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EDUCATION AND VIGILANCE ARE KEY IN PREVENTING POISONING INCIDENTS AND MINIMIZING HARM

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Abstract

Poison is a natural or synthetic substance that causes damage to living tissues. It has an injurious or fatal effect on the body whether it is ingested, inhaled, absorbed, or injected through the skin. When poison is introduced into the body in sufficient quantities, can cause harm or even death by disrupting normal biological functions. Poisons are classified into several categories, including chemical, biological, and physical poisons, each having distinct mechanisms of action. Chemical poisons, such as heavy metals, pesticides, and industrial chemicals, often interfere with cellular processes, while biological poisons, such as toxins produced by bacteria, plants, and animals, can cause severe damage through enzymatic or metabolic disruption. Physical poisons, like radiation, cause cellular and tissue damage through energy transfer. The effects of poisons depend on factors such as dosage, exposure route, and individual susceptibility. The diagnosis and management of poisoning require prompt intervention, which may include decontamination, antidote administration, and supportive care. Understanding the biochemical pathways involved in poisoning has led to advancements in the development of antidotes and therapies aimed at neutralizing toxic effects.

Keywords: Natural or synthetic poisons, effect on the body, can cause harm or even death, the diagnosis and management of poisoning, which may include decontamination, antidote, administration and supportive care.

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Introduction

Poison refers to any substance, whether solid, liquid, or gas, that can cause harm to living organisms when it is absorbed into the body. These harmful substances disrupt the normal functioning of cells and organs, leading to toxicity, illness, or even death, depending on the nature and amount of poison involved. Poisons can enter the body through various routes, including ingestion, inhalation, skin contact, or injection. They may originate from various sources such as plants, animals, chemicals, and even manufactured goods [1].

The effects of poison depend on several factors, including the type of substance, the dose, the duration of exposure, and the individual's age, health, and genetic factors. Some poisons act quickly, while others may take days or even weeks to show symptoms. Common examples of poisons include toxic chemicals like cyanide, venom from certain snakes and insects, and harmful substances found in some plants, like ricin or poison ivy.

While the concept of poison has long been associated with malicious intent, poisoning can also occur accidentally or through environmental exposure [2, 3]. The study of poisons, or toxicology, is crucial for understanding their mechanisms of action, identifying symptoms, and developing treatments or antidotes. Poison control centers and healthcare professionals play an essential role in managing poisoning cases and minimizing harm, emphasizing the need for education and awareness about the risks associated with toxic substances.

Poison is a broad term that describes substances that cause harm when introduced into the body. Their harmful effects disrupt the normal functioning of cells and biological systems, often interfering with metabolic processes or damaging vital organs. Poisons can cause a wide range of symptoms depending on their type and

how they enter the body. These effects may be immediate or delayed, and they can range from mild discomfort to severe organ failure or death [4].



Fig: 01[04]

Classification of Poisons

Poisons can be classified in various ways based on their origin, chemical structure, target organs, or the mechanisms by which they cause harm. Below is a breakdown of the most common methods of classifying poisons:

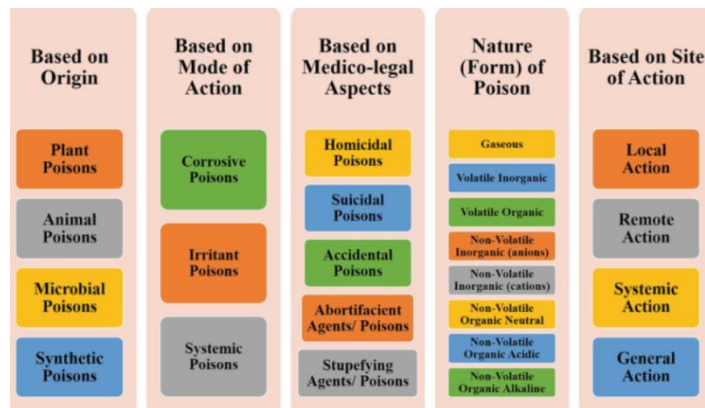


Fig: 02[04]

1. Based on Origin:

- **Chemical Poisons:** These are synthetic or naturally occurring toxic substances that can cause harm to the body. Examples include industrial chemicals, heavy metals, and pesticides.
- **Biological Poisons (Toxins):** These poisons are produced by living organisms, such as plants, animals, bacteria, and fungi. Toxins can be highly specific in their action and may target particular tissues or organs. Examples include snake venom, botulinum toxin, and plant toxins like ricin.



