

Potential Health Effects of Pesticides

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Introduction

Pesticides are the potential chemicals meant to kill pests such as rodents, insects, weeds, fungi etc with the ultimate goal of protecting and enhancing crop production. They are manufactured for various sectors such as agriculture, food, forestry and aquaculture. They can either be applied to the seeds as a coating or a seed treatment by spray fogging or dusting on the crops during different stages of growth. Pesticides tend to remain in the harvested crops at varying levels depending on the chemical composition and decomposition time of the pesticides. Despite all the beneficial effects of pesticides, they have a potentially harmful effect on the environment as well as human health. Environmental effects include destroying ecosystems and biodiversity and introducing harmful chemicals or toxins to the soil and water. Through soil and water, they can get entry directly or indirectly into the food chain. After entering the food chain, they are non-biodegradable and can accumulate progressively in the body causing various harmful effects. The health problems can either be acute or chronic depending on the exposure.

Pesticides and Human Health

Based on origin, pesticides are either artificially synthesized chemicals or can be obtained from natural sources such as plants, animals, microbes and minerals which are called organic pesticides. These organic pesticides are easily broken down by the microbes in the soil as well as the weather conditions. If not degraded, these persistent pesticides can also last from months to years. The most common examples of organic pesticides include neem extracts, diatomaceous earth and pyrethrins (extracted from chrysanthemum plants). The pesticides synthesized using chemicals are economical and superior in terms of their effectiveness in protecting crops. These are also known as conventional pesticides and can be classified into various classes based on their chemical composition.

The bioaccumulation of these chemicals can cause adverse effects in humans and also in the environment. It has been found that only 0.1% of these

chemicals reach their target and the remaining enters the environment through runoff and infiltration. These chemicals enter the plant and work their way to nectar, pollen and sap which can cause potential harm to pollinators such as bees, butterflies, birds, bats etc. According to various animal studies, exposure to certain pesticides can cause serious health effects. The major disturbances were observed in the organs like the liver, thyroid, eyes, heart, nervous system and reproductive system. Human studies suggest that the labourers working in the pesticide manufacturing industries have shown symptoms like blurry vision, cataracts, increased cerebrospinal blood pressure, inflammation, hepatomegaly and infertility problems.

Based on their functionality, these can be either classified into herbicides (weeds or unwanted plants), insecticides (insects), fungicides (fungi), bactericides (bacteria), rodenticides (rodents) and larvicides (larva). Herbicides are the most widely used and account for approximately 50% of the total pesticides used globally.

The pesticide can cause harmful effects on health and chronic toxicity can even damage the vital organs. In severe cases, it may even cause death. Following are some health effects of pesticides:

- **Nervous system:** Chemicals like organophosphates and carbamates can cause acute nervous system damage leading to symptoms like dizziness, tremors, confusion, seizures and severe headaches. Chronic toxicity can lead to degenerative diseases like Parkinson's disease, cognitive degeneration and physical developmental issues in children.
- **Respiratory system:** Inhalation of pesticides as powder, vapours and spray mist can cause problems in the respiratory system leading to severe irritation, coughing, sneezing, shortness of breath and congestion. It can also trigger an asthma attack causing respiratory distress. Prolonged inhalation of these harmful chemicals can lead to other serious respiratory issues such as bronchitis, emphysema and chronic obstructive pulmonary disorder.

- **Liver:** Pyrethroids and organophosphates can affect liver functioning and cause liver damage. The liver is the organ that is involved in metabolizing harmful chemicals but if the amount of these chemicals is very high crossing the threshold level it can damage liver cells which in turn causes toxicity in the body and ultimately leading to death.
 - **Kidneys:** Chemicals like glyphosate and triazine can lead to renal toxicity as the metabolites of these chemicals accumulate in the kidney leading to nephropathy or kidney damage.
 - **Skin:** Prolonged exposure to these toxic chemicals on the skin can cause irritation, itching, rashes and redness. Permethrin (synthetic) insecticides get absorbed in the skin causing systemic toxicity.
 - **Eye:** Pesticide exposure can cause irritation, redness, watering burning sensation etc. It can also cause conjunctivitis and corneal damage.
- **Endocrine system:** Recent research has shown that harmful chemicals are a type of endocrine disrupters resulting in disruption of hormone formation and functioning. The increasing cases of infertility, thyroid disruption, hormonal imbalances, and menstrual irregularities are the main implications of endocrine dysfunction due to the intake of these harmful chemicals.
 - **Immune system:** Pesticides can affect the immune system functioning resulting in frequent infections and even leading to autoimmune disorders.
 - **Cardiovascular system:** Long-term exposure to pesticides such as Organophosphates has been linked to increased blood pressure altering normal heart functioning.

Table 1. Impact of different types of pesticides on human health

Type of pesticide	Examples	Toxic chemical	Health Impact
Herbicide	Atrazine, Glyphosate	Glyphosate	Gastrointestinal tract and endocrine system
Fungicide	Carbendazim, Mencozeb	Carbendazim	Reproduction, liver
Insecticide	Chlorpyrifos, deltamethrin	Pyrethroids, Chlorpyrifos, Deltamethrin, organophosphates and carbamates	Neurotoxicity in children eye and skin irritation central nervous system, muscles, liver, pancreas, and brain
Bactericide	Copper oxychloride, Streptomycin	Copper oxychloride	Respiratory system, liver and kidney damage
Rodenticide	Zinc phosphide, Bromadiolone	Bromadiolone	Bleeding disorders
Larvicide	Methoprene,	Methoprene	Allergies and Skin problems

Conclusion

Pesticides play a crucial role in protecting various crops from pests, insects, rodents and diseases but their health risks should not be overlooked. They are the leading cause of various health issues such as multiple organ system damage. The components of these chemicals can also cause serious health issues such as infertility, degenerative diseases and cognitive problems. To mitigate these health hazards, we should

focus on safer pesticide use that prioritizes both health as well as crop production. These practices may include integrated pest management systems, organic farming, and strict bylaws for pesticide-producing companies to ensure that these chemicals are not health hazardous along with ensuring a safe environment for all. So that the balance between the benefits of pesticides and health is not compromised and sustainable agricultural practices are ensured.
