

Module

2

Poisoning and First Aid

After you have completed this module, you will be able to:

- *Identify the routes of entry of pesticides into the body*
- *Identify the most common signs and symptoms of poisoning*
- *Explain what is meant by LD_{50}*
- *Differentiate between acute and chronic toxicity*
- *List essential information required in case of an emergency*
- *Assist a person in case of poisoning.*

Poisoning

A poison is a substance that causes injury, illness or death. Poisoning occurs when a living organism is exposed to a substance that produces one or more of such effects. The potency of a poison is determined by its toxicity. Pesticides are toxic to the target pests and may also be toxic to other organisms, including humans.

For example, even products with very low toxicity can cause serious harm if they are absorbed over a long enough period.

How Poisons Enter the Body

In most cases pesticides cause harm after they have been absorbed by the body. It is, therefore, important to understand how pesticides enter the body.

Ingestion

Pesticides can enter your body if you swallow (ingest) contaminated food and poisonous liquids, put contaminated equipment in your mouth or lick poison from your lips or fingers. To minimize the potential for ingesting pesticides, follow good hygiene practices such as washing your hands with soap and water before eating, drinking, rubbing your face or going to the bathroom.

Children, especially, have been poisoned by drinking pesticides that are improperly stored in containers that look like drink containers. Store pesticides in the original container or, if that container is leaking, in a similar container, with the pesticide label transferred onto the new container. Always store pesticide containers out of reach of children.

Inhalation

Pesticides can enter your body if you inhale pesticide mist, vapors or dust.

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Reduce the potential for inhaling pesticides by using proper respirators and following good safety practices such as making sure no one is in the area when spraying.

Absorption Through the Eyes

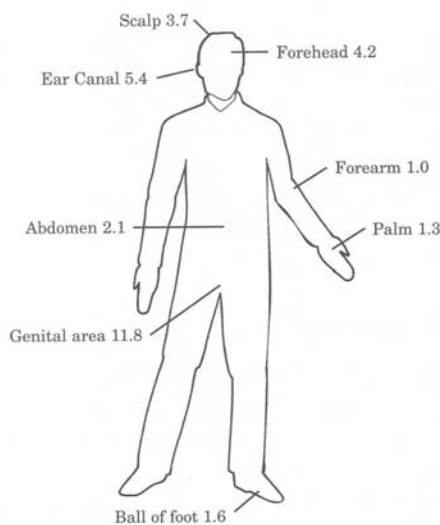
Pesticides can enter your body by absorption through the eyes. Eyes are very sensitive and can absorb large amounts of pesticides. Eye exposure can result from splashes, spills, drift or rubbing the eyes with contaminated hands. Reduce the risk of exposure by wearing appropriate goggles.

Absorption Through the Skin

Pesticides can enter your body by dermal exposure which is absorption through the skin. Exposure can result from direct contact with the concentrated pesticide, spray solution, spray mist or contaminated clothing. Body areas with thinner skin that tend to be more moist and are better supplied by blood vessels, absorb pesticides at a higher rate. Absorption is affected by the condition of the skin. Cracks, skin rashes or sores more readily allow pesticide entry. Some pesticides are more readily absorbed through the skin than others. It is, therefore, very important to closely follow the label instructions regarding handling and protective clothing, such as wearing proper gloves, coveralls, foot and head protection in addition to a respirator and adequate eye protection.

Pesticide absorption rates varies considerably between body parts. In figure 1 body parts are compared to the forearm which is given a rating of 1.0.

Figure 1. Pesticide Absorption Rates



Poisoning Symptoms

Symptoms of pesticide poisoning must not be ignored. Anyone who experiences poisoning symptoms, even if they are only mild symptoms, should contact the poison centre or seek immediate medical attention.

It is therefore important to be able to recognize poisoning symptoms. This is not always easy because symptoms vary depending on the type of pesticide involved and are often not consistent between individuals. Therefore any type of physical discomfort following exposure to a pesticide should be

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treated as a potential poisoning symptom, especially if there is no other obvious cause.