Fig: 03[08]

- **Physical Poisons:** These substances cause harm through physical mechanisms rather than chemical or biological means. Examples include radiation, extreme heat or cold, and pressure changes (such as decompression sickness).

2. Based on the Chemical Structure:

- **Organic Poisons:** These poisons contain carbon in their molecular structure and can include a variety of substances like alcohol, hydrocarbons, and drugs. Organic poisons are often more complex and may be derived from plants, animals, or synthetic sources. Examples include ethanol (alcohol), cyanide, and heroin.
- **Inorganic Poisons:** These poisons do not contain carbon and usually consist of simple elements or compounds. They often affect the body by interfering with enzymatic processes or causing organ damage. Examples include heavy metals (lead, mercury, arsenic), chlorine gas, and hydrogen sulfide.

3. Based on Mode of Action:

- **Neurotoxic Poisons:** These poisons primarily affect the nervous system by interfering with nerve cell communication. They can cause paralysis, convulsions, or neurological damage. Examples include:
 - *Botulinum toxin* (from *Clostridium botulinum*), which blocks neurotransmitter release.
 - *Sarin* (a nerve agent), which inhibits acetylcholinesterase, leading to nerve over-stimulation.
- **Cytotoxic Poisons:** These poisons directly damage cells, leading to cell death or dysfunction. This type of poison may destroy tissue or impair organ function. Examples include:
 - *Cyanide*, which inhibits cellular respiration.
 - *Ricin*, a protein toxin from castor beans that interferes with protein synthesis in cells.
- **Hematotoxic Poisons:** These poisons primarily affect the blood, disrupting the normal function of red blood cells, platelets, or clotting factors. Examples include:
 - *Carbon monoxide*, which binds to hemoglobin, reducing oxygen delivery to tissues.
 - *Warfarin*, a substance that prevents blood clotting and increases the risk of hemorrhage.
- **Hepatotoxic Poisons:** These poisons damage the liver, impairing its detoxification functions. The liver is a key organ involved in processing toxins and drugs. Examples include:
 - *Acetaminophen (paracetamol)* in high doses, which can lead to liver failure.
 - *Alcohol*, which, in excessive amounts, can cause cirrhosis or fatty liver.
- **Renotoxic Poisons:** These poisons primarily affect the kidneys, disrupting filtration, reabsorption, or secretion processes. Examples include:
 - *Ethylene glycol* (antifreeze), which can cause acute kidney failure.
 - *Mercury* and *lead*, which can lead to kidney damage over time.
- **Cardiotoxic Poisons:** These poisons have a detrimental effect on the heart, disrupting its electrical or mechanical function. Examples include:
 - *Digitoxin* (found in foxglove), which can cause arrhythmias.
 - *Cocaine*, which can cause myocardial infarction (heart attack) due to vasoconstriction [5,6].

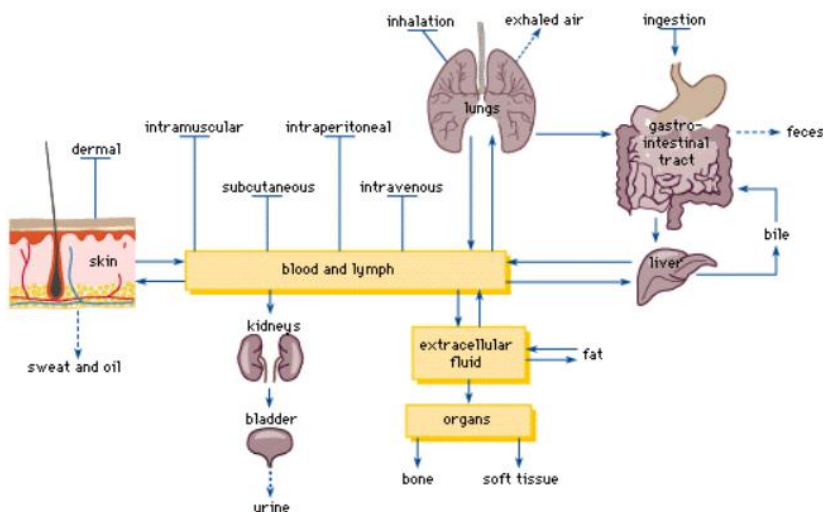


Fig: 04[5,6]

