

# IMPACT OF PESTICIDES ON HUMAN BEINGS AND FARM ANIMALS: A CASE STUDY

PHUL KUNWAR SINGH RANA<sup>1</sup>

Department of Zoology, Govt. Degree College, Marwahi Distt. Bilaspur, Chhattisgarh, India

## ABSTRACT

Pesticides can cause harm to humans, animals, or the environment because they are designed to bill or otherwise adversely affect living organisms. Anyone who uses pesticides or is present when pesticides are sprayed is at risk for dangerous exposure. The findings suggest that consumption of eggs and meat is also a significant source of exposure to the majority of organochlorine chemicals studied. Many pesticides act at the same site no calculations are made to determine multiple residual exposure in diets. They are airborne thus they are found long distances from the site of application. Exposure of wildlife over an extended period of time to pesticide levels not immediately lethal may result in chronic poisoning.

**KEYWORDS:** Pesticides, Exposure, Risk, Wildlife, Effects.

A pesticide is any substance or mixture of substances intended for: preventing, destroying, repelling, or mitigating any pest. While they can be extremely useful in protecting plants from disease-carrying insects and pests, most pesticides are risky by nature. The term pesticide also applies to herbicides, fungicides, and various other substances used to control pests. Under United States law, a pesticide is a plant regulator, defoliant, or desiccant.

To be effective, pesticides must be able to kill some living organisms, and this can pose risks to humans, pet or the environment. Pesticides can cause harm to humans, animals, or the environment because they are designed to bill or otherwise adversely affect living organisms. At the same time, they are useful to society-pesticides can kill potential disease-causing organisms and control insects, weeds and other pests. First identify the pest which is trying to get rid of, they check the risks and benefits of specific products, observe the ingredients, as well as the risks and the intended outcome of using it. Natural pesticides are quite safe. They derived from plants, but they can be toxic as their synthetic counterparts. Biologically based pesticides, such as pheromones and microbial pesticides are becoming increasingly popular and often are safer than traditional chemical pesticides. Pesticides should always be evaluated on an individual basis for both effectiveness and toxicity.

One common organic pesticide is insecticidal soap. Insecticidal soap is made up of potassium or sodium salt in combination with fatty acids. Although this is one of the safest pesticides, its effectiveness is limited. In order to be effective,

the insecticidal soap must directly touch the insect while it is wet. Once it is dry it is in effective. The fatty acids present in insecticidal soap are able to penetrate the insects exoskeletons and cause the cells inside to collapse. This is a popular pesticide because it is one of the safest, causing no problem for humans or pets when used on garden plants and vegetables. Neem oil is a new type of natural pesticide which is rapidly gaining popularity. The tropical neem tree produces seeds which contain oil that has been found to negatively effect insect development and feeding. Neem has low toxicity for humans and pets and is very effective against a variety of insects, including some types of moths, beetles, and caterpillars.

Extract from the *Pyrethrum daisy* can be used as a pesticide. This natural pesticide is not highly toxic to mammals but is effective against some types of beetles, caterpillars, and leafhoppers. Pyrethrum does not last long, and must be applied frequently.

*Bacillus thuringiensis* (BT) is a pesticide that is sold in powdered form and sprinkled on a plant. The targeted insect must eat the powder for it to be effective. The many kinds of BT available are very safe for birds, humans, and mammals, but may also kill butterflies. In addition, this pesticide quickly becomes ineffective because sunlight cause it to break down.

## ANTIMICROBIAL

Pesticides are substances or mixtures of substances used to destroy or suppress the growth of harmful microorganisms like bacteria, viruses and fungi. More than 5000 antimicrobial products are currently registered with the U.S.

<sup>1</sup>Corresponding author

Environmental Protection Agency (EPA) and sold in the marketplace. Antimicrobial products are divided into two categories based on the type of microbial pest against which the product works:

#### **Non Public Health Products**

They are used to control growth of algae, odour causing bacteria, bacteria which cause spoilage, deterioration or fouling of material and microorganisms infectious only to animals.

#### **Public Health Products**

They are intended to control microorganisms infections to humans in an inanimate environment. The more commonly used public health antimicrobial products are sterilizers (sporicides), disinfectants, sanitizers, Antiseptics and Germicides etc.

