



A SHORT REVIEW ON HOW PESTICIDES AFFECT HUMAN HEALTH

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Pesticides are designed to kill and because their mode of action is not specific to one species, they often kill or harm organisms other than pests, including humans. The World Health Organization estimates that there are 3 million cases of pesticide poisoning each year and up to 2,20,000 deaths, primarily in developing countries. The application of pesticides is often not very precise, and unintended exposures occur to other organisms in the general area where pesticides are applied. Children, and indeed any young and developing organisms, are particularly vulnerable to the harmful effects of pesticides. Even very low levels of exposure during development may have adverse health effects.

Key words: Pesticide, Human health.

introduction-

A pesticide is any chemical which is used by man to control pests. The term "-cide" comes from the Latin word "to kill." A pesticide is generally a chemical or biological agent (such as a virus, bacterium, antimicrobial or disinfectant) that through its effect deters, incapacitates, kills or otherwise discourages pests. Target pests can include insects, plant pathogens, weeds, molluscs, birds, mammals, fish, nematodes (roundworms), and microbes that destroy property, cause nuisance, spread disease or are vectors for disease. Although there are human benefits to the use of pesticides, some also have drawbacks, such as potential toxicity to humans and other animals.

Food and Agriculture Organization (FAO) has defined the term of pesticide as:

any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Pesticides include all materials that are used to prevent, destroy, repel, attract or reduce pest organisms. Insecticides, herbicides, fungicides and rodenticides are some of the more well-known pesticides. Less well-known pesticides include growth regulators, plant defoliants, surface disinfectants and some swimming pool chemicals.

Types Of Pesticide-

According to the U.S. EPA, chemical pesticides can be divided into four main categories:

1. Organophosphate Pesticides

These were developed in the 19th century, and can be so poisonous that they were used in World War II as nerve agents. Most fall into the insecticide category, and they are the most commonly used pesticides today. Organophosphates affects the nervous system by disrupting the enzymes that regulates acetylcholine, a neurotransmitter. The effects of organophosphate pesticides on insects is similar to the effect they have on humans is discovered in 1932. They usually are not persistent in the environment.

2. Carbamate Pesticides

These were introduced in the 1950s, and similar to organophosphate pesticides, affect the nervous system of insects. They are widely used in gardens, and the most common form is carbaryl. The enzyme effects are usually reversible.

3. Organochlorine Insecticides

These were commonly used in the past, but have been removed from the market because of environmental and health risks. Examples include Dichloro-Diphenyl-Trichloroethane (DDT) and chlordane.

4. Pyrethroid Pesticides

Developed in the '70s, pyrethroid pesticides utilize synthetic versions of pyrethrin. Pyrethrin is a pest repellent that naturally occurs in chrysanthemums. In addition to gardens, pyrethroids are used on pets and livestock, as well as transport vehicles. Some variations of this type of pesticide are toxic to the nervous system. They are typically less toxic to mammals (including humans), because they are deactivated by metabolic processes.

Classification Of Pesticide-

Pesticides are grouped or classified according to the pests they control, their chemical structure, how/when they work, or their mode of action (site of action).

✓ Classification by Target Pest Species:-

Insecticides

Insecticides are chemicals used to control insects. Often the word "insecticide" is confused with the word "pesticide." It is, however, just one of many types of pesticides. An insecticide may kill the insect by touching it or it may have to be swallowed to be effective. Some insecticides kill both by touch and by swallowing. Insecticides called Systemic may be absorbed, injected, or fed into the plant or animal to be protected. When the insect feeds on this plant or animal, it ingests the systemic chemical and is killed.

Miticides and Acaricides

Miticides (or Acaricides) are chemicals used to control mites (tiny Insecticides spider-like animals) and ticks. The chemicals usually must contact the mites or ticks to be effective. These animals are so numerous and small, that great care must be used to completely cover the area on which the mites live. Miticides are very similar in action to insecticides and often the same pesticide kills both insects and mites. The terms "broad spectrum," "short term," and "residual" are also used to describe miticides.