4. Based on Symptoms or Effects:

- **Acute Poisons:** These poisons produce immediate or short-term effects that can lead to rapid deterioration of health or death if not treated quickly. Acute poisoning typically occurs after a single exposure to a toxic dose. Examples include:
 - *Sarin* nerve agent, which causes rapid onset of symptoms (convulsions, paralysis).
 - *Carbon monoxide*, which leads to asphyxiation and can kill in a short time.



Fig: 05[06]

- **Chronic Poisons:** These poisons cause long-term damage after prolonged exposure to low levels over time. Symptoms may develop gradually and may not be immediately obvious. Chronic poisoning often results from repeated exposure or accumulation of the toxin in the body. Examples include:
 - *Lead poisoning*, which can cause developmental delays and neurological damage over time, particularly in children.
 - *Asbestos*, which can lead to lung cancer or asbestosis after prolonged inhalation.



Fig: 06[05, 06]

Chronic Arsenic poisoning

5. Based on Method of Entry into the Body:

- **Ingested Poisons:** These poisons enter the body through the digestive tract (mouth, stomach, intestines). Common examples include:
 - *Poisonous plants* like oleander.
 - *Foodborne toxins* like salmonella or E. coli.
- **Inhaled Poisons:** These poisons enter the body through the respiratory system, typically by breathing in toxic gases or particles. Examples include:
 - *Carbon monoxide* from incomplete combustion.
 - *Cyanide gas* or *chlorine gas* from industrial accidents.
- **Absorbed Poisons:** These poisons enter through the skin or mucous membranes. Examples include:
 - *Pesticides* and *herbicides* absorbed through skin contact.

- *Organophosphate compounds*, which can enter through skin contact and affect the nervous system.
- **Injected Poisons:** These poisons enter directly into the bloodstream, typically through a needle, insect sting, or bite. Examples include:
 - *Snake venom* from venomous snakes.
 - *Heroin* or other intravenous drugs.

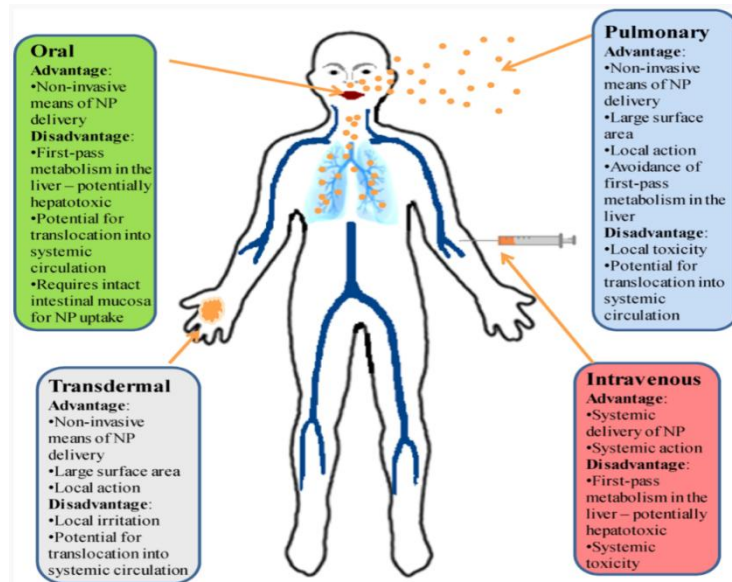


Fig: 07[8]

6. Based on Lethality

- **Very Toxic Poisons:** These substances are highly lethal, even in small doses. For example, a few milligrams may be fatal. Examples include:
 - *Botulinum toxin*, which is lethal in small amounts.
 - *Ricin*, derived from castor beans, which is deadly in minute quantities.
- **Moderately Toxic Poisons:** These require higher doses to cause serious harm but can still be lethal if exposure is prolonged or high enough. Examples include:
 - *Mercury* in certain forms.
 - *Caffeine* in large quantities.
- **Mildly Toxic Poisons:** These may cause harm, but are typically not fatal unless consumed in very large amounts. They may cause minor health problems, but recovery is often possible with appropriate treatment. Examples include:
 - *Nicotine* in small doses.
 - *Ethanol* (alcohol), when consumed in excess over time.

