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PESTICIDE POSIONING: PAKISTAN'S PERSPECTIVE

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ABSTRACT

In this article a comprehensive review on pesticide poisoning in Pakistan's perspective with reference to hospital records and studies with reference to impact of pesticide on health point of view is carried out. The consequences of these poisoning cases are discussed and future plan and strategies are briefly highlighted to tackle its implication on human health of occupational and non occupational groups. A concept of net working of laboratory for monitoring pesticides across Pakistan and a need of a regulatory body in the country is also emphasized for reliable monitoring assessment and reporting procedures in accordance with the appropriate environmental policies, laws and regulations in order to minimize the pesticides cases of poisoning as suggested in this article.

Key-words: Pesticides poisoning, human health, agro-chemicals.

INTRODCUTION

Pesticides are in use from time immemorial. The Greek poet Homer wrote about pest-averting properties of sulphur 1000 years before Christ. Ever since man organized agriculture as a profession, used pesticides in some form or the other i.e. Plant protection agents e.g. nicotine, rotenone, natural pyrethrins and inorganic sulphur. In 1938, Paul Müller discovered the insecticidal activities of DDT which opened a new era in pest management both in agricultural and public health sectors (Bealty, 1973). Recent research and development brought about hundreds of new synthetic chemicals of varying toxicity which do benefit the agriculture but they are also the potential source of environmental pollution and exposure to pesticides which could have negative consequences for human health.

Mankind enjoyed the benefits of these synthetic agro-chemicals for three decades without knowing their ill effects. Carson (1962) in her curtain-raising publication, "Silent Spring", has rightly said "for the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals, from the moment of conception until death". Pesticide residues in food commodities are a fast growing global problem with serious repercussions on human health (Asmatullah, 1996) as contamination of soil, water and air, destruction of predators, parasites and other non-targeted organisms including wildlife This brought about the realization that these chemicals are not exclusively doing the job they were intended to do but also have adverse effects on ecological systems with which human welfare is inseparably bound (Hussain, 1998).

In developing countries the use of pesticides has increased rapidly and one fifth of all pesticides are consumed here. In Pakistan pesticides were introduced in 1954 with 254 metric tons of formulation (Kafi and Baig, 1987; Jabbar and Mallick, 1994). Agricultural Pesticide Ordinance and Rules were adopted almost 17 years later in 1971 and 1973 respectively. By the mid 1960s pesticide consumption reached over 7000 tons per annum, increasing to the level of 16,226 metric tons in 1976-1977 (Baloch, 1985).

The long history of higher pesticide applications on cotton agricultural areas with coarse sandy soil and shallow groundwater lead to the contaminations of this important source (Jabbar *et al*., 1993; Ahad *et al*., 2001; Tahir *et al*., 2001 and Tariq *et al*., 2004 a, b and 2006). In Pakistan, DDT was reported in soil samples from some croplands in Multan and Muzaffarabad in range of 3.70 -5.77 ppm; around 0.5 - 1.37 ppm in cotton fields at Sahiwal; and within a range of 0.44 to 0.66 from paddy fields of Kamoki and Kalashah Kaku and citrus field at Bhalwal (Mumtaz *et al.* (1983).

Pesticides used in agriculture are mainly adsorbed and degraded in the top soil, while the pattern of use of some persistent pesticides combined with environmental conditions could involve a risk of leaching which leads to increased risk of ground water contamination (Felding, 1992). It is recognized that soil is also a potential pathway of pesticide transport to contaminate water, air plants, food and ultimately the human via runoff and subsurface drainage, interflow, leaching and transfer to plant and animals that constitute the human food chain could also pose life threatening problems (Abraham, 2000 and Ahmad and Anwar, 2007). The accumulative effects of these pesticides result in ill health. They could result in sudden death (Ahmad, 1998).

