

# Effect of Pesticides on Human Health

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## ABSTRACT

In a country like India, production of agriculture is the most important factor which influences the economic development of a country. The population of India in 2022 is 1.40 crores (approx.) To meet the demands of agricultural goods and to feed the increasing population, use of fertilizers and pesticides has increasing day by day. The farmers use various agrochemicals to protect crops from pests. These can do the growth of food grains, vegetables, and fruits but also affects human health. Although pesticides are prepared through very strict regulation processes to function with minimal impact on human health and the environment, serious concerns have been raised about health risks resulting from occupational exposure and from residue in food and drinking water. High level exposure to selected organochlorines appears to cause abnormalities of liver function, skin and nervous system. Many effects depend on the toxicity of the pesticide, the dose applied, the weather conditions, and how long the pesticide persists in the environment. Therefore, an urgent strategic approach is needed for a reduction in use of agrochemicals and for the implementation of sustainable practices. It should be noted that washing and peeling cannot completely remove residues.

**Key Words** *Pesticides, human health, Toxicity, pesticide chronicity, Agrochemicals*

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## INTRODUCTION

The manufacturing of pesticide in India started in 1952. In 1958, India manufactured over 5000 metric tonnes which increased to 85,000 metric tonnes in the mid-90s with the registration of 145 pesticide<sup>1</sup>.

Any substance or mixture of substance intended for preventing, destroying, repelling, or mitigating any pest is known as Pesticides<sup>2</sup>. Insecticides, and herbicides are some well-known pesticides. The type of pesticide, the duration, and route of exposure and individual health status are determining factors in the health outcome.

They help farmers grow more food on less land by protecting crops from disease and weeds.

One 2010 review study shows that 3% of polish apples contained pesticide levels above the legal safety limit for pesticides on food<sup>3</sup>.

The Commonest types of pesticide substances used for poisoning are Organophosphates, Chlorinated, Hydrocarbons, Aluminium Phosphide, Carbamates, and Pyrethroids<sup>4</sup>.

1. ORGANOPHOSPHATE:- OP compounds are a diverse group of chemicals used in both domestic and industrial areas. OPs are also the main components of nerve gas. Acute or

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chronic exposure to organophosphates can produce varying toxicity levels in humans, animals, plants, and insects. OP samples degrade rapidly by hydrolysis on exposure to light, air, and soil, however, small amounts are detected in food and drinking<sup>5</sup>.

2. **ORGANOCHLORINES:-** The review of statistics on the use of different pesticides shows that 40% of all pesticides used to belong to the organochlorine class of chemicals<sup>6</sup>.

3. **CARBAMATES:-** They are rapidly detoxified and eliminated from animal tissues. carbamate pesticides also impact non-target organisms, leading to ecological imbalance<sup>7</sup>.

**BIODEGRADABLE PESTICIDE:-**  
Biodegradable pesticides are those that can be broken down into harmless compounds by microbes and other living organisms within a short period of time.

**NON-BIODEGRADABLE PESTICIDE:-** The most long-lived pesticide materials include Aldrin, Parathion, and Eldrin, they take a long period of time to break down. These pesticides (Pyrethrin, Bacillus thuringiensis) can be found in the soil for over 15 years or more

**PESTICIDE RESIDUE:-**  
“Pesticide Residue” means any specific substances in food, agriculture commodities, or animal feed resulting from the use of a pesticide. The term includes any derivative of a pesticide such as conversion products, metabolites, reaction products, and impurities considered to be toxicological significance<sup>8</sup>.

The sample of brinjal showed the maximum number of pesticide residues detected followed by a sample of tomato, cabbage, cauliflower, cucumber, etc. The residues of acephate, chlorpyrifos, imidacloprid, chlorpyrifos, acetamiprid, profenophos, methamidophos, and thiamethoxam were commonly detected in vegetable samples<sup>9</sup>.

Chlorpyrifos and carbendazim are the most commonly used pesticides.

CPF is a broad spectrum chlorinated organophosphate pesticide used for the control of a variety of insects and pathogens in crops, fruits, vegetables as well as households. The toxicity of CPF has been associated with neurological dysfunction, endocrine disruption, and cardiovascular disease. Eye irritation and dermatological defects are also reported due to CPF toxicity. The mechanism of action of CPF involves blocking the active sites of enzyme acetylcholinesterase thereby producing an adverse nervous system<sup>10</sup>.

The Use of carbendazim is only allowed in cereals and vegetables. Still many food items like cucumber, oranges, and spinach are contaminated with carbendazim. It is possibly a human carcinogen. It is very toxic and has been banned in Australia, the USA, and most European countries<sup>11</sup>.