The following is a list of common symptoms arranged in order of severity:

Mild symptoms

- Headache
- Fatigue
- Irritation of skin, eyes, throat
- Loss of appetite
- Nausea
- Dizziness
- Perspiration
- Weakness
- Diarrhoea

Moderate symptoms

- Trembling
- Loss of coordination
- Blurred vision
- Mental confusion
- Rapid pulse
- Pressure in the chest, difficulty breathing
- Flushed or yellow skin
- Abdominal cramping
- Vomiting

Severe symptoms

- Very rapid breathing
- High fever
- Muscle spasms
- Loss of reflexes
- Stop breathing, unconsciousness

Symptoms such as the ones listed may develop in a matter of minutes, but in most cases poisoning symptoms develop more slowly, depending on the route of entry and the amount absorbed. In some cases it may take 24 hrs or longer.

There is also the possibility of developing an allergic reaction to a pesticide after repeated exposure. In this case the symptoms may be caused by the active ingredient or any of the inactive formulants. Such allergic reactions can be just as severe and life threatening as other poisoning symptoms, but sensitized individuals may be affected at much lower concentrations.

Toxicity

Toxicity is the degree to which a substance or mixture of substances can harm humans or animals. Toxicity varies between pesticides and even between formulations of the same pesticide.

Toxic effects vary with health, age, weight and route of exposure. For example, children and elderly people tend to be more susceptible to pesticide poisoning. Persons with pre-existing health conditions such as asthma, heart and skin conditions may also be more susceptible to pesticide exposure. Persons with health conditions should consult with their doctor

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to determine whether they are at more risk for pesticide poisoning than an average person.

Toxicity can be described as either acute or chronic.

Acute Toxicity

Acute toxicity is defined as the ability of a substance to cause injury or death soon after a single exposure or dose. It is also any poisonous effect resulting from a single short-term exposure to a toxic substance.

Acute Toxicity

- Develops within a few minutes or few days of exposure
- Results in rapid poisoning—victims can die
- Occurs from a single exposure or from multiple exposure over a limited time period, usually 24 hours
- Can result in acute poisoning after a person becomes sensitized to a product through repeated exposure.

Acute toxicity can be measured in three ways: Oral LD_{50} , Dermal LD_{50} and Inhalation LC_{50} .

The smaller the LD_{50} , the more toxic the substance. This allows pesticides to be ranked according to their acute toxicity.

The LD_{50} or LD_{50} may vary considerably between different types of test animals



Table 2 gives the LD_{50} (of rats) for some common substances.

Table 2. LD_{50} of rats for some common pesticides.

Product	LD_{50} rats (mg product/kg body weight)	Product	LD_{50} rats (mg product/kg body weight)
Aspirin®	1,000	Malathion®	2,800
Table salt	3,320	Roundup®	4,320
2,4-D	550	Lannate®	17 to 24
Avadex BW®	1,675 to 2,165	Furadan®	11

Individual plants and animals differ in their sensitivity to poison. Some suffer severe poisoning after exposure to an amount of pesticide much smaller than its LD_{50} . Others might survive amounts larger than the LD_{50} .

Remember these points about LD_{50} s:

- The smaller the LD_{50} number, the more poisonous the substance
- LD_{50} is a guide to acute toxicity; it does not indicate any effects of chronic toxicity or adverse effects to the environment..

The letters “LD” stand for Lethal Dose; the letters “LC” stand for Lethal Concentration.

- Oral LD_{50} is established by feeding different doses of test product to animals, usually rats. The animals are observed for a specified period of time and the dose that kills 50 percent of the population of the test animals is called the LD_{50} . The dose is related to body weight and is expressed as milligrams of pesticide per kilogram of body weight.
- Dermal LD_{50} is determined in a similar manner. The product is applied to the skin of test animals and the amount of substance contacting skin that kills 50 percent of the population of test animals within a specified time period is determined.
- Inhalation LC_{50} exposes the test animals to vapors at different concentrations. LC_{50} is the concentration of inhaled vapors that will kill 50 percent of the test animals within a specified time period.



Toxicity

Look at Table 2. Which substance is most toxic to rats? Which is least toxic?

Chronic Toxicity

Chronic toxicity is the capacity of a substance to cause long-term adverse health effects in humans, animals, fish and other organisms.

Chronic Toxicity

- May be a complication of acute exposure
- Is a progressive condition
- Occurs as a result of long-term exposure of weeks, months or years
- May not be fatal but can cause irreversible long-term disability or discomfort.