The possible reason for pesticides to reach aquatic environment is through direct run off, leaching, careless disposal of empty containers, equipment washing etc. (Ahad *et al*., 2000, 2001 Tariq *et al*., 2004 a, b and 2006). Once contaminated, an aquifer may retain pollutants for years. Hence the importance of protecting the groundwater from pollution in the recharge area is also very difficult and takes long time and required additional cost to clean up an aquifer, once it has been contaminated. Pesticides may enter water supplies from several sources. These include careless over spraying of water courses, drains or standing water; run off from sprayed or treated areas; careless disposal of containers; the illegal disposal of wastes, pesticides in farmyards; washing down of contaminated equipments; spills; and leaching from soil in treated areas. On occasion's pesticides particularly pyrethroids, are deliberately added to water supplies to control infestations of asellus and shrimps in water. In Pakistan pesticides are being used to trap fishes (Ahad *et al*, 2006). In developed countries the doses of pyrethroids although are very small (0.03 mg L^{-1}) and closely controlled, but can harm the fish and contaminate the water resources that is used by the public. A considerable number of common pesticides have been detected in water supplies as a result of routine monitoring. The principal pesticides detected in surface water were dimethoate, endosulfan and chlorpyriphos which were found regularly in great majority at each monitoring site.

The pesticide exposure intentional or accidental is followed by medical symptoms (Jabbar and Mohsin and FAO, 2001). The pesticide poisoning starts with vomiting, headache, nausea, sweating, suffocation, restlessness, muscular pain and fasciculation of muscles. The WHO recognizes the ChE bio monitoring as a preventive measure against OP exposure and there is a good correlation between exposure and ChE reduction (Tahir *et al*., 2001; Khan *et al.* 2005).

A study was conducted on the perception of information about the health workers occupationally exposed to pesticides residues recently by the present authors (Anwar *et al*., 2006) appear very limited in Pakistan. farmers about hazards of pesticides and its effect on their health. The base line information collected from this study would help to design appropriate community health awareness interventions that will improve families' knowledge about the use of pesticides and their effect on the health and environment.

Pesticides continue to be a significant input in modern agriculture. The relative importance of pesticides has continued, despite the availability of alternatives such as resistant varieties, Integrated Pest Management (IPM) etc. As pesticides are inherently toxic to living organisms, they are more likely to affect the health of human beings than other agricultural chemicals. However, the toxicity of different pesticides for human being varies greatly.

Although the developed countries consume more pesticides, the pesticide poisoning cases are observed more in developing countries, where health is recognized as one of the most important component of human capital for rural people, while malnutrition and dehydration are likely to increase susceptibility to pesticide poisoning (WHO, 1990). Excessive use of pesticides, lack of education, inappropriate labeling, inadequate agricultural extension services and the discomfort of using protective clothing in hot and humid climate increase poisoning risks in agricultural workers. Indiscriminate use of pesticides results in health impairment due to direct or indirect exposure to hazardous chemicals and annually 10,000 farmers and field workers get poisoned by pesticides in Pakistan.

Cotton is a cash crop of Pakistan and plays a pivotal role in the country's economy. It is grown on 2.9 million hectors. This crop receives tremendous amount of organophosphate (OP), carbamate and pyrethroid pesticides against insects. About 60-70-% of pesticide poisoning cases are due to occupational exposure and female cotton pickers appear to be at the greatest risks: Pesticide reduces the enzyme cholinesterase (ChE) level in the blood which can be used as an indicator of its exposure. The pesticide poisoning starts with vomiting, headache, nausea, sweating, suffocation, restlessness, muscle pain and fasciculation of muscles. Acute clinical poisoning is likely to appear when the ChE activity is inhibited by 50% or more and 30% inhibition is considered as a hazard level (WHO, 1990).

Such an over reliance on the use of pesticides in crop protection in general and cotton agro-ecosystem in particular reflects on the attitude and concepts being developed by masses and short-comings in our pesticide policy. The Government of Pakistan, while understanding the gravity of the misuse, intends to review her policy for pesticides in a realistic economic framework which incorporates health risks and environmental concerns associated with its usage. Hopefully this would help reduce the pesticide usage to an optimal level; a level acceptable to both the society and the farmers. For this purpose a project was executed to analyze the existing policy which suggested further reforms for rational use of pesticides in the country (FAO, 2001). It is necessary to take into account the whole body intake of pesticides via food and air, as well as the small amount that may be used for the safety testing relevant to human exposure.

