

Review Article

A review on pesticides related health effects in agricultural workers of Sindh, Pakistan

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Abstract

Pesticides are most commonly used throughout the world for agriculture, even some of them, although forbidden due to their severe toxicity and ill health effects are being used in developing countries including Pakistan. Increased pesticide exposure, especially in cotton growing areas of Sindh and Punjab along with poverty, lack of education, poor hygiene and insufficient precautionary measures are leading to increasing health problems. Few investigations have been completed regarding this matter. This review has tried to identify the factors contributing to ill health effects of pesticides in agriculture worker's suggestive preventive measures. Studies were located using Medline database. All Searches included the key headings Pesticides combined with agriculture workers and health effects. Inclusion criteria included studies carried out since 1997 related to pesticide exposure and its ill health effects on agricultural workers. A total of twenty studies was selected during search for four categories of health effects. The studies on acute human toxicity and animal toxicology were excluded. The effects of pesticide on health showed the strongest relationship with neurotoxicity. All the studies reviewed showed evidence of ill health effects mainly on the nervous system, skin, Respiratory and reproductive systems. The farmers working in agricultural fields should be monitored with a passage of time to avoid the spread of diseases due to pesticide residues.

Keywords: Agricultural workers; Neurotoxicity; Pesticide residues

Introduction

Pesticides are playing an important role in meeting the demand of food of the increasing population of the world and the diseases spread by vectors. Application of a pesticide not only affects the health of agriculture workers, but also spreads into the

environment. The health effects are mainly due to contamination of the skin, inhalation and ingestion of water and food. Pesticide exposure and its health effects are an important issue in developing countries [1, 2]. Identification of pesticide hazards helps in the establishment of safe handling of

pesticide. The indiscriminate use of pesticide in agriculture is usually associated with health and environmental issues [3, 4]. In developing countries laws related to its sale and proper use are not being implemented resulting in increased cases of pesticide poisoning [1]. Lack of proper knowledge and understanding about pesticide toxicity, safety precautions during handling and spraying, improper spraying equipment and technique and lack of protective mask and clothing are important issues of developing countries [5-7].

The widespread use of pesticides in agricultural fields has controlled spread of pests; however, it has been accounted with various environmental changes, which causes a multiple set of diseases in different individuals. The ground water in Sindh and mainly in Punjab has been found to be contaminated with the overuse of pesticide. This might be due to the misuse of pesticides by farmers in their cotton fields. The clinical investigations of these farmers evaluated that they were at higher risk to acquire acute and chronic diseases due to the pesticide exposure. A research survey evaluated that higher risk of infections was evaluated from the agricultural workers of cotton fields due to the misuse and overdose of pesticide residues [8]. As analyzed by a research project, a compound called as Endosulfan was evaluated as a residue from the cotton field workers in Multan, Pakistan [9]. A study conducted in Gadap, Karachi, Pakistan revealed that the agricultural workers exposed to pesticides complained about liver and kidney function problems and respiratory tract infection [10].

Diseases occurred in agricultural workers of farm have long been observed with a greater prevalence and it has raised the global burden of disease worldwide. Agricultural environment polluted with residues of pesticides is harmful for the health of workers. Aerosols of pesticides and other

toxic gases like the respiratory irritants can cause respiratory dysfunction in individuals working near the field. These irritants are thought to damage the inflammatory cells, causing neurogenic inflammation, which ultimately damages the bronchial epithelium [11].

The wide and a long term use of pesticides on farms and industries have been associated with the incidence of rapidly growing health impacts on animals and humans. A number of research studies have evaluated a correlation between the exposure of pesticides and the occurrence of chronic diseases like different types of cancers, diabetes, neurodegenerative diseases which includes Parkinson, Alzheimer's and amyotrophic lateral sclerosis (ALS). Many of the studies have further enlightened the correlation between the exposure of pesticides with different reproductive disorders and congenital diseases. Previous research studies also evaluated the association between exposure of pesticides and respiratory disorders which include asthma, Chronic Obstructive Pulmonary Disease (COPD), cardiovascular diseases like atherosclerosis and Chronic artery diseases (CAD) [12]. Pesticides lead to disturbance in cellular homeostasis which ultimately leads to the development of chronic disorders. Pesticides are thought to induce perturbation of ion channels, enzymes and protein receptors.