Chronic or long-term toxicity of a substance cannot be measured as easily as acute toxicity. Symptoms of chronic toxicity include:

- Skin rashes that do not clear up or reappear on slight exposure to a substance
- Respiratory ailments and coughing
- Nervous disorders, including weakness, dizziness or disorientation.

Chronic toxicity testing involves exposing animals to frequent low doses of the pesticide over their lifetime. The animals and their offspring are examined for commonly suspected abnormalities such as an increased incidence of cancer, reproductive problems and birth defects.

Key factors that affect the amount of exposure and absorption:

1. Attitude

The greatest risk of exposure occurs during mixing and loading.

If you are safety conscious and try to anticipate and minimize where the risk of exposure is greatest, practice good hygiene and practice safe work procedures, your risk of exposure is lowered.

2. Application method

Clean, calibrated and properly maintained and operated application equipment will reduce exposure.

3. Protective clothing and equipment

Suitable (check the label and MSDS) clothing and equipment that you keep clean and properly maintained will reduce exposure if you use it according to the manufacturer's direction.

4. Safety Practices

Developing and following good safety practices will help reduce the potential for exposure.

Risk

Risk can be minimized by choosing the least toxic pesticides and reducing exposure.

Risk is the chance that the pesticide will harm someone or something. The risk of poisoning depends on the substance and your exposure to it.

$$\text{Risk} = \text{Toxicity} \times \text{Exposure}$$

Risk increases as the toxicity of the pesticide increases. Type and concentration of the pesticide affects the toxicity of a pesticide product. Some active ingredients are more toxic than others.

Increased exposure also increases risk, especially for adverse health effects. Long term exposure, even to a pesticide with low toxicity increases the risk of becoming poisoned. Conversely, short term exposure, even to highly toxic pesticides, decreases risk.

Consider exposure to table salt. Table salt has an LD₅₀ that is similar to some pesticides but the two substances are not equally hazardous. Salt does not produce toxic fumes, is not absorbed through the skin and is actually required by the body. Long term exposure to salt carries no health risk, provided that it is not consumed in excessive amounts. However, long term exposure to pesticides, even if their LD₅₀s are higher than table salt, is likely to present a significant health risk, as these compounds are of not benefit to the body and must be eliminated.

Preventing Pesticide Poisoning

Take these precautions to prevent pesticide poisoning.

Pesticides can poison people, livestock, pets, crops ornamental planting, water, beneficial organisms and the environment. Using pesticides safely minimizes the risk of poisoning, injury to applicators, general public, land and the environment. You should always work safely around pesticides.

Safety is critical for all activities using pesticides: selection, purchase, storage, transportation, mixing, application, cleanup and maintenance of application equipment.

Make sure that everyone who has to be around pesticides has received training regarding safety and proper handling of pesticides. This includes knowing how to work safely around pesticides, how to protect oneself, others and the environment from pesticides, how to safely handle cleaning application equipment or laundering contaminated clothing. Anyone likely to enter a treated field must also be trained and informed about possible risks and hazards of entering the field along with re-entry intervals. Compliance with label instructions and all regulations pertaining to storage, handling and use of pesticides is the responsibility of the farm owner, unless a contractor is hired.

General Precautions

- Read label instructions before using a pesticide and be familiar with the signs and symptoms of poisoning and first aid procedures to deal with poisoning.
- Never eat or drink when handling or applying pesticides.

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- Don't carry snacks or drinks on you when you are applying pesticides, they could become contaminated.
- Always wash hands and face with soap and water before eating, smoking or going to the bathroom.
- Wear recommended protective clothing and equipment.
- Advise another adult that you are applying pesticides. Tell them the product you are applying in case of an accident.
- Always shower thoroughly at the end of the day, washing all your body including under the fingernails.
- Immediately wash off any pesticide that has spilled on you.
- Wash your protective clothing and equipment daily with soap and water.
- Restrict access to pesticides.
- Store pesticides in original containers or properly labeled containers you use exclusively for pesticides.
- Ventilate pesticide storage areas.
- Lock building where you store pesticides.

First Aid

When a person is in distress and you suspect pesticide poisoning, it is important to act quickly and stay calm.

First determine whether the poisoning was caused by inhalation, ingestion or absorption through skin or eyes. The immediate actions required depend on the type of exposure and the severity of the symptoms.

Information for the Poison Control Centre

When calling the Poison Control Centre, assemble the following information:

- Age, gender, weight and condition of the victim (i.e. if the victim is breathing, conscious, has visible injury or symptoms, etc.)
- Time of poisoning
- Type of exposure (absorbed, inhaled, ingested) and amount
- Exact name of the product on the label (have the label at hand if possible).

First-Aid for Inhalation Poisoning

1. Determine if you can approach the victim without exposing yourself to inhalation of the poison.

- If not, put on an appropriate respirator as well as protective clothing.
- Remember, you can't help the victim if you become a victim yourself!

2. Move the victim to an uncontaminated area and call 911 if the victim is unconscious or having a seizure.

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3. Determine if the victim is breathing.

- If not breathing or if breathing is very weak, check for obstructions in the airway and clear if obstructions are present.
- Loosen any tight clothing on the victim.
- Begin artificial respiration or CPR.
- Continue until the victim is breathing normally or medical assistance arrives.
- Always place an unconscious breathing person in recovery position (on his or her side).

4. Determine what happened and symptoms present.

- What pesticide was involved?
- How did it poison the victim?
- When did it happen?
- What are the symptoms of the victim?

5. If the victim is conscious, call the Poison Control Centre at 1-800-332-1414 or a doctor.

- Provide as much information as you can about the emergency.
 - Symptoms of the victim
 - Pesticide trade name, active ingredient and PCPA registration number.
- Write down and carefully follow any instructions given.

6. Follow instructions given by the poison centre, or follow label instructions if medical assistance cannot be obtained.

7. Transport the patient to the nearest hospital.

- Record and take along the pesticide trade name, active ingredient and PCPA registration number from the label.
- Take the label, if possible.

First Aid for Ingested Pesticides

Take the following steps when a person who has **swallowed** a poison is conscious and you cannot immediately reach a poison control centre.

1. Protect yourself by wearing personal protective equipment appropriate for the pesticide that caused the symptoms.

2. Rinse or wipe out the victim's mouth, especially if a powdered or solid formulation is involved.

- Do not induce vomiting unless specifically instructed to do so by a medical professional.

3. Call the Poison Control Centre at 1-800-332-1414 or a doctor.

4. Follow instructions given by the poison centre, or follow label instructions if medical assistance cannot be obtained.

5. Transport the patient to the nearest hospital.

- Record and take along the pesticide trade name, active ingredient and PCPA registration number from the label.
- Take the label, if possible.

First Aid for Pesticides Spilled on Skin

- 1. Remove the person from the contaminated area and remove their contaminated clothing. Protect yourself by wearing proper protective equipment.**
- 2. If the pesticide is a liquid, flush the affected area with large amounts of water for 15 minutes.**
- 3. If the product is a powder, brush off as much visible powder as possible before flushing.**
- 4. Wash the skin with soap and water and rinse thoroughly. Pay careful attention to hidden areas such as underneath fingernails and in the hair.**
- 5. Call the Poison Control Centre at 1-800-332-1414 or a doctor.**

First Aid for Pesticides in the Eyes

- 1. If both eyes are affected, flush eyes with lukewarm running water for at least 15 minutes, getting the victim to blink as much as possible.**
- 2. If only one eye is affected, position the victim so you can treat the injured eye for at least 15 minutes without threatening the unaffected eye. Flush the injured eye with water, away from the unaffected eye.**
- 3. Call the Poison Control Centre at 1-800-332-1414 or a doctor.**

What to Do if You are Working Alone

If you are the victim of a pesticide poisoning and you are working alone:

- Remain calm.
- Try to call or contact someone who can help you or dial 911 for you.
- If no one is around, or you don't have a telephone, mobile or cell phone or there is no service in the area you are located, follow first-aid measures on the label.
- Seek medical attention as soon as possible
- Take the trade name, active ingredient and PCP Act registration number of the pesticide or label with you.

First-Aid Kits

If you work with pesticide, you should have a special first-aid kit available. It could save someone's health, eyesight or life.

First-aid kits should be:

- Kept in convenient location
- Inspected and updated on a regular basis.

Immediately replace any first-aid kit materials you use.

Ensure family members and employees know where first aid kits are kept.

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Items for a Pesticide First-Aid Kit

Use the following checklist to assemble a pesticide first-aid kit.