One of the key difficulties which are faced by the scientists in assessing the potential health risk areas from what is popularly called, "the cocktail effect" is the problem which could be illustrated by the reference to pesticide residues in fruits, vegetables and water and that may contain residues of different types of pesticides. To prevent adverse effects on public it is a must to establish control measures in order to ensure MRLs to be respected. The pesticide's contaminate

water, soil and food and accumulate in the soil for relatively a longer period of time and then passed into various parts of the plant grown on the contaminated soil.

Ahmad (2004) emphasized the continuous monitoring of pesticide residue in our food, environment and biosphere at large and its need for creating awareness of trend of level on contamination and to build up a data base upon which future plan could be decided. The misuse of pesticides has led to tremendous economic losses and hazards to human health. Human exposure to pesticides is usually estimated by measuring the levels in the environment i.e. soil, water and food (Tahir *et al*., 2001, Ahmad 2004, Anwar *et al.* 2004, 2005). About 60-70% of pesticide poisoning cases were reported due to occupational exposure and female cotton pickers appeared to be at high risk of hazards (Ahmad, 1998; Tahir, 2000) and recently Tariq *et al*. (2007) reviewed the pesticide exposure cases in Pakistan.

REVIEW OF LITERATURE

Sarwar (1973) reported that 12 children were poisoned due to pesticides out of 407 poisoned cases registered in the poisoning causality department of Mayo Hospital, Lahore. Mughal and Rehman (1973) reported first time the high content of chlorinated pesticide in the fatty tissue of a patient. Jamil *et al.* (1977) reported 39% out of 755 poisoned cases registered during January, 1976 to December, 1985 in the intensive care department of Jinnah Post Medical Centre, Karachi, Sindh. Baloch (1985) studied a major accidental poisoning case occurred in occupational group in 1979 in Multan. Workers with improper clothing unloaded the consignment of phorate under extreme summer conditions as a result seven of them were reported dead. Jamil (1989) reported that out of 108 patients 73 died during 10 years due to organophosphate poisoning. Jamil (1990) reported organophosphate insecticide as the main cause of acute poisoning and its incidence had been found to be increased at alarming rate from 34% in 1979 to 48% in 1981 to 63% in 1985. Khan and Khan (1991) reported low and moderately low levels of serum AChE in 3 and 6 males, respectively in a village of Punjab from the 45 males of the 18-80 years of age. The authors concluded that the low level was due to exposure of organophosphate insecticides which had been used in the agricultural fields around the village. Jabbar and Mohsin (1992) carried out a community survey on acute health effects of pesticides in the districts of Bahawalpur, Rahim Yar Khan and Sahiwal. A sample of 43 individuals (22 males and 21 female workers) were selected randomly and interviewed. Males were associated with the application of pesticides whereas the females were engaged in cotton picking of which 77% complained of health problems, 16% experienced blisters on their skin, 42% complained vomiting, 49% had headache and 26% itching or allergic reactions, 10% experienced other side effects like depression, diarrhea over the last 10 years with occasional occurrence. The female cotton pickers received medical treatments for pesticide poisonings and other ailments, conversely with their male counterparts. 45% of the pesticide applicators received medical treatments or advice. Females (86%) were not aware of the side effects of pesticide poisoning and 95% were not taking any precautionary measures, while 86% of the males had full awareness and 82% were taking precautionary measures. Chaudhry *et al.* (1992) reported death of 75% patients due to insecticide poisoning from 755 cases registered during January, 1986 to December, 1986 in Nishtar Hospital, Multan, Pakistan. Naqvi (1994) reported that 57% suicidal cases were due to pesticide by analyzing three years hospital records of patients who were brought for treatment.

Baloch (1995) interviewed doctors and reviewed the pesticide poisoning cases in 72 hospitals throughout the country. Interviews with doctors showed that the number of accidental poisoning cases was the highest during summer in the cotton spray season. Lack of knowledge, inadequate precautionary measures and improper storage conditions were regarded as the major causes. There were 448 poisoning cases recorded during survey. Of these 205 were accidental (40.4%) and 243 (59.6%) suicidal. The total number of deaths due to accidental and suicidal poisoning were 85 (21.3%) among all the reported cases. Maqbool *et al.* (1995) discussed some of the various common household poisons and their specific treatment modalities in children. Common household agents like cleaners, bleaches and disinfectants contained hydrochloric acid, oxalic acid, ammonia and rodenticides. These substances should either be kept out of reach of children or in cases of poisoning should be removed through emesis, gastric lavage or antidotes.