#### **Exposure to Pesticides**

Diet is an important source of exposure to pesticides (Washington, 1993). Currently regulatory system look only at the average exposure of the entire population. As a consequence, variations in dietary exposure to pesticides and health risk related to age and to other factors such as geographic region and ethnicity are not addressed (Washington, 1993). Infants and children may develop toxic outcomes from smaller quantities due to different metabolic rates, greater absorptive areas, diets more concentrated with certain foods high in pesticides but they may also have outcomes such as neurological, behavioural, endocrinological and oncological that are not seen in adults due to critical windows of exposure both in utero and during certain growth phases. Anyone who uses pesticides or is present when pesticides are sprayed is at risk for dangerous exposure. The findings suggest that consumption of eggs and meat is also a significant source of exposure to the majority of organochlorine chemicals studied (Hoar, *et al.* 1886; Sherman, 1996; Colborn, *et al.* 1996; Herman-Giddens, *et al.* 1997 and Swan, *et al.* 1997).

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.

### **EXPOSURE OCCURS THROUGH INGESTION OF FOOD AND WATER AS**

### **WELL AS SKIN RESPIRATORY ABSORPTION**

#### **Food**

Although many pesticides act at the same site no calculations are made to determine multiple residual exposure in diets. Many food products will have a number of pesticide residues. Agriculture Canada reports that the average peach in Canada has 31 pesticide residue (Lowengart, 1987). The majority of these act at the same sites; the parasympathetic and central nervous systems although the residue of one pesticide may not exceed the maximum allowable level, a number of pesticides of the same class, acting at the same physiological sites, will have a cumulative and possibly toxic effect.

#### **Water**

Pesticides are commonly found in water consumed by both rural and urban populations. Groundwater was found to have residues of 39 pesticides and their degradation products in a study of U.S. states and Canadian provinces (Zahm and Ward, 1998).

Allowable pesticides levels for water are calculated on the basis of adult exposure and toxicity but again the pediatric population is exposed to a considerably greater total amount of residues that are potentially toxic because they are consuming on average 4 times the amount of water per kg of body weight (Washington, 1993).

Residues of pesticides that are "severely restricted" because of their serious effects on human health were also found in significant quantities in the water sources.

Residues enter the water supply as they are leached from soil into ground water after home, lawn, roadway and agriculture spraying.

#### **Respiratory and Skin Absorption**

Infants and children can absorb enough pesticide through their skin. There are a number of reports of infants and children presenting with poisoning secondary to playing on lawns and surfaces that have had pesticides applied (Zahm and Ward, 1998). The surface area of infant per unit body weight is double that of the adult, infants have much greater unprotected skin contact with such surfaces and tend to mouth objects that may be exposed to these surfaces. It must also be

realized that adults also are absorbing pesticide residues from such sources contributing to chronic exposure.

Insect repellents and pediculocides are concentrated exposures that are absorbed through the intact skin. There are reports of children developing behavioural changes, encephalopathy, ataxia, seizures and coma following cutaneous exposure (Hallberg, 1989) and neurobehavioural correlations have been found between cutaneous exposure and affective symptoms, insomnia, muscle cramps and urinary hesitation (Oranskey, *et al.* 1989).

Farmers exposed to herbicides, through spraying and predominantly skin absorption for more than 20 year have been found to have a six fold increase of non-Hodgkin's lymphoma (McConnell, *et al.* 1987).

Pesticides are airborne thus they are found long distances from the site of application. Restricting the use of organochlorines (DDT etc.) in Canada does not result in eliminating human exposures, as air and then water and food contamination are not obstructed by borders.

## EFFECTS OF PESTICIDES ON PLANTS AND ANIMALS (WILD LIFE)

### Pesticides Reach Us Through

Pesticides can be absorbed through the skin swallowed or inhaled (most toxic). During application pesticides drift and settled on ponds laundry, toys, pools and furniture. People and pets track pesticides residue into the house. Only 5% of pesticides reach target weeds. The rest runs off into water or dissipates in the air. Drift from landscaping ranges from 12 feet to 14.5 miles. More serious effect appear to be produced by direct inhalation of pesticide sprays than by absorption or ingestion of toxins.

### Pesticide Poisoning of Wildlife

Pesticides are applied in many forms via various delivery methods to forests, rangeland aquatic habitats, farmland, rights-of-way, urban turf and gardens. Their widespread use makes contact with pesticide residues inevitable for some wildlife. Pesticide poisonings to wildlife may result from acute or chronic exposure. Additionally, pesticides may impact wildlife via secondary exposure or through indirect effects to the animal or its habitat.

### A. Acute poisoning

Short exposures to some pesticides may kill or sicken wildlife. Examples of acute wildlife poisoning include fish kills that are caused by pesticide residues carried to ponds, streams, or rivers by surface runoff or spray drift, and bird die-off caused by foraging on pesticide-treated vegetation or insects, or by consumption of pesticide treated granules, baits, or seeds. In general acute poisoning to wildlife takes place over a relatively short time, impacts a very localized geographical area, and is linked to a single pesticide.

### B. Chronic Poisoning

Exposure of wildlife over an extended period of time to pesticide levels not immediately lethal may result in chronic poisoning. The most well-known example of a chronic effect in wildlife is that of the organochlorine insecticide DDT (via the metabolic DDE) on reproduction in certain birds of prey. DDT and other organochlorine pesticides such as dieldrin, endrin and chlordane have been implicated in bird mortality, resulting from chronic exposure. Organochlorine pesticides used in some foreign countries may pose risk to migratory birds which overwinter there.

### C. By Secondary Poisoning

Pesticides may impact wild life through secondary poisoning when an animal consumes prey species that contain pesticide residues. Examples of secondary poisoning are birds of prey becoming sick after feeding on an animal that is dead or dying from acute exposure to a pesticide, and (2) the accumulation and movement of persistent chemicals in wildlife food chains.

### D. Indirect Effects

A pesticide may affect wildlife in ways other than direct or secondary poisoning. Pesticides may impact wildlife indirectly when a part of its habitat or food supply is modified. For instance, herbicides may reduce food, cover and nesting sites needed by insect, bird, and mammal populations; insecticides may diminish insect populations fed on bird or fish species; insect pollinators may be reduced, thereby affecting plant pollination. The study of indirect effects is an emerging area and one that may be difficult to investigate

## HEALTH EFFECTS OF PESTICIDES IN HUMANS

- Asthma
- Birth Defects
- Neurological Effects
- Cancer
- Hormone Disruptions

### **Asthma**

Researcher found an association between asthma and use of pesticides by male farmers (Washington, 1993). Although this study involved adults, it raises concerns about children's exposures to pesticides used in the home or residues brought home on parents' clothes or equipment.

### **Birth Defects**

The commonly used pesticide, chlorpyrifos caused severe birth defects in four children exposed in utero. Chlorpyrifos is used widely as an agricultural chemical, but is also the most common pesticide used indoors to kill termites, fleas, roaches and in pest control strips.

### **Neurological Effects**

Pesticides can be potent neurotoxins. When people are exposed to neurotoxins they may feel dizzy, lightheaded, confused and may have reduced coordination and ability to think. These are the short term effects, while long term exposure can result in reduced IQ and learning disability, associated with permanent brain damage. There is new evidence that prolonged exposure to pesticides in areas where they are used routinely may cause permanent brain damage to children who live in these areas.

### **Cancer**

Concern over possible carcinogenic risks from chlorophenoxy herbicides (Lawn and Weed killers such as 2, 4-D or Killex; Par 3) is heightened by the potential for widespread exposure. The pesticide used in pest strips has been shown to be a carcinogen in animals and this strong association with leukemia in children is disturbing given their common use and accessibility to infants and children.

Sheila Zahm and Mary Ward, summarized the studies of pesticides and childhood cancer and concluded that the following childhood cancers were linked to pesticide exposure: Leukemia, neuroblastoma, Wilms tumor, soft tissue sarcoma,

Ewing's sarcoma, non-Hodgkin's lymphoma, and cancers of the brain, colorectum and testes.

Thirty seven pesticides have limited, suggestive or sufficient evidence of carcinogenicity in animals. (International Agency for Research on Cancer). Following few examples linking pesticides and childhood cancer :

Leiss et al, found a 4-fold increased risk of soft tissue sarcoma among children whose yards had been treated with pesticides during childhood.

Parental use of pesticides in the home or garden during pregnancy was associated with 3- to 9- fold increases in leukemia in Los Angeles Co. (Health and the Environment, 1995).

A review of 17 case control studies and one cohort study shows a possible role for pesticides in child hood leukemia (Neidert, *et al.* 1994).

Hoar *et al.* (1986) found that exposure to herbicides on greater than 20 days per year resulted in a 6 fold increase in non-Hodgkin's lymphoma. These findings coincide with the findings of increased incidence of NHL in caretakers of golf courses and previous studies on farmers. Elevation in brain cancer risk related to at least one measure of pesticide exposure were demonstrated in nine studies (Neidert, *et al.* 1994).

2,4-D, a widely used phenoxy herbicide, goes by the name weed-Be-Gone. There is suggestive evidence that 2,4-D caused cancer. The phenoxy herbicides are associated with increased risk for non-Hodgkin's lymphoma, soft tissue sarcoma and prostate cancer. A March, 1993 EPA report stated that 2,4-D contained deadly dioxins, which are stored in fatty tissue, causing cancer, birth defects, miscarriages and reduced fertility.

The greatest concerns with the organochlorines are the long term effects. The U.S. EPA has concluded that DDT, DDE and DDD are probable human carcinogens.

### **Hormone Disruptions**

There is a need for well designed studies that need to incorporate sensitive outcome measures such as time to pregnancy, spontaneous abortion rates and breast cancer as well as better defined means of determining body burdens of suspected reproductive toxins. While some substances cause physical birth defects, others can

cause subtle hormonal effects on the developing foetus or affect a child's functional capacities. Hormone disruptors have been linked to many health problems including reproductive cancers. The drug DES, which was given to pregnant women to prevent miscarriage between 1941-1971, worked as an endocrine disrupting chemical on the developing foetus. Decades later, many of these DES exposed daughters developed cervical cancer. Twenty-four pesticides still on the market including 2, 4-D, lindane and atrazine, are known endocrine-disrupters. Animal studies link many of these conditions with prenatal exposure to hormone disrupting substances.

- Endometriosis
- Hypospadias
- Undescended testicles
- Precocious puberty in Girls
- Reduced Sperm Counts
- Fertility Problems

#### **Endometriosis**

A disease in which the uterine tissue grows outside the uterus, and a common cause of infertility was virtually unheard of twenty years ago. It now affects 5.5 million women in the U.S. and Canada, about 10-20% of women of childbearing age. The National Institute of Child Health and Human Development noted that only 20 cases were reported in the medical literature prior to 1921 (Senthilselvan, *et al.* 1992).

#### **Hypospadias**

A condition in which the urethra is near the base of the penis, not the end as it should be, has doubled in the last 10 years.

#### **Undescended testicles**

Which is linked with later risk of testicular cancer, is increasing. Researchers reported a doubling in cases between 1962 and 1982 in England and Wales (Senthilselvan, *et al.* 1992).

#### **Precocious puberty in girls**

It is now common. A study of 17,077 girls in the US found that the onset of puberty for white girls was 6-12 months earlier than expected and African-American girls experienced puberty 12-28 months earlier than whites (Lowengart, 1987).

#### **Reduced sperm counts**

Reduced sperm counts are documented. Between 1938 and 1990, sperm counts dropped 1.5% each year for American men and 3.1% per year of European men. There was no decrease in men from nonwestern countries. Low sperm count is a marker for testicular cancer (Zahm and Ward, 1998).

#### **Fertility Problems**

Fertility Problems are becoming more common and now affect more than two million couples in the U.S.

### **EFFECTS OF PESTICIDES ON SOIL MICRO-ORGANISMS**

The effects of pesticides on soil micro-organisms can cause a ripple effect that can last for years. Micro organisms are essential to healthy soil. There are literally hundreds of pesticides that have been manufactured and applied to soil in the past. In places where the chemicals are used extensively, plants will no longer grow at all or will fail to thrive. Unfortunately, many pesticides can kill more than just their intended targets, namely the necessary microorganisms in the soil. When chemicals are used for a period of time on plants in an area, they will eventually leach into the soil. Once in the soil they can kill the micro-organisms living in the soil that break down organic material and aid in plant growth. It can take years before micro-organisms can once again live in soil that has had toxic chemicals applied to it.

### **ALTERNATIVE TO HARMFUL CHEMICAL PESTICIDES**

For the average gardener, the use of organic pesticides can keep a healthy balance in the soil. Many organic pesticides are made of minerals or other plant materials that will keep pests at bay and break down quickly in the soil.

Examples of some common organic pesticides include the following:

#### **Cayenne pepper spray**

Can be sprayed on the leaves of plants to deter harmful insect. Soap Spray – Also sprayed on plants to get rid of aphids.

#### **Tobacco powder**

A spray can be made from the finely ground tobacco leaves and water. It is use to kill

sucking insects on plants such as aphids, thrips and spider mites.

### Pyrethrin

Made from chrysanthemum plant. This organic pesticide is used to knock out and flying insects and ground pests such as grubs.

### Neem

Derived from the neem tree. Used to control Gypsy moths, leaf miners, mealy bugs, whiteflies and caterpillars.

### Sabadilla

Derived from the sabadilla lily. Used to control caterpillars, leaf hoppers, stink bugs and squash bugs.

## CONCLUSION

For decades people have believed that harmful chemical pesticides were the only true way to rid gardens and crop fields from pests. Soil pollution, Air pollution has occurred from the use of pesticides and it takes years and sometimes decades for some of these chemicals to break down. These pesticides are also harmful to animal plants as well as human health. Luckily there are many organic chemicals that are just as effective. The effects of pesticides on soil micro-organisms are less invasive when organic pesticides are used.

People need to break the habit of using harmful pesticides and switch to rising organic ones that break down quickly in the sunlight and in the soil. The faster a chemical breaks down, the sooner the soil can return to a healthy state. Most organic pesticides are also safe to use around people and pets. They can easily be washed from fruits and vegetables making them healthier for us and our family to eat.

## ACKNOWLEDGEMENT

The author is greatly indebted to Principal of Govt. Degree College, Marwahi Distt. Bilaspur (C.G.) who permitted to carry out this work.

## REFERENCES

Colborn T., Dumanoski D. and Myers J.P., 1996. *Our Stolen Future : Are We Threatening Our Fertility, Intelligence, and Survival? A Scientific Detective Story.* New York, Penguin.

Hallberg G.R., 1989. Pesticide Pollution of Ground Water in the Humid U.S. Agr Ecosystem Environ. **26**:299- 368, p. 228.

Health and the Environment. (1995). *A Handbook for Health Professionals.* Prepared by the Great Lakes Health Effects Program Health Protection Branch, Health Canada and The Environmental Health and Toxicology Unit Public Health Branch. Ont. MOH.

Herman-Giddens M.E., Slora E.J. and Wasserman R., 1997. Secondary sexual characteristics and menses in young girls seen in office practice: A Study from the Pediatric Research in Office Settings Network. *Pediatrics.*, **99**:505-512.

Hoar S.K., Blair A. and Holmes F.F., 1986. Agricultural Herbicide use and risk of lymphoma and soft tissue sarcoma. *JAMA.*, **256**:1141-1147.

Hoar Z.S. and Blair A., 1886. Agricultural Herbicide use and risk of lymphoma and soft tissue sarcoma. *JAMA.*, **256**:1141-1147.

Lowengart R., 1987. Childhood Leukemia parents occupational and home exposure. *Journal of the National Cancer Institute*, **79**:39-46.

McConnell, 1987. *Health Hazard Evaluation Report in Pesticides in the Diets of Infants and Children.* (1993).

Neidert E., Trotman R. and Saschenbrecker P., 1994. Agriculture Canada, Agri-Food Safety and Strategies Division. Levels and Incidences of Pesticide Residues in Selected Agricultural Food Commodities Available in Canada. *Journal of AOAC International.*, **77**(1).

Oranskey, 1989. Seizures temporally associated with the use of DEET insect repellent – New York and Connecticut. *MMWR*, **38**:678-680. In *Pesticides in the Diets of infants and Children* (1993).

Senthilselvan A., McDuffie H.H. and Dosman J.A., 1992. Association of Asthma with Use of Pesticides: Results of a cross-sectional survey of farmers. *Amer Rev Respir Dis.*, **146**:884-887.

Sherman J.D., 1996. Chlorpyrifos (Dursban) – Associated birth defects: report of four cases. Arch Env Health., **51**(1):5-8.

Swan S.H., Elkin E.P. and Fenster L., 1997. Have Sperm density decline? A reanalysis of global trend data. Environ Health Perspect., **105**:1228-1232.

Washington D.C., 1993. Pesticides in the Diets of infants and children: National Research Council : National Academy Press.

Zahm S.H. and Ward M.H., 1998. Pesticides and Childhood Cancer. Environ Health Perspect., **106** (Suppl. 3):893-908.