Fungicides

Fungicides are chemicals used to control the fungi which cause molds, rots, and plant diseases. All fungicides work by coming in contact with the fungus, because fungi do not "swallow" in the normal sense. Therefore, most fungicides are applied over a large surface area to try to directly hit every fungus. Some fungicides may be systemic in that the plant to be protected may be fed or injected with the chemical. The chemical then moves throughout the plant, killing the fungi.

Herbicides

Herbicides are chemicals used to control unwanted plants. These chemicals are a bit different from other pesticides because they are used to kill or slow the growth of some plants, rather than to protect them. Some herbicides kill every plant they contact, while others kill only certain plants.

Rodenticides

Rodenticides are chemicals used to control rats, mice, bats and other rodents. Chemicals which control other mammals, birds, and fish are also grouped in this category by regulatory agencies. Most rodenticides are stomach poisons and are often applied as baits. Even rodenticides which act by contacting the pest are usually not applied over large surfaces because of the hazard to domestic animals or desirable wildlife. They are usually applied in limited areas such as runways, known feeding places, or as baits.

Nematicides

Nematicides are chemicals used to control nematodes. Nematodes are tiny hair-like worms, many of which live in the soil and feed on plant roots. Very few of these worms live above ground. Usually, soil fumigants are used to control nematodes in the soil. However, a few contact insecticides and fungicides are also effective against these tiny worms.

Molluscicides

Molluscicides are chemicals used to control snails and slugs. Usually the chemicals must be eaten by the pest to work. Baits are often used to attract and kill snails or slugs in an area.

Repellents

A repellent is a pesticide that makes a site or food unattractive to a target pest. They are registered in the same way other pesticides are and must be used according to the label. Insect repellents are available as aerosols and lotions and can be applied to skin, clothing, or plants to repel biting and nuisance insects. Vertebrate repellents are available as concentrates to be mixed with water, powders, and granules. They can be sprayed or painted on nursery crops, ornamental plantings, orchards, vineyards, vegetables, and seeds. Repelling deer, dogs, birds, raccoons, and others can protect sites from damage.

✓ Classification by Chemical Structure:

Most pesticide active ingredients are either inorganic or organic pesticides. From a scientific view, inorganic pesticides do not contain carbon and are usually derived from mineral ores extracted from the earth. Inorganic pesticides include copper sulphate, ferrous sulphate, copper and sulphur. Organic pesticides include: captan, pyrethrin, and glyphosate.

✓ **Classification by How or When They Work:-**

Contact pesticides generally control a pest as a result of direct contact. Insects are killed when sprayed directly or when they crawl across surfaces treated with a residual contact insecticide. Weed foliage is killed when enough surface area is covered with a contact herbicide.

Systemic pesticides are pesticides which are absorbed by plants or animals and move to untreated tissues. Systemic or translocated herbicides move within the plant to untreated areas of leaves, stems or roots. They may kill weeds with only partial spray coverage. Systemic insecticides or fungicides move throughout treated plants and kill certain insects or fungi. Some systemic insecticides are applied to animals and move through the animal to control pests such as warble grubs, lice, or fleas. Some pesticides only move in one direction within the plant, either up or down. Knowing what direction the pesticide moves will help guide your decisions. For example some insecticides only move upwards in plants. If applied to the root zone, it will travel throughout the plant, but if applied to the leaves it will not move throughout the plant. Some pesticides are considered locally systemic. These will only move a short distance in a plant from the point of contact.

Foliar pesticides are applied to plant leaves, stems and branches. Note, they may be either a contact pesticide or a systemic pesticide.

Soil-applied pesticides are applied to the soil. Some are taken up by roots and translocated inside the plant. Other soil-applied herbicides kill weed seedlings by contact with young shoots or leaves as they break through the soil.

Fumigants are chemicals that are applied as toxic gas or as a solid or liquid which forms a toxic gas. The gas will penetrate cracks and crevices of structures or soil or the spaces between products stored in containers.