Habeeb (1996) conducted a survey in the Southern Punjab in small farmer groups of 7 villages in cotton growing area. A sample of 30 people from each village was interviewed including both males and females. Majority of them had no awareness of the ill effects of the pesticides. Due to lack of knowledge the only means of protection during the spray season included a piece of cloth wrapped around the face or in very rare cases spectacles, gloves or other protective clothing were used. After work they usually took a bath in the nearby canal with protective cloths still on. Those who were interviewed also mentioned that they mixed pesticides with water near water sources in the village. This results in a high risk for pollution of water sources, which are used for domestic purposes and drinking. During cotton picking season, the cotton pickers (women and children) worked without any precautionary measures often in an environment

when pesticides were still being applied. During this season females reported for complaints such as sneezing, muscular pain, dizziness, nausea, skin burning, itching, cough, headaches and blisters on the body.

Hussain *et al* (1998) presented as per report of United Nations that the annual death toll due to handling of pesticides is as high as 80,000 deaths and about 2 million are poisoned. In addition to these figures a large chunk of world population suffers from acute and chronic ailments. In Pakistan it is feared that at least 100 people lay their lives every year because of lethal effects of pesticides and 50,000 individuals are poisoned. The author further pointed out that the use of the agricultural chemicals is not suitably regulated in the developing counties including Pakistan and here farmers and their families and livestock were hit worst due to pesticides.

Khan and Raza (1998) reported that the tranquilizers and hypnotic were the poisons (65%) followed by OP insecticides (21%) used for suicide in a study conducted in psychiatric department of Aga khan University Hospital in Karachi. Ahmad, (1998) reviewed the different groups of toxic chemicals including pesticides that had been used to manage pests, in the ecosystem food chain and tissues and body part on non-target species including man and animals. Moreover, toxicology and biochemistry of these chemicals and their important metabolites were also discussed with special reference to ways and means through which these poison hit the non-target species. Hussain *et al.* (1999) confirmed in a study that pesticides had a negative impact on the health of cotton-picking females in the southern Punjab. The information about the pesticide hazards available to farmers, dealers, spray men and cotton-picking women was either insufficient for their safety or not understood properly. The findings also revealed that there was a high level of suicidal attempt among women by drinking pesticides.

Bunggush and Anwar (2000) reviewed pesticide poisoning cases in Pakistan. The total number of deaths due to suicidal poisoning was found to be 63 (26%) from 242 suicidal attempts. Whereas survival rate was reported to be 100% in accidental poisoning cases. Feenstra *et al*. (2000) collected data of 1997 from 1354 farmers and reported that 80% farmers used pesticides. Out of 1080 farmers 18.7% had family health problems associated with pesticides (95% accidental and 5% intentional), 60% farmers were aware about health hazards of pesticides. Tahir (2000) generated baseline information to assessing the health damage to female cotton pickers in cotton growing areas of Punjab. It was observed that majority of cotton pickers did not protect themselves from the adverse effect of pesticides during cotton picking due to lack of awareness. Their perception about hazards was so poor that they (86%) ate and drank (100%) with contaminated hands and breast-fed (67%) their babies during picking. Some (78%) were aware of the hazards, but still did not protect themselves due to unavailability of protective tools. Most of them (89%) stored pesticides in the living room. The picker's perception and knowledge about the health problems caused by pesticides was the main reason for health hazards. The study was conducted in Multan and Bahawalpur divisions, major cotton growing belt to assess the levels of pesticide poisoning on enzyme ChE among female cotton pickers. Blood samples were collected twice (pre and post spray) from 40 non picker females lived in same area. It was observed that ChE levels in blood samples collected pre spray week 5.36 Ku L^{-1} and 5.26 Ku L^{-1} in non pickers and pickers respectively, while in post spray samples the activities of enzyme were 4.80 Ku L^{-1} and 2.81 Ku L^{-1} in non pickers and picker groups. The % activity of ChE was decreased and 42 % females were in acute range during post season as compared to 71% in normal range during the pre spray. 100 % female suffered from headache, vomiting and nausea as a result of symptoms of pesticide poisoning.

