

Effects of Agrochemicals on Human Health

¹Bibhuti B Pradhan, ²Shishira Kanta Behera

Abstract--- *The industrialization of agricultural segment has increased the chemical pressure on natural ecosystems. Nowadays, agrochemicals are commonly used in food production. Pesticides are agrochemicals used to protect plants and humans from various diseases in urban green areas, agricultural land and public health programs. Farmers use agrochemicals to monitor weed growth and to prevent insects, moulds and rodents from destroying crops. The extreme use of agrochemicals has led to growing concerns about the adverse effects on environment and the human health. The continued use of agrochemicals against disease vectors and agricultural pests presents serious threats to human health as well as the environment. The periods and levels of exposure to agrochemicals, the types of agrochemicals used (in terms of toxicity and persistence) and the different environmental conditions of the areas are also some of the factors for acute and chronic human health and environmental poisoning. Farmers should use alternative methods such as integrated pest management (IPM), organic farming or crop rotation to avoid contamination of foods with agrochemicals. Consumers should also have organic food products in order to get away from the harmful effects of agrochemicals. However, their side effects can be an important factor in environmental health risk because of their known ability to cause a large number of negative environmental and health effects.*

Index Terms--- *Agrochemicals, pesticides, human health, organic farming, integrated pest management.*

I. INTRODUCTION

Food security and environmental safety are the major concerns of the world's increasingly growing human population. Agricultural inputs generally refers to the products used or added in the agricultural production process and include chemical inputs, biological inputs and agricultural equipment and facilities[1]. Agricultural chemical inputs in general indicate various types of chemical applications such as pesticides (including biological and natural pesticides), veterinary drugs, chemical fertilizers and feed additives, among others in agricultural production[2]. Pests cause severe agricultural damage in terms of yield and high chemicals price, costing billions of dollars annually and increase the budget for agricultural production. Regardless of the high expenses, the widespread use of chemical pesticides was favored because of the advantages they provide in agriculture, particularly by protecting crops from pest damage[3]. Pesticide, on the other hand, poses a serious threat to human health and the environment. Farmers and particularly those directly involved in the management of pesticides, are at high risk of pesticide exposure while combining and applying pesticides or working in treated fields and from residues on drinking water and food[4]. Pesticide residues can be found

in a wide range of everyday beverages and foods, including for example wine, cooked meals, water, refreshments, fruit juices and animal feeds[1], [4]. Many of the pesticides were associated with the health and environmental issues, and some pesticides were abandoned for agricultural use. Pesticide exposure may occur through skin contact, inhalation or ingestion. Factors that determine the potential health outcomes are: the type of pesticide, route and duration and individual health status (e.g., healthy / damaged skin and nutritional deficiencies)[5]. Pesticides can be excreted, metabolized, stored or bio-accumulated in body fat within a human or animal body[3], [4].

Most of the pesticides are highly resistant to microbial degradation, particularly organochlorines. Therefore, they can accumulate fats in the human body and the environment that pose human health problems[6]. Pesticides are associated with various human health concerns, ranging from short-term effects such as nausea and headaches to chronic effects such as various birth defects, cancers, endocrine disruption and infertility. In general, children are more at risk from short-term and chronic exposure to pesticides[2], [6]. The numerous adverse health effects associated with agrochemicals include gastrointestinal, dermatological, neurological, respiratory, carcinogenic, endocrine effects and reproductive effects. In addition, high accidental, occupational or deliberate exposure to pesticides may result in hospitalization and death[7].

Agricultural management practices, for example, increased use of agrochemicals or fertilizers is often assessed on the basis of their benefits for economic efficiencies in production (e.g. reduction in total cost of production and increased yield production) whereas less attention is generally given to their possible environmental effects[8]. For example, fertilizer and pesticide application plays a fundamental role in ensuring the supply of agricultural products and rising agricultural production[4]. Spraying of pesticides can significantly reduce or mitigate the economic costs of insect pests, plant diseases and weeds on agricultural production and application of fertilizer can supply a diversity of nutrients required for the crop growth and increased production yield[9]. On the other hand, many countries reported alarming residues in soil, air, agricultural products, and water and even in adipose tissue and human blood[6], [8].

In addition, too much use of pesticides can contribute to biodiversity destruction, secondary outbreaks of pests, destruction of non-target species, and pollution of soil, water, and air. The purpose of this study is to address the harmful effects of chemical pesticides on human health and health effects associated with exposure to specific groups of chemical pesticides, i.e. organochlorines, organophosphates and carbamates[10].