Preplant herbicides are applied to the soil before seeding or transplanting.

Preemergent herbicides are applied to the soil after planting but before emergence of the crop or weed. The pesticide label should indicate if a pesticide is preemergent to the crop or weed.

Postemergent herbicides are applied after the crop or weed has emerged.

Translocated herbicides enter the roots or above ground parts of plants and move within the plants. They are also called systemic herbicides.

Eradicant fungicides destroy fungi that have already invaded plants and begun to damage plant tissues. They inhibit metabolic processes of growing fungal organisms.

Protectant fungicides prevent fungal infections. They retard fungal growth or prevent the organisms from entering treated plants. They must be used before the fungi reach the infection stage. Once a plant is infected, the fungicide will normally not kill the fungi inside the plant.

Selective pesticides will only control certain pests.

Non-selective pesticides will control a wide range of pests.

Suffocating insecticides clog the breathing system of insects and may affect eggs.

Residual pesticides do not break down quickly and may control pests for a long time (i.e. several weeks or a year).

Non-residual pesticides are quickly made inactive after application and do not affect future crops.

✓ **Classified by Mode of Action (Site of Action)**

Pesticides can be grouped according to their mode of action or the way a pesticide destroys or controls the target pest. This is also referred to as the primary site of action. For example, one insecticide may affect an insect's nerves while another may affect moulting. One herbicide may mimic the plant's growth regulators and another may affect the plant's ability to convert light into food. One fungicide may affect cell division and another may slow the creation of an important compound in the fungus. There are a limited number of different modes of action, but there are many pesticides.

TYPES OF PESTICIDE FORMULATION-

When a pesticide active ingredient is manufactured, it is not in a usable form. They may not mix with water or may be unstable. Therefore they are mixed with other compounds to improve their effectiveness, safety, handling and storage. The other compounds can include solvents, mineral clays, stickers, wetting agents, or other adjuvants. This mixture and inert (inactive) ingredients is called a pesticide formulation. Some formulations come ready to use while others must be mixed before use. One a.i. is often made into several different formulations.

Pesticide formulations can be divided into three main types: solids, liquids or gases. The most commonly used formulations are listed in the following table. The formulations abbreviation is shown below in parentheses.

HOW DO PESTICIDES ENTER INTO HUMAN BODY-

Pesticides can enter your body during mixing, applying, or clean-up operations. There are generally three ways a chemical or material can enter the body:

- through the skin (dermal),
- through the lungs (inhalation), or
- by mouth (ingestion).

- (i) Dermal (absorption through skin)-In most work situations, absorption through the skin is the most common route of pesticide exposure. People can be exposed to a splash or mist when mixing, loading or applying the pesticide. Skin contact can also occur when you touch a piece of equipment, protective clothing, or surface that has pesticide residue on it.
- (ii) Inhalation (through the lungs)-Inhalation may occur when working near powders, airborne droplets (mists) or vapours. The hazard from low-pressure applications is fairly low because most of the droplets are too large to remain in the air. Applying a pesticide with high pressure, ultra low volume, or fogging equipment can increase the hazard because the droplets are smaller and they can be carried in the air for considerable distances. Pesticides with a high inhalation hazard will be labelled with directions to use a respirator.
- (iii) Ingestion (by mouth)-While ingestion (by mouth) is a less common way to be exposed, it can result in the most severe poisonings. There are numerous reports of people accidentally drinking a pesticide that has been put into an unlabelled bottle or beverage cup/container (including soft drink cans or bottles). Workers who handle pesticides may also unintentionally ingest the substance when eating or smoking if they have not washed their hands first.

EFFECT ON HUMAN HEALTH-

The greatest risk to our environment and our health comes from the chemical pesticides. Farmers and their families and other persons who use chemical pesticides regularly are at greatest risk for achieving toxic levels in their bodies. The danger is spread out to larger areas, as the pesticides:

- Are carried on the wind
- Leave residues on produce
- Remain inside produce and animals
- Run off into open water, contaminating public water supply as well as fish and other seafood

Anyone who uses pesticides or is present when pesticides are sprayed is at risk for dangerous exposure. The pesticides can enter the body through skin, eyes, mouth and nose. Pesticides can be toxic to humans and lower animals. It can take a small amount of some toxins to kill. And other toxins that are slower acting, may take a long time to cause harm to the human body.