Azmi *et al*. (2006) examined persons from 14 different fruits and vegetable family site in Gadap (rural area) of Karachi, Pakistan for the presence of pesticide residues (cypermethrin, deltamethrin, diazinon, monocrotophos, DDT, DDE and Polytrin-C) in their blood its effect on enzyme levels i.e. glutamate pyruvate transaminase (GPT), glutamate oxaloacetate transaminase (GOT), alkaline phosphatase (ALP), and health hazards of pesticide exposed person. Significant increased in enzyme concentration at different site was observed with complaints about liver and kidney disfunction and renal tract infection (RTI). Exposed to multiple pesticides for a prolonged period affected normal functioning of different organ systems, possibly producing char chin effect, dyspnea and burning in urine.

Anwar *et al*. (2006) studied the socioeconomic background, health status of a family and perception about the use of pesticides and health sign and symptoms of farmers. The information was collected on a pre designed questionnaire with close and open questions and survey was conducted in cotton growing areas of District Nawabshah, Sindh in Pakistan. The authors pointed out the need of epidemiological studies for the assessment and management of risk associated with the pesticides in the country.

Akhtar *et al*. (2007) assessed the knowledge about the health safety measures of among the 367 vegetable growers in two potato growing districts of Punjab. This study concluded that growers needs training for health safety measures on priority basis regarding the areas; knowledge of personal equipment and clothing (mean = 1.95); knowledge of personal equipment and clothing (mean = 2.65); knowledge of personal hygiene and sanitation ((mean = 3.26) in human body;

Tariq *et al.'s* (2007) systematical review of the studies carried out since 1960 in Pakistan regarding the human exposure, animals, plants and etc. categorized the farmers on the basis of biological monitoring studies reported to

be at high risk for acute and chronic health effects associated with pesticides due to occupational exposure. In the cotton growing areas, the workers are at high risk due to intensive use of pesticide spray. The authors have also discussed the merit and demerits of consumption of contaminated food and food chain due to pesticides. Also pointed out the limitation of data on pesticides exposure and poisoning is major obstacle towards establishing clear environmental trends and suggested implementation of environmental policies in Pakistan.

Manzar *et al*., (2010) reported the common household agent followed by kerosene (50%), medicines (38%), insecticides (7%) and bath room cleaner (5%) as agents of poisoning of children in a study carried out in the Pediatric Department, Civil Hospital Karachi form 1st January to 31st December 2008. Factors such as mother education level, number of siblings and storage places were found significantly correlated the accidental poisoning cases. The authors emphasized the importance of study on the implications for public health and highlighted the prevalence of accidental house poisoning of the Pakistan's population of Asiatic origin.

Khan *et al*. (2010) reported mild to moderate pesticide poisoning, which was correlated with depression on Plasma Cholinesterase (PChE) levels during a study conducted among the 105 tobacco farmers in Sawabi, Pakistan. Among the 58 (55%) had positive-exposure reduction in PChE level < 20% from baseline, 35 (53%) had mild poisoning (20-40% reduction and 12 (11%) had moderate poisoning (> 40% reduction. Moreover, most farmers reported to have little knowledge about the safety measures, casual attitude and unsatisfactory safety practices with regards to the use of basic protective equipments during pesticide applications on the tobacco crop.

Anwar (2011) in a book entitled "Pesticide residues in agricultural commodities", published by LAMBERT Academic Publishing, Germany, discussed about pesticide impact on human health and presented the results of survey conducted in district Nawabshah, Sindh, about the farmer's socio-economic background, health status of family's perceptions and use of pesticides and health signs and symptoms from pesticide use were collected on pre-designed questionnaire's. Results of pesticide residues in water, soil, fruit and vegetable samples collected from cotton growing areas in Sindh and Punjab provinces of Pakistan were presented and discussed in detail with studies conducted in Pakistan and worldwide.

Hashmi and Khan (2011) written a chapter-1 on "*Adverse health effects of pesticide exposure in agricultural and industrial sectors of developing country*" in a Book entitled Pesticide –The Impact of pesticides exposