate the poisoning, the organism is to be exposed to the toxic chemical. When a toxic level of the chemical is accumulated in the cells of the target tissue or organ, the resultant injury to the cells disrupts their normal function and structure. Symptoms and toxic signs then develop and if the toxicity is severe enough that may result in death.

Definition- poison may be defined as a substance which, when absorbed into the living organism, or when acts locally on its tissues, injures the health or destroys life.
Or in Biochemistry it can be defined as a substance, natural or synthetic that causes damage to living tissues and has an injurious or fatal effect on the body, whether it is ingested, inhaled or absorbed or injected through the skin.

The most common domestic products associated in poisoning cases are cleaning solutions, fuels, medicines, and other materials such as glue and cosmetics.
Certain animals secrete poison, commonly referred to as venom, which is usually injected with a bite or a sting such as snake and scorpion poisons.

Some household plants like Datura, some cacti and pollen of flowers can also prove to be noxious to human and animals.

The systematic study of poison began during the 16th century when the German Swiss physician Paracelsus first stressed the chemical nature of poisons. It was Paracelsus who introduced the concept of dose and studied the actions of poison through experimentation.
Poisoning involves four elements. The poison, the poisoned organism, the injury caused to the cells and the symptoms and signs of poisoning or death, which in turn represent the course subject, effect and consequences of poison.

Classification of poisons.
A mode of action defines a functional or anatomical modification at the cellular level, starting from the exposure of a living organism to a material or a substance. For practical purposes in toxicology, poisons are classified into four classes based on the mode of action. Corrosives, irritants, neurotics, also called as nerve poisons and cardiac poisons
Corrosives- A corrosive poison is simply a highly active irritant, which produces inflammation and ulceration of the tissues. Basically, a corrosive poison destroys and erodes the surface with which it comes in contact. It acts by extracting water from the tissues and coagulates cellular proteins.
Corrosives consists of strong acids and strong alkalis. These include mineral acids such as sulfuric acid, nitric acid, hydrochloric acid; organic acids such as oxalic acid, acetic acid, salicylic acid and concentrated alkalis such as caustic soda, carbonates, ammonium, sodium and potassium.

Symptoms- Pain is felt in parts which come in contact with the corrosive. When swallowed violent burning pain from mouth to alimentary tract followed by uncontrolled vomiting. The patient collapses, skin becomes cold with sweating and pulse becomes feeble. Difficulty in breathing, an intense thirst, swallowing becomes difficult, rather impossible.

Treatment -There are three ways of counteracting the action of corrosives.
First, neutralization by an antidote. In case of acid, neutralization is done by giving mild alkalis and chalk, egg shells. While in case of alkali, by dilute acids like vinegar and lime juice.
Second, dilution of the corrosives by giving plenty of water to drink, and
Third way is administration of egg white, butter, rice water etc which provides a soothing effect.

Irritants- Irritants produce inflammation of the part which comes in contact but does not destroy the tissues. Corrosives in dilute solutions act as irritants.
Examples of non-metallic irritants are phosphorus, chlorine, bromine and iodine. The metallic poisons include arsenic, antimony, mercury, lead, copper, thallium, zinc, manganese, barium and radioactive substances.
Examples of plant poison are caster, marking nut, ergott and calotropis.
Animal poisons include snakes, insects, spiders etc.

Symptoms- When swallowed, the symptoms do not appear immediately. There is usually half an hour or so for commencement of the symptoms.
Pain is felt from mouth to stomach. violent vomiting and purging occurs with intense thirst. Gradually the patient collapses.

Treatment- Similar to corrosives, acid should be neutralized with mild alkalis and vice versa.
Demulcent drinks should be freely given. Specific treatment only by a physician

Neurotics- Neurotic poisons act only on the nervous system after absorption into the system.
This group consists of poisons that have specific action on the cerebrum, spinal cord and peripheral nerves.
Neurotics are divided into four groups based on specific symptoms exhibited.

- Narcotics,
- Deliriants,
- Excitants and
- Spasmodics.

Narcotics produce symptoms such as drowsiness, passing into deep sleep and coma.
Example of narcotics is opium, morphine.

Deliriants produce active delirium, sudden fits of laughter, catching at imaginary objects, staggering and becoming insensate.
Examples are the Datura fruit and flower, belladonna.

Excitants- These produce excitement, reduced control over the movement. Deep sleep passing onto coma.
Examples are alcohol, hemp and cocaine.

Spasmodics- These produce muscular spasm and fixation of heart. Death results from suffocation or exhaustion.
Examples are Strychin, Nux vomica.

Treatment- Neurotically affected person should be kept under observation and soon treated by a competent physician. However, an attempt to induce vomiting should be made as quickly as possible.

Cardiac poisons- These have mainly action on the heart, either directly on the musculature or through its nerve supply. These poisons generally produce deleterious effect on the action of the heart due to poisoning of the cardiac muscle or of its conducting system.
Most of the cases reported related to cardiac poisons are due to accidental poisoning by plants containing certain compounds called as glycosides or alkaloids, which are poisonous in nature and effect.
The best known cardioactive glycoside is *digitalis purpurea,* which is commonly called as Fox glow.

Certain chemical compositions are also responsible for death due to cardiac poisoning. Such chemicals may be medicines related to blood pressure or other cardiac irregularities, which are although taken for the treatment of cardiac irregularities but they may affect adversely, which could be lethal.
Examples- Nicotine, Digitalis, Aconite hydrocyanic acid, Reserpine and Methyldopa.

Symptoms of cardiac poisoning are giddiness, fainting, low pulse and respiratory failure.

Treatment- Immediate intake of excess of water followed by immediate hospitalization.

Special poisons are the ones which are normally used for homicidal, suicidal or accidental.
For homicidal purposes, arsenic is most commonly used and for Suicidal or infanticidal purposes, opium is commonly used. Frequently used poisons, arsenic and opium, so lives may be saved if timely treatment is given.
Arsenic- It is easily available, tasteless, colourless and odourless, hence can be easily mixed with food in small quantity to kill a person.

Symptoms- It commences about half an hour after consumption. Arsenic, an irritant poison causes burning pain in the throat, stomach and abdomen. Thirst, vomiting, purging are signs of poisoning. Presence of blood in vomit and stools. Scantiness of urine, cramps, feeble pulse, headache, delirium, etc are the symptoms. Death occurs within 24 hours.

Treatment- Vomiting should be encouraged. The patient should be given plenty of mild warm water. Freshly prepared, hydrated ferric oxide is used as an antidote, it should be given a tablespoon every 5 -10 minutes until the symptoms are relieved. Doctor should be consulted immediately.

Opium- Solid opium often mixed with mustard oil, is swallowed to commit suicide.

Symptoms- These commence half an hour after consumption. There is excitement followed by giddiness and drowsiness followed by deep sleep, coma and unconsciousness. The odour of opium can be detected in the breath of the patient. Breathing becomes shallow and slow, pulse weak and irregular, the skin sweats and becomes cold and the pupil gets contracted. Death usually occurs in about 12 hours.

Treatment- Solution of common salt in hot water should be given immediately to initiate vomiting. Tickling of the throat also excites vomiting. Patient should be kept awake by sprinkling water on face and head and wet towel to be kept on the head. Patient should be given hot coffee to drink if conscious. Artificial respiration may be given. Patient should be kept under the observation of a physician.

References-
Fundamentals of toxicology by Pandey Shukla and Trivedi,

Textbook of Environmental Biology by Verma an Agarwal.