Pesticide production can be dangerous, too. One disaster at a pesticide manufacturing plant was in Bhopal, India. The plant accidentally released 40 tons of an intermediate chemical gas, methyl isocyanate, used to produce some pesticides. In that disaster, nearly 3,000 people were killed immediately, overall approximately 15,000 deaths occurred. Today nearly 100,000 people suffer from mild to severe permanent damage as a result of that disaster.

Children seem to be greatly susceptible to the toxic effects of pesticides. The Natural Resource Defense Council has collected data which recorded higher incidence of childhood leukemia, brain cancer and birth defects. These results correlated with early exposure to pesticides.

Even just using pesticides in amounts within regulation, studies have revealed neurotoxins can do serious damage during development. Researchers report the dangers of pesticides can start as early as fetal stages of life as:

- Fetuses, (pre-birth babies), may suffer from exposure and exhibit behavioral problems, growth issues
- Lower cognitive scores, fewer nerve cells and lower birth weight
- A lower resistance to the toxic effects of pesticides
- A greater risk (70% increase), for Parkinson's disease, even with low levels of pesticides.

Toxins from pesticides can remain in the body and build up in the liver. And, even at "safe" levels your reactions can be mild to severe. Several factors determine how our body will react including our level of exposure, the type of chemical we ingest, and our individual resistance to the chemicals. Some people are unaffected or are mildly affected, while others become severely ill from similar levels of exposure. Some possible reactions are:

- Fatigue
- Skin Irritations
- Nausea
- Vomiting
- Breathing Problems
- Brain Disorders
- Blood Disorders
- Liver & Kidney Damage
- Reproductive Damage
- Cancer
- Death

Pesticide exposure can cause a range of neurological health effects such as memory loss, loss of coordination, reduced speed of response to stimuli, reduced visual ability, altered or uncontrollable mood and general behavior, and reduced motor skills. These symptoms are often very subtle and may not be recognized by the medical community as a clinical effect. Other possible health effects include asthma, allergies, and hypersensitivity, and pesticide exposure is also linked with cancer, hormone disruption, and problems with reproduction and fetal development.

Acute ingestion of **organochlorine insecticides** can cause a loss of sensation around the mouth, hypersensitivity to light, sound, and touch, dizziness, tremors, nausea, vomiting, nervousness, and confusion. In 1975, over 70 workers manufacturing Kepone, an organochlorine insecticide, in Hopewell, Virginia, developed a variety of neurological symptoms, the most prominent of which became known as the "Kepone shakes." The workers' symptoms started about 30 days after their first exposure to Kepone. Subsequent testing also revealed decreases in sperm count and motility. In 1976, Kepone was discontinued and substituted with organophosphates.

Acute **organophosphate** and **carbamate** exposure causes signs and symptoms of excess acetylcholine, such as increased salivation and perspiration, narrowing of the pupils, nausea,

diarrhoea, decrease in blood pressure, muscle weakness, and fatigue. These symptoms usually decline within days after exposure ends as acetylcholine levels return to normal.

Some organophosphates also have a delayed neurological reaction characterized by muscle weakness in the legs and arms.

Among the most promising alternatives to organophosphates were synthetic **pyrethroids**. However, pyrethroids can cause hyper-excitation, aggressiveness, uncoordination, whole-body tremors, and seizures. Acute exposure in humans, usually resulting from skin exposure due to poor handling procedures, usually resolve within 24 hours. Pyrethroids can cause an allergic skin response, and some pyrethroids may cause cancer, reproductive or developmental effects, or endocrine system effects.