Pesticides use in tobacco farms and its adverse effects on health

Tobacco has always been counted as a cash crop in Pakistan, damage to its field may cause a wide loss, and therefore a number of irrational pesticides are being used to save the crop from getting damaged. The leaves of tobacco crops provide favorable conditions for insects and pest to grow, therefore these fields are largely dependent upon pesticide use to provide a safe broad spectrum yield. The overuse of pesticides in agricultural fields provides beneficial effects on crops,

but unfortunately, there is no check and balance to the health hazards they are producing on farmer's health [13]. Prolonged use of these pesticides and its elevated concentration in human body alter the normal body metabolism and produces toxic events, which turns to chronic disorders. Health risks due to the exposure of pesticides mainly depend upon the type of toxicity produced by the compound, the symptoms may include headaches, skin diseases, respiratory disorders, gastric disorders and neurologic disorders [14].

A research study was done to evaluate the biomarkers in farmers working in tobacco fields, and majority of worker were being evaluated by more than the allowable daily intake residues of pesticides. The majority of the farmers was evaluated with Methomyl and Thiodicarb residues above the normal limit, this was due to the unsafe practice of mixing pesticides and spraying them in fields. Some farmers were evaluated with the residues of Cypermethrin, this compound is found to be very toxic, as it causes nervous system degeneration and is also found to be carcinogenic [15].

Use of pesticides and respiratory disorders

Pesticides related dysfunctions mostly affect the agricultural workers working in farms and villages. The global burden of chronic respiratory disorders is most commonly observed in children and adults and it's the most predominant dysfunction observed to affect the agricultural workers of Pakistan. Since decades, several surveys have reported the raised incidence of asthma in rural community of Pakistan, most of them are serving as agricultural workers in different farms. Researchers believed that the increased rate of these populations who are acquiring asthma, is due to the increased usage of pesticides to their sites [11]. However, some research studies demonstrated that the risks of chronic obstructive pulmonary diseases are also

observed in agricultural workers due to the use of pesticides [16]. Some research studies evaluated that organophosphorus insecticide causes hyperactivity in respiratory airways [17]; this pesticide is believed to interact with the cholinergic regulation in the lungs, cause allergen sensitization and makes the lung susceptible to develop asthma [11].

Use of pesticides and reproductive disorders

Reproductive disorders are defined as any condition prejudicing the female to reproduce in a healthy and normal manner. Previous research studies enlightened the effects of environmental exposures of pesticides and reproductive disorders in male and female subjects. Pesticides have long been observed to cause infertility in both males and females, increased ratio of miscarriage and maturity patterns in children [18]. The alterations caused in human reproductive systems to gain more importance of scientists when correlated with the alterations occurred in endocrine system. Pesticides which include chlordane, Dichlorodiphenyltrichloroethane DDT, dieldrin, and endosulfan, the herbicide atrazine, and the fungicide vinclozolin are believed to alter the function endocrine system which ultimately leads to reproductive disorders [19, 20].

Use of pesticides and neurotoxicity

Acute and chronic neurotoxicity occurs due to pesticide exposure. Chronic exposure results in cognitive and psychomotor dysfunction and also neurodegenerative disorder. Maternal and early childhood exposure in preschool children of agriculture workers produces neurodevelopmental effects. Most of the studies have documented the mixed occupational exposure.

Alzheimer's disease (AD) is included in the most common neurodegenerative diseases around the world, the prevalence and incidence of disease is being continuously increased with a passage of time. It has been estimated that over the next 40 years, its

incidence would be further raised to 3 folds around the world. The onset of AD is most commonly observed after late 60's and its causes are not completely understood till now, however, most of the scientists discovered that the incidence of disease is linked to the genetic and environmental factors and sometimes lifestyle factors can also contribute an individual's chance to develop the risk factors for AD. Previous research studies depicted that the occupational exposure to certain metal, ions toxic solvents and pesticides may contribute to develop the risk of AD. A research study reported that the presence of p, p'-dichlorodiphenyl di-chloroethylene (DDE), a metabolite of the organo-chlorine, which has been included in several pesticides as DDT was evaluated in serum of Alzheimer's disease patients. The ratio of the presence of DDE was compared with the control group, which was observed to be higher in AD patients.

Conclusion and limitations

The effects of pesticide on health showed the strongest relationship with neurotoxicity. All the studies reviewed showed evidence of ill health effects mainly on the nervous system, skin, Respiratory and reproductive systems. The estimated and calculated use of pesticides is being beneficial for the crops to be safeguarded against the growth of pest and insects, however the mixing practice and spraying them in fields should be kept under control to prevent the environmental alterations and water pollution. The farmers working in agricultural fields should be monitored with a passage of time to avoid the spread of diseases due to pesticide residues. The most important limitation of the studies regarding the health effects of pesticides is that these were unable to establish a clear cause-effect association.

Authors' contributions

Conceived the idea: SAA Rizvi, Corrections: SAA Rizvi, Proof Reading: A Anzar, A

Tariq, Correspondence: KF Altaf, Wrote the Paper: KF Altaf.

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