Symptoms

The symptoms of poisoning depend on the type of poison, the amount, and the way it was ingested (swallowed, inhaled, absorbed through the skin, etc.). Here are some common symptoms of poisoning:

General Symptoms of Poisoning:

- Gastrointestinal Issues: Nausea, vomiting, diarrhea, stomach pain
- Neurological Symptoms: Dizziness, confusion, seizures, unconsciousness, slurred speech
- Respiratory Problems: Difficulty breathing, coughing, wheezing, chest pain
- Heart Issues: Irregular heartbeat, slow or rapid pulse, low blood pressure
- Skin Reactions: Rash, irritation, burns, excessive sweating, or pale/blue skin
- Psychological Changes: Hallucinations, agitation, drowsiness, mood changes
- Eye Symptoms: Blurred vision dilated or constricted pupils, eye pain.

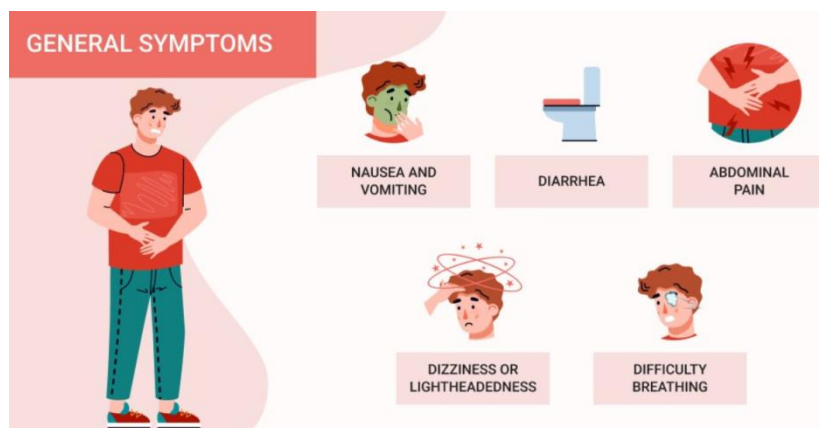


Fig: 08[9]

Severe Poisoning Symptoms (Life-Threatening):

- Loss of consciousness
- Difficulty breathing or not breathing
- Seizures
- Severe confusion or hallucinations
- Chest pain or heart palpitations.

Common Types of Poisoning & Their Symptoms:

- Food Poisoning: Nausea, vomiting, diarrhea, fever, dehydration
- Carbon Monoxide Poisoning: Headache, dizziness, weakness, confusion, loss of consciousness
- Chemical Poisoning (Cleaning Products, Pesticides, etc.): Burning sensation in the throat, difficulty breathing, skin irritation
- Drug Overdose: Drowsiness, confusion, slowed breathing, unresponsiveness
- Alcohol Poisoning: Confusion, vomiting, seizures, slow breathing, unconsciousness

Tab: 01[11]

S.No.	Sign and Symptoms	Type of Poison involved
1.	Nausea, vomiting, abdominal pain, tinnitus, deafness, sweating, fever, disorientation, lethargy, hyperventilation, vasodilatation, metabolic acidosis	Salicylates
2.	Nausea, vomiting, abdominal pain, jaundice, confusion, coma may develop later	Acetaminophen
3.	Agitation, restlessness, tremor, mydriasis, anxiety, arrhythmias, convulsions, tachycardia,	Sympathomimetics
4.	Delirium, hyperthermia, agitation, tachycardia, mydriasis	Ecstasy (MDMA), amphetamines, cocaine
5.	Blurred vision, dry mouth, fever, hypotension, coma, seizures, confusion, , mydriasis, sinus tachycardia arrhythmias, respiratory depression, hyper-reflexia, myoclonus,	Tricyclic antidepressants, orphenadrine, antihistamines less commonly,
6.	Blindness	Quinine, methanol
7.	Drowsiness, hypotension, hypothermia, lethargy, dysarthria, coma, ataxia, respiratory depression with overdoses	Benzodiazepines
8.	Hyper-salivation, miosis, bronchorrhoea	Organophosphate and carbamate insecticides, nerve
9.	Anxiety, nausea, vomiting, euphoria, headache, chest pain, hypertension , fever, tachycardia, tachypneaagitation, twitching, mydriasis, diaphoresis, confusion, hypotension, abdominal cramps, cardiopulmonary arrest, hallucinations, seizures,	Cocaine