II. ORGANOCHLORINE PESTICIDES:

A group of chlorinated compounds widely used as pesticides are organochlorines. These chemicals with high persistence belong to the class of persistent organic pollutants (POPs)[11]. Previously, organochlorines insecticides were used effectively to combat typhus and malaria but in most advanced countries they are banned. Dichlorodiphenyltrichloroethane is the most widely known organochlorine pesticide, i.e. the DDT insecticide, whose uncontrolled use raised many environmental and human health problems[12]. Some other organochlorines used as pesticides are dieldrin, heptachlor, endosulfan, and dicofol. Also, there is an evidence that DDT and its p-dichlorodiphenyldichloroethylene (DDE) metabolite may have carcinogenic action and endocrine-disrupting

potential[13]. Neuro-developmental effects in children were associated with utero exposure to both DDT and DDE. Health effects such as endocrine disorders, lipid metabolism, effects on embryonic development, and hematological and hepatic changes have been correlated with the general class of organochlorine pesticides[14].

III. ORGANOPHOSPHATE PESTICIDES:

Organophosphate insecticides are highly toxic to insects, but are comparatively less so to domestic animals and humans. While specific organophosphates, such as compounds of trichlorofon, nipafox and triorthocresyl phosphate are obviously neurotoxic, the situation for other organophosphate pesticides is less clear[15]. Organophosphates, marketed as a more environmental friendly alternative to organochlorines, include a wide range of pesticides, the most popular of which is glyphosate. The group also includes other known pesticides such as dimethoate, malathion and parathion some of which are noted for endocrine-disrupting potential. This class of pesticides has been correlated with effects on the activity of cholinesterase enzymes, disruption of normal cellular protein, carbohydrate and fat metabolism, reduced insulin secretion, as well as effects on mitochondrial function and genotoxic effects, causing cellular oxidative stress and endocrine and nervous system problems.

Population-based studies have identified potential associations between exposure to organophosphates and severe health effects including negative effects on the male reproductive system, cardiovascular diseases and on the nervous system, dementia, and also an increased risk of non-Hodgkin's lymphom. In addition, organophosphate prenatal exposure was correlated with reduced gestational duration and neurological harms happening in children.

IV. CARBAMATE PESTICIDES:

Carbamate pesticides are made from carbamic acid and destroy insects like organophosphate insecticides in a similar fashion. They are used extensively in gardens, houses and farming. Like organophosphates, their mode of action is cholinesterase enzyme inhibition, affecting transmission of nerve impulses. In 1956, the first carbamate, carbaryl, was introduced, and more amount was used worldwide than all other combined carbamates. Some of the carbamates are translocated inside plants, making them a systemic treatment that is effective. Carbamate pesticides such as ziram, carbofuran and aldicarb and are another class of chemical pesticides associated with potential reproductive disorders, endocrine-disrupting behavior and effects on mitochondrial function and cellular metabolic mechanism. It has also been confirmed that carbaryl, which belongs to the carbamate pesticides category, act as a ligand for the aryl hydrocarbon receptor, a transcription factor involved in the dioxin toxicity mechanism. There is also an evidence that carbamate pesticides are capable of causing lymphoma of non-Hodgkin's lymphoma, neurobehavioral effects and increased risk of dementia[9].

V. EXPOSURE AND POISONING OF AGROCHEMICAL:

Exposure to pesticides requires contact of a substrate or organism with pesticides. For humans, exposure to pesticides means receiving pesticides in or on the body. The toxic effect depends on the time of exposure and pesticide

concentration[9]. Human exposure to pesticides can occur in four ways:

- Oral exposure (swallowing a pesticide),
- Exposure to inhalation (breathing in a pesticide),
- Ocular exposure (through the eyes),
- Dermal exposure (through the skin).

Residues of pesticides in food items have been a concern for their extensive use to the environment and consumer groups. Some pesticides, in general, are very resistant to microbial degradation, particularly, organochlorines. Therefore, they can accumulate fats in the human body and the environment that pose human health problems. Pesticides and their residues can be accumulated by their lipophilicity and persistence in the adipose tissues and in the blood serum of animals, contributing to environmental persistence, bio-magnification and bio-concentration through the food chain[8]. Three types of harmful effects can be caused by pesticides: acute, chronic or delayed and allergic.

V.I. Acute illness:

In humans, typical symptoms of acute pesticide poisoning include headaches and body aches, skin irritation, exhaustion, skin rashes, feelings of weakness, poor concentration, circulatory issues, nausea, dizziness, vomiting, impaired vision, excessive sweating, tremors, cramps, panic attacks, etc., and coma and death in severe cases. Acute pesticide poisoning diagnosis usually occurs when one or more of these signs are detected, which arise shortly after contact with pesticides. Among the most noticeable health problems in a survey, 16% of respondents reported eye irritation, 5% skin irritation, 6% dizziness, 7% vomiting, 21% headaches, after pesticide treatment. Furthermore, the interviews revealed that 30 percent of respondents had multiple health effects, and the duration of the disease was also quite significant.