- Soap or detergent to wash pesticide off skin
- Clean, nitrile gloves to protect the person giving first aid
- A cup for rinsing a victim's mouth
- A plastic resuscitator for artificial respiration to protect the person giving the first aid in case the victim's mouth is contaminated
- Paper towels to wipe up splashes or small spills
- A nail brush to clean beneath contaminated fingernails
- Telephone numbers of poison control centres
- Pen and note pad to write down instructions from poison control centre or doctor
- Four litres of fresh water
- A clean plastic bottle for mixing activated charcoal and water
- Dressing gauze
- An eye wash bottle for rinsing eyes
- Syrup of ipecac and activated charcoal
 - You may be advised by a doctor to give syrup of ipecac to a conscious victim of pesticide poisoning to induce vomiting. Activated charcoal may be advised by a doctor to absorb pesticides in the stomach. Both are available without prescription at drug stores.
 - NEVER give syrup of ipecac or activated charcoal to anyone UNLESS YOUR ARE TOLD to do so by a doctor or poison control center personnel. Corrosive pesticides and petroleum-based products can cause more injury if the victim is forced to vomit.
 - Regularly check the expiry date on the syrup of ipecac as it has a short shelf life.

Review Checklist

Check your understanding of the material in Module 2.

- I know the principal routes of entry of pesticides into the body.
- I can recognize common symptoms of pesticide poisoning.
- I understand the relationship between the LD₅₀ value and toxicity.
- I know the difference between chronic and acute toxicity.
- I know how to assist a person with symptoms of pesticide poisoning.

If you cannot check off the above items, review the appropriate section.

Exercises

Exercise 2.1

What are the three most common ways pesticides can enter the body?

1. _____

2. _____

3. _____

Exercise 2.2

You find a 3 year old boy playing in the garden with an open bottle of liquid pesticide in his hands. What information should you try to find out immediately?

Check all answers that apply.

- a. Where did he find the pesticide?
- b. Did he drink the pesticide?
- c. Was the pesticide in a locked cupboard?
- d. What quantity of pesticide did he drink?
- e. If he drank the pesticide, how long has it been since he drank it?

Exercise 2.3

A farm worker spilled liquid pesticide concentrate on his clothing. What should be done first?

- a. Read label for first-aid procedures.
- b. Remove clothing.
- c. Wash with plenty of cold water.
- d. Call the Poison Control Centre.
- e. Take him to the nearest hospital at once.

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Exercise 2.4

You find a man unconscious in a half full grain bin. Fumes suggest that he has inhaled poisonous gas. Which of the following would you do first?

- a. Take him outside.
- b. Check for breathing.
- c. Give liquids to dilute the poison.
- d. Begin artificial respiration if breathing has stopped.
- e. Apply ice packs to reduce head and chest pain.
- f. Call an ambulance to take him to the hospital immediately.
- g. None of the above.

Exercise 2.5

One of your workers has splashed corrosive pesticide into his eyes. He is in pain and holding both eyes closed.

Which one of the following actions should you take immediately?

- a. Cover his eyes with dressing and take him to medical aid.
- b. Call 911.
- c. Keep his eyes open and let the tears flush out the chemicals.
- d. Rinse both eyes for 15-20 minutes with plenty of water.

Exercise 2.6

An LD₅₀ value is defined as (check the correct answer):

- a. The lowest dose required to kill 50 rats in a test population.
- b. The dose required to kill a population of test animals under experimental conditions.
- c. The legal dose acceptable for use.
- d. The dose required to kill 50 percent of a test population within a given period of time.
- e. 50 percent of the dose required to kill a population of test animals under experimental conditions.

Exercise 2.7

Mark each statement True (T) or False (F).

- a. LD_{50} is a measure of toxicity.
- b. Pesticides vary widely in toxicity.
- c. Many medicines can be toxic.
- d. Pesticides with a high LD_{50} are still hazardous.
- e. There are different kinds of toxicity.

Answers

Answer 2.1

1. Ingestion
2. Breathing
3. Absorption through skin or eyes

Answer 2.2

b, d, e

Answer 2.3

b

Answer 2.4

g

Answer 2.5

d

Answer 2.6

d

Answer 2.7

- a. True
- b. True
- c. True
- d. True. Some pesticides are non-toxic; others are in a form that is difficult to ingest accidentally, but all have some hazard to you or the environment.
- e. True