**HAZARDS OF PESTICIDES:-** the pesticides include enhanced economic potential in terms of increased production of food then their debits have resulted in serious health implications. No segment of the population is completely

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protected against exposure to pesticides and potentially serious health effects. The worldwide death and chronic diseases due to pesticide poisoning number about 1 million per year<sup>12</sup>.

The high-risk groups exposed to pesticides include production workers, sprayers, mixers, loaders, and agriculture farm workers. during manufacturing and formulation, the hazards may be higher because the processes involved are not risk-free. In industrial settings, workers are at high risk since they handle various toxic chemicals including pesticides, raw materials, and toxic solvents. Pesticides are a combination of harmful chemicals absorbed by plants and possibly enter the food chain through cereals, and vegetables and can even make their way through drinking water. Food crops that are grown using inorganic fertilizers are known to be less nutritious because it mainly targets the fast growth of plants rather than its nutritional value.

Human Exposure to Pesticide:-

Human beings get exposed to pesticides either actively through occupational exposure or passively through non-occupational exposure. Occupational exposure may occur during the manufacturing, transportation, sale, and application process. People working in the agriculture industry usually take contaminated clothing, and equipment home, which may cause harm to the family and may reflect in serious complications in long term. The presence of pesticide residues has been detected in the blood plasma of workers of agriculture farms<sup>13</sup>. Direct

or Indirect exposure to pesticides leads to neuromuscular disorders.

Non-occupational exposure may include pesticide residue ingestion with contaminated food and water and inhalation of pesticide droplets from the air through drift from point of release. Human beings are also exposed to residual indoor sprays and outdoor fogging of insecticide applied against insect pests of public health importance and homeowners are exposed to structural pest control pesticides. Another mode of exposure to these pesticides is from the diet. Among food items, fatty food such as meat, fish, poultry, and dairy products serve as the main cause<sup>14</sup>.

LONG-TERM HEALTH EFFECTS OF PESTICIDES: -

Damage to Lungs: People exposed to pesticides may get a cough that never goes away. Damage done over time to the lungs may lead to lung cancer<sup>15</sup>.

Cancer:- People exposed to pesticides have a higher chance of getting cancer. Hundreds of pesticides and pesticide ingredients are known to cause cancer<sup>16</sup>.

Damage to Liver:- Pesticides are very strong poisons the liver sometimes cannot get rid of them. Toxic hepatitis may also occur<sup>17</sup>.

Damage to the nervous system:- Long-term exposure to pesticides can cause loss of memory, anxiety, mood changes, and trouble concentration<sup>18</sup>.

WAYS TO MINIMISE PESTICIDE EXPOSURE:-

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As we cannot eradicate pesticides completely but we can limit the use of pesticides by following methods:-

1. Organic Farming: - it is a method of a farming system which primarily aimed at cultivating the land and raising crops in such a way as to keep the soil alive and in good health by use of organic waste. To identify fruit grown organically, look at the sticker the no. should be of 5 digits starting with 9 [eg. 91324]<sup>19</sup>. Fruits and vegetables from farmers contain fewer pesticides even if they are not organic.

2. Wash fruits and vegetables before using: - wash using a very diluted solution of mild detergent. For grapes, green leafy vegetables, and strawberries use mild detergent then rinse with slightly warm water.

Processing food products: - Pesticide residue levels in fruits and vegetable may change due to processing such as peeling, washing, boiling etc. cooking also reduce pesticides in food boiling may remove 35-60% of organophosphate residues and 20-25% of organochlorines<sup>20</sup>.

3. Use of biopesticides:- Biopesticides are biodegradable so no harmful residues are produced.

4. Use of less hazardous pesticides:- As WHO classify pesticides as per their toxicity. Phasing out the use of highly hazardous pesticides and replacing them with less hazardous ones.

### PREVENTIVE MEASURES:

Maximum Residue Limit [MRL] is the highest level of pesticide residue that is legally tolerated

in or on food or feed when pesticides are applied correctly<sup>21</sup>. For example as per table no. 1.

**Table 1** Maximum residue limit of some fruits and vegetables

	MRL [mg/kg]	
	Chlorpyrifos	Carbendazim
Carrot	0.20	0.20
Banana	3.00	0.20
Onion	0.20	3.00
Tomato	0.50	0.50

One study found that pesticide levels were reduced by 10-80% by a variety of cooking and food processing methods<sup>22</sup>.

Another analysis found that washing with tap water reduces pesticide levels by 60-70%<sup>23</sup>. As pesticides penetrate deep into fruits and vegetables and require the use of cleaning solution

Rule 44-AA prohibited the use of carbide gas in the ripening of fruits<sup>24</sup>

Rule 48-E Fresh fruits and vegetables shall be free from rotting and also from a coating of waxes, mineral oil, and colors<sup>25</sup>.