V.II. Chronic poisoning:

In addition to causing acute poisoning, when introduced over a longer period of time, pesticides can also cause chronic diseases even the quantities taken up are relatively small. Several agrochemicals, especially pesticides widely used today, have been identified as possibly or probably carcinogenic to humans based on animal testing. While the results of different epidemiological studies are contradictory, these findings leave no doubt that farm workers exposed to pesticides are at significant risk of constricting leukemia and non-Hodgkin lymphomas. Other studies found a correlation between the use of pesticides and sarcomas, prostate cancer, multiple myelomas, pancreas, ovaries, lungs, the breasts, liver, testicles, brain tumors, kidneys and as well as intestines. Some commonly used pesticides, such as carbamates, organophosphates, ethylene-bisdithio-carbamates, and chlorophenoxy, should be considered toxicants for neurodevelopment. Experimental, medical and epidemiological evidence suggests that, at much lower exposure levels, neurotoxic pesticides can also induce developmental neurotoxicity. The general effects of pesticides include cognitive health effects such as memory loss, reduced response speed to stimuli, loss of coordination, reduced vision capacity, reduced motor skills uncontrollable and

changed mood and general behavior. Certain possible health consequences include allergies, asthma, and hypersensitivity as well as exposure to pesticides. Exposure is also associated with hormone disruption, cancer, problems with fetal development and reproduction.

V.III. Allergic reactions:

Allergic reactions are harmful effects produced by some people in response to substances that in most other people do not cause the same reaction. During a person's first exposure to the drug, allergic reactions are not considered to occur. The first contact causes the body to produce chemicals that repel the reaction to that drug. Later exposures lead to an allergic reaction. This procedure is called as sensitization, and chemicals are known as sensitizers which cause people to become allergic to them. Several people are allergic to pesticides. Allergic effects of pesticides include: irritation of the skin, such as rash, systemic effects, such as asthma or life-threatening shock, blisters or open sores, and irritation of the eye and nose, such as watery, itchy eyes and sneezing[4], [9].

The health risk for the general population has been increased from residues of pesticides on drinking water and food. However, various studies have shown that insufficient lack of information and product labeling from consumers have resulted in the systematic misuse and overuse of hazardous pesticides. There is also the risk of unintended contamination of agrochemicals at home from the utilization of chemicals around the house and garden. Vegetable farmers used pesticides that are potentially highly dangerous and in most cases have not been registered. Such conditions could have unintended impacts, including exposure to health hazards by consumers[11]. Such indoor insecticide sprays, which still include DDT, have adverse health effects.

VI. PESTICIDE IMPACT ON HUMAN HEALTH:

Worldwide, the use of pesticides has resulted in various cases of acute and chronic toxicity, ranging from mild symptoms to death, and effects of various hazards on human health. Every year, about three million cases occurring due to acute poisoning of pesticides are recorded worldwide. Two million of these three million cases of pesticide poisoning were suicide attempts, and the majorities are attributed to accidental or occupational poisoning[8]. Pesticide exposure normally occurs while the spray solutions are being formulated, packed into the spray tank and the pesticide is being applied. Continued exposure for an extended period of time to sub-lethal amounts of pesticides can lead to chronic diseases in humans. Symptoms at a later stage are not immediately apparent and manifest. These effects on health depend on the dosage received, nature of substance, skin absorption or ingestion, the route of exposure such as inhalation, and individual sensitivity. Several reports have demonstrated the prevalence of chronic health risks related to pesticides, such as cancer, neurological, diabetes, depression, fertility and respiratory problems. Human epidemiological studies indicated that pesticide exposure and infertility, prostate, breast, and ovarian cancer, and cancers of the nervous system may be associated.

From the study of the pesticide-induced dermal respiratory symptoms in the United Arab Emirates, it turned out that most farmers were poorly educated and used substantial pesticides. These farmers had a very high occurrence of chronic respiratory symptoms, especially cough, bronchitis, pharyngitis, asthma, pneumonia, shortness of breath,

nasal catarrh, pharyngeal irritation, sinusitis, nasal irritation (dryness, secretions and sneezing), cutaneous pruritus, ocular irritations and contact dermatitis. Many health problems such as glucose homeostasis disturbance, Parkinson's disease have been associated to oxidative stress-induced pesticides.

VII. CONCLUSION

Present agriculture needs to address significant factors such as health risks from agrochemicals, population growth, pesticide resistance, food security, natural environment degradation and climate change. Considering the environmental and health effects of chemical pesticides, it is obvious that in agriculture there is an urgent need for a new concept. Some acute and chronic poisoning has now appeared as a result of intake of polluted water, food and air, with effects of varying severity on human health diseases. As a result, they easily kill the beneficial organisms and establish resistance to pests that cause more problems and loss of crops. Adopting a few simple steps such as using sprayers of good quality, wearing headgear, not smoking during spraying and changing clothes straight away after spraying can decrease the acute symptoms. Biofertilizer is an excellent alternative than chemical fertilizers. Biopesticide is also an alternative solution for the control of insects. Agrochemicals are often regarded as a fast, easy and inexpensive result for controlling insect pests and weeds and rising yields in agricultural landscapes. Biological solution can play an effective role in the reduction of chronic effects and green environment.

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