Herbicides are generally less toxic to mammals than insecticides. Most herbicides interfere with plant hormones or enzymes that do not have any direct counterpart in animals. The most serious human health concerns have been related to chemical contaminants in the active ingredient. Military personnel and others exposed to Agent Orange, a mixture of the herbicides 2,4-D and 2,4,5-T that was contaminated with dioxin (TCDD), reported birth defects, cancers, liver disease, and other illness. These concerns lead to improvement in the manufacturing process of 2,4,5-T to reduce TCDD contamination and ultimately lead to cancellation of 2,4,5-T and reduction in use of 2,4-D. However, some herbicides may cause cancer, reproductive or developmental effects, or endocrine system effects.

There is also concern that some herbicides may affect wildlife, especially aquatic organisms. For example, atrazine, a persistent herbicide, may adversely affect frogs. Concerns about the effect of atrazine on amphibians resulted in its ban in the European Union, but atrazine remains one of the most widely used herbicides in the US (over 70 million pounds used per year). Persistent herbicides may also contaminate surface water and groundwater.

In summarized general symptoms are as follows-

Table		
General Symptoms that Might Indicate Pesticide Poisoning		
Mild Poisoning	Moderate Poisoning	Severe Poisoning
Any of the following: irritation of the nose, throat, eyes or skin headache dizziness loss of appetite thirst nausea diarrhoea sweating	Any of the mild symptoms, plus any of the following: vomiting excessive salivation coughing feeling of constriction in throat and chest abdominal cramps blurring of vision rapid pulse	Any of the mild or moderate symptoms, plus any of the following: inability to breathe extra phlegm or mucous in the airways small or pinpoint pupils chemical burns on the skin increased rate of breathing loss of reflexes uncontrollable muscular twitching unconsciousness

weakness or fatigue restlessness nervousness changes in mood insomnia	excessive perspiration profound weakness trembling muscular incoordination mental confusion	death
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After describe the general symptoms, specific symptoms produced by active ingredients of insecticides, fungicides or herbicides are also included in different tables as:-

Table-1 Sign and symptoms of acute exposure for several insecticide active ingredients-

Active Ingredient	Brand name	Sign and symptoms
Acephate (organophosphate)	Orthene	Headache, excessive salivation and tearing, muscle twitching, nausea, diarrhoea, Respiratory depression, seizures, loss of consciousness, Pinpoint pupils
Aldicarb(N-methyl carbamate)	Temik	Malaise, muscle weakness, dizziness, sweating, Headache, salivation, nausea, vomiting, abdominal pain, diarrhoea, Nervous system depression, pulmonary edema in serious cases
Carbary (N-methyl carbamate)	Sevin	Malaise, muscle weakness, dizziness, sweating, Headache, salivation, nausea, vomiting, abdominal pain, diarrhea, Nervous system depression, pulmonary edema in serious cases
Chlorpyrifos(organophosphate)	Dursban	Headache, excessive salivation and tearing, muscle twitching, nausea, diarrhea, Respiratory depression, seizures, loss of consciousness, Pinpoint pupils
Endosulfan(organochlorine)	Thiodan	Itching, burning, tingling of skin, Headache, dizziness, nausea, vomiting, lack of coordination, tremor, mental confusion, Seizures, respiratory depression, coma
Malathion(organophosphate)	Cythion	Headache, excessive salivation and tearing, muscle twitching, nausea, diarrhoea, Respiratory depression, seizures, loss of consciousness, Pinpoint pupils

Methyl Parathion (organophosphate)	Pennacp-M	Headache, excessive salivation and tearing, muscle twitching, nausea, diarrhoea, Respiratory depression, seizures, loss of consciousness, Pinpoint pupils
Phosmet (organophosphate)	Imidan	Headache, excessive salivation and tearing, muscle twitching, nausea, diarrhoea, Respiratory depression, seizures, loss of consciousness, Pinpoint pupils
Pyrethrins (natural origin)		Irritating to skin and upper respiratory tract, Contact dermatitis and allergic reactions—asthma
Pyrethroids (synthetic pyrethrin)	Cypermethrin, permethrin	Abnormal facial sensation, dizziness, salivation, headache, fatigue, vomiting, diarrhoea, Irritability to sounds or touch Seizures, numbness

Table no 2-Signs and symptoms of acute exposure for several fungicide active ingredients-

Active Ingredient	Brand name	Sign and symptoms
Azoxystrobin	Abound, Quadris	Irritating to skin, eyes, respiratory tract
Captan	Captol, Orthocide	Irritating to skin, eyes, respiratory tract
Chlorothalonil	Bravo, Daconil	Irritation to skin, mucous membranes of the eye, respiratory tract, allergic contact dermatitis
Copper compounds	Bordeaux mixture, Copper sulfate	Irritating to skin, eyes, respiratory tract, Salts are corrosive to mucous membranes and cornea, Metallic taste, nausea, vomiting, intestinal pain
Mancozeb	Dithane M-45, Manzate 200	Irritating to skin, eyes, respiratory tract
Maneb	Dithane M-22, Manzate	Irritating to skin, eyes, respiratory tract, Skin disease in occupationally exposed individuals
Pentachloronitrobenzene	PCNB, Terraclor	Allergic reactions
Sulfur	Cosan, Thiolut	Irritating to skin, eyes, respiratory tract Breath odor of rotten eggs Diarrhoea, Irritant dermatitis

		in occupationally exposed individuals
Thiram	Polyram-Ultra, Spotrete-F	Irritating to skin, eyes, respiratory tract
Ziram	Cuman, Vancide	Irritating to skin, eyes, respiratory tract, Prolonged inhalation causes neural and visual disturbances

Table no.-3 Sign and symptoms of acute exposure for several herbicide active ingredients-

Active Ingredient	Brand name	Sign and symptoms
2,4-dichlorophenoxyacetic acid	2,4-D, Barrage	Irritating to skin, mucous membranes, Vomiting, headache, diarrhea, confusion, Bizarre or aggressive behavior, Muscle weakness in occupationally exposed individuals
Acetochlor	Harness, Surpass	Irritating to skin, eyes, respiratory tract
Atrazine	Aatrex, Atranex	Irritating to skin, eyes, respiratory tract abdominal pain, diarrhoea, vomiting, Eye irritation, irritation of mucous membranes, skin reactions
Dicamba	Banvel, Metambane	Irritating to skin, respiratory tract, Loss of appetite (anorexia), vomiting, muscle weakness, slowed heart rate, shortness of breath, Central nervous system effects
Glyphosate	Rodeo, Roundup	Irritating to skin, eyes, respiratory tract
Mecoprop	Kilprop, MCP	Irritating to skin, mucous membranes, Vomiting, headache, diarrhoea, confusion Bizarre or aggressive behavior, Muscle weakness in occupationally exposed individuals
Metolachlor	Bicep, Dual	Irritating to skin, eyes
Paraquat	Gramoxone	Burning in mouth, throat, chest, upper abdomen, Diarrhoea Giddiness, headache, fever, lethargy, Dry, cracked hands, ulceration of skin
Pendimethalin	Prowl, Stomp	Irritating to skin, eyes, respiratory tract

Propanil	Propanex, Stampede	Irritating to skin, eyes, respiratory tract
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Some health effects from pesticide exposure may occur right away, as you are being exposed. Some symptoms may occur several hours after exposure. Other effects may not be noticed for years, for example cancer. Some symptoms of pesticide exposure will go away as soon as the exposure stops. Others may take some time to go away. For people exposed to pesticides on a regular basis, long-term health effects are a concern. Women who are pregnant or breast-feeding should check with their doctors before working with pesticides as some pesticides may be harmful to the fetus (unborn baby) or to breast-fed infants.

CONCLUSION-

After all above description it is concluded that due to beneficial to the agricultural sector and in vector borne disease control, pesticides can cause both illnesses and death in humans. These problems arise from various circumstances, either direct or indirect human contact with pesticides.

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