Diagnosis of Poisoning

Diagnosing poisoning involves a combination of medical history, physical examination, and laboratory tests to determine the type of toxin and its effects on the body.

1. Medical History & Symptoms Analysis:

A doctor will ask about:

- Symptoms and when they started
- Any exposure to chemicals, medications, or toxic substances
- Any unusual food or drinks consumed
- The environment (e.g., exposure to fumes, insect bites, or contaminated water)
- Any suicide attempts or accidental ingestions

2. Physical Examination

- Vital Signs: Checking heart rate, breathing rate, blood pressure, and temperature
- Skin & Eyes: Looking for burns, rashes, pupil changes (dilated or constricted), jaundice
- Neurological Exam: Testing reflexes, coordination, and mental status
- Breath Odor: Certain poisons have distinct smells (e.g., fruity odor for diabetic ketoacidosis, garlic for arsenic poisoning)

3. Laboratory Tests & Imaging

- Blood Tests: To check for toxic substances, organ function, and blood gas levels
- Urine Tests: Identifies drugs, heavy metals, and other toxins
- Electrocardiogram (ECG): Detects heart rhythm abnormalities
- Liver & Kidney Function Tests: To assess organ damage from poisoning
- X-rays or CT scans: May be used to detect swallowed objects or lung issues (e.g., inhaled toxins)

4. Specific Poison Detection Tests

- Carbon Monoxide Poisoning: Blood carboxyhemoglobin levels
- Paracetamol (Acetaminophen) Overdose: Blood acetaminophen level
- Lead Poisoning: Blood lead levels
- Alcohol or Drug Overdose: Blood alcohol level, toxicology screen
- Organophosphate (Pesticide) Poisoning: Blood cholinesterase levels.

Treatment Options for Poisoning

The treatment for poisoning depends on the type of poison, how it was ingested, and the severity of symptoms. Immediate medical attention is crucial.

1. General First Aid for Poisoning

- Call Emergency Services or Poison Control immediately.
- Do NOT induce vomiting unless instructed by a healthcare professional.
- Identify the Poison: If possible, provide information about the substance, amount, and time of exposure.
- Check for Breathing & Consciousness: If unconscious or not breathing, begin CPR if trained.

2. Specific Treatments Based on Type of Poisoning

A. Ingested Poisoning (Swallowed Toxins, Medications, Food Poisoning)

- Activated Charcoal: Absorbs toxins in the stomach (only given in medical settings).
- Gastric Lavage ("Stomach Pumping"): Used in severe cases if ingestion was recent.
- Antidotes: Specific antidotes are available for certain poisons (see below).
- IV Fluids: To prevent dehydration and support organ function.

B. Inhaled Poisoning (Carbon Monoxide, Chemical Fumes, Gas Exposure)

- Move to Fresh Air Immediately.
- Oxygen Therapy: Administered in a hospital setting, sometimes in a hyperbaric chamber for severe carbon monoxide poisoning.

C. Skin or Eye Exposure (Chemical Burns, Pesticides, Acids/Bases)

- Rinse the affected area with plenty of water for at least 15-30 minutes.
- Remove contaminated clothing.
- Avoid applying creams or ointments unless instructed by a doctor.

D. Injection Poisoning (Drug Overdose, Snake Bites, Insect Stings)

- For Drug Overdose:
 - Naloxone (Narcan): Used for opioid overdoses.
 - Flumazenil: Used for benzodiazepine overdoses.
- For Snake or Insect Bites:
 - Keep the person calm and immobilized.
 - Do NOT suck out the venom.
 - Antivenom may be required in the hospital.