### METHODS TO REDUCE THE PESTICIDE RESIDUES FROM THE FOOD PRODUCTS:-

1. Scrubbing method is used in firm fruits and vegetables like melons, root vegetables like carrots, and potatoes. Soft brushing can be used to scrub fruits and vegetables. Then rinse for 5-10 seconds with slightly warm water.

Pesticide residues can be minimized by washing methods. Washing in clean running preferably drinking water reduces pesticide residues. About 75-80% of pesticide residues on the surface of cereals, pulses, fruits, and vegetables are removed by washing with water<sup>26</sup>. Washing with 2% of salt water will remove most of the contact

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pesticide residues that normally appear on the surface of the fruits and vegetables<sup>27</sup>. The pesticide residues that are on the surface of the grapes, apples, guava, plums, mangoes etc., and vegetables like tomatoes and, brinjal requires 2-3 washing, for example as per figure no. 1.



**Figure 1** Washing vegetables with running water)

1. Carrot, okra, brinjal, cabbage, and cauliflower can be washed with 1% tamarind solution.

2. Vinegar Soak:- Whip up a solution with 10% white vinegar and 90% water and soak fruits and vegetables in them. Stir them around and rinse thoroughly.

3. Blanching<sup>28</sup>:- Blanching is a process in which hot water or steam is applied to most vegetables. Certain pesticide residues can effectively be removed by blanching. But you should always wash fruits and vegetables before blanching, for example as per figure no. 2.

4. Peeling:- pesticide that appears on the surface of the fruits and vegetables can be removed by peeling.

Discard the upper layer of leafy vegetables like cabbage, lettuce etc. before washing as they grow close to the ground where soil could be tainted, for example as per figure no. 3



**Figure 2** Blanching of vegetable



**Figure 3** Peeling of Carrot

1. Some Vegetables and fruits which are consumed along with the peel, can be soaked in water for half an hour to 1 hour and rinsed a few times before use. Soaking fruits and vegetables for 5-10 minutes in a solution of diluted form of hydrochloric acid with 4 tablespoons of salt and juice of half a fresh lime and rinsing with clean water helps in reducing residues. Use of dilute vinegar followed by a thorough rinsing is also recommended.

2. Steaming and cooking can eliminate most of the residues that are not removed by washing or peeling.

3. Juicing of fruits like grapes reduces the residue level. Clarification processes such as centrifugation and filtering can also reduce the residues.

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4. Lemon Wash:- 1 tbsp. lemon juice, 2 tbsp. white vinegar cleans and neutralises most pesticides

5. Baking Soda:- 1 tbsp. lemon, 2 tbsp. baking soda, 250ml of water. Put the mixture in a spray-topped bottle. Spray the fruits or vegetables, leave it to sit for 5-10 minutes, then rinse well.

6. Salt Wash:- Soak the fruits or vegetables in salt water for about 20 minutes, then rinse.

7. Cooking Animal Products:- Animal products may be a source of contamination by pesticide residues in human diets. Pressure cooking, frying, and baking will minimize the harmful effects of pesticides<sup>29</sup>.

14. Dairy Products:- Boiling milk at high temperature destroys the persistent pesticide residue<sup>30</sup>.

Discussion:- It is very clear that we cannot completely eradicate the use of pesticides, but can reduce it to some extent. The Government started plant clinics for improving the production of plants. Plant clinics are a relatively new addition to agriculture extension methods already used in India, they increase the accessibility of up-to-date information to all farmers' groups. India also has around 3000 agriculture in 25 states. Plant health clinics vary in how they operate and the service they offer, institute based plant clinics have laboratory facilities for identifying pests and pathogens. Research and study play important role in the identification and commercialization of alternative means of crop protection that are less hazardous more

sustainable and eco-friendly. To control and monitor the excessive pesticide residue in agricultural produce it is necessary to establish a well-equipped modern laboratory in the major vegetable and fruit collection and distribution center for rapid and effective tests.

## CONCLUSION

Pesticides have been used and regarded as a rapid, convenient, and low-cost alternative for managing weeds and pests in agriculture. It is established that pesticides have contributed significantly to increasing agricultural production and the farmers' income globally. India has become self-sufficient in the production of pesticides. Bio-pesticides can help farmers stay away from chemical pesticides and gravitate toward more dependable, sustainable, and environment-friendly options. We should work together to help farmers with the use of bio-pesticides and chemical pesticides. So minimizing the use of pesticides or founding new alternative ways, we can surely save our environment and can give a healthy life to our future generation.

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