3. Common Poison Antidotes [8]

Tab: 02

Poison	Antidote
Acetaminophen (Tylenol)	N-acetylcysteine (NAC)
Opioids (Heroin, Morphine)	Naloxone (Narcan)
Benzodiazepines (Valium, Xanax)	Flumazenil
Carbon Monoxide	100% Oxygen / Hyperbaric Oxygen
Organophosphates (Pesticides)	Atropine & Pralidoxime
Methanol or Ethylene Glycol (Antifreeze)	Fomepizole / Ethanol
Cyanide	Hydroxocobalamin (Vitamin B12a)

Poison	Antidote
Acetaminophen	N-acetylcysteine
Anticholinergics	Physostigmine
Anticoagulants	Vitamin K, FFP
Aspirin	Sodium bicarbonate
Beta blockers	Glucagon, insulin
Benzodiazepines	Flumazenil
Calcium channel blockers	Calcium, glucagon, insulin
Carbon monoxide	Oxygen
Cholinergics	Atropine, pralidoxime (2-PAM)
Cyanide	Hydroxycobalamin, amyl nitrite, sodium thiosulfate
Digoxin	Digoxin FAB
Heparin	Protamine
Heavy metals • Arsenic • Copper • Lead • Mercury	Dimercaprol EDTA Penicillamine Succimer (DMSA)
Hydrofluoric acid	Calcium gluconate
Insulin	Glucose
Iron	Deferoxamine
Isoniazid	Pyridoxine
Methanol	Ethanol
Ethylene glycol	Fomepizole, ethanol
Methemoglobin	Methylene blue
Opioids	Naloxone
Serotonin reuptake inhibitors	Cyproheptadine
Sulfonylurea	Octreotide, glucose
Tricyclic antidepressant	Sodium bicarbonate

Fig: 03

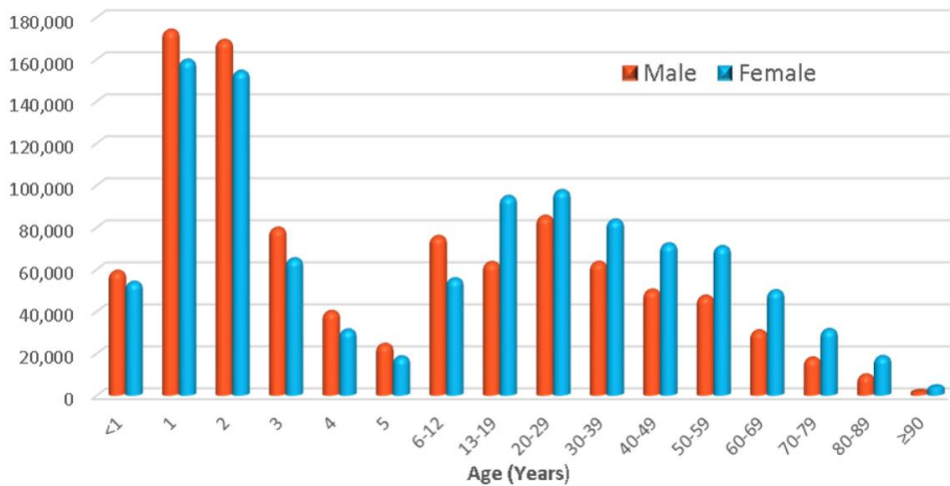
4. Hospital Treatments

- **IV Fluids & Electrolytes** to prevent dehydration.
- **Dialysis** for severe kidney-affecting poisons (e.g., antifreeze, lithium).
- **Ventilator Support** if breathing is affected.
- **Blood Transfusions** in cases of severe poisoning (e.g., lead poisoning).

The death rate of poisoning

Over the past decade, poisoning has remained a significant public health concern in India. The mortality rate due to unintentional poisoning has shown a gradual decline, decreasing from approximately 1.1 deaths per 1,00,000 population in 2000 to 0.8 deaths per 1,00,000 in 2018. According to a study, from 1990 to 2019 32.6% reduction in the absolute number of deaths due to unintentional poisoning in South Asia, with figures decreasing from 10,558 deaths in 1990 to 7,112 deaths in 2019. In India specifically, the number of such deaths declined from 7,275 in 1990 to 3,945 in 2019.

Despite this decline, intentional poisoning, particularly through pesticide ingestion, remains a critical issue, Pesticides are the leading cause of poisoning in India, accounting for approximately 63% of cases among individuals presenting to hospitals[9]. This prevalence varies regionally, with North India reporting the highest at 79.1%, followed by South India at 65.9%. The fatality rate from poisoning in India is notably higher than in advanced countries, ranging from 20% to 30%, compared to approximately 1% to 2% in developed nations.



Poison Statistics National Data 2016

Fig: 09[12]

Death rate from poisoning, 2021
Annual number of deaths from poisoning per 100,000 individuals.

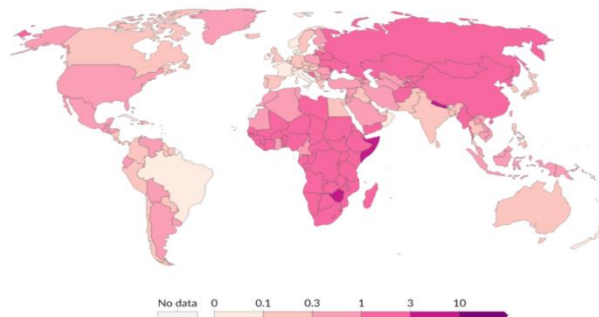


Fig: 10

Conclusion

Present study indicates the Poison is a harmful substance that can cause serious injury or death if ingested, inhaled, or absorbed. Its effects depend on the type and amount of poison, the method of exposure, and the individual's health. Preventive measures, such as proper storage of hazardous materials and public awareness about potential toxins, are crucial in reducing the risk of poisoning. Prompt medical intervention can be life-

saving, making it essential for individuals to recognize the symptoms and seek help immediately. Education and vigilance are key in preventing poisoning incidents and minimizing harm. In conclusion, poisoning remains a significant health risk worldwide, with various substances posing threats to individuals of all ages [10]. Whether accidental or intentional, the effects of poisoning can be devastating, affecting both the body and mind. Prevention through education, proper handling of toxic materials and awareness of potential hazards is essential in minimizing these risks, can reduce the impact of this serious issue and save lives.

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Author contribution

All authors contributed equally

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References

1. "poison - Search Online Etymology Dictionary". *Www.etymonline.com*. Retrieved 3 November 2017.
2. Latin: Dosis sola venenum facit. Paracelsus: Von der Besucht, Dillingen, 1567
3. *Hutchinson DA, Mori A, Savitzky AH, Burghardt GM, Wu X, Meinwald J, Schroeder FC (2007)*.
4. *Reddy KV, Yedery RD, Aranha C "Antimicrobial peptides: premises and promises". International Journal of Antimicrobial Agents. 24 (6): 536–(2004)*.
5. "Poison" at Merriam-Webster. Retrieved December 26th, 2014.
6. "Poison vs. Venom". Australian Academy of Science. 3 November 2017. Retrieved 17 April 2022.
7. *Chippaux, JP; Goyffon, M "[Venomous and poisonous animals--I. Overview]". Médecine Tropicale (2006),(in 66 (3): 215–20. ISSN 0025-682X. PMID 16924809*.
8. *Gupta, Ramesh C., ed. (24 March 2017)*.
9. *Reproductive and developmental toxicology. Saint*
10. *Hunt, Chris (13 May 2013)*. "The Arsenic in Your Chicken". *Huffington Post*.
11. "Did the FDA Admit That 70% of U.S. Chickens Contain Arsenic?". *Snopes*. 20 Jan 2015.
12. *Global Burden of Disease Study 2013 collaborators (22 August 2015)*. "Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and c 2013". *Lancet*. 386 (9995): 743–800.
13. *GBD 2013 Mortality and Causes of Death collaborators (17 December 2014)*.
14. Complete diving manual by Jack Jackson
15. *Chyka PA, Seger D, Krenzelok EP, Vale JA (2005)*. "
16. *Toxicology, American Academy of Clinical (2004)*. "Position paper: cathartics". *J Toxicol Clin Toxicol*. 42 (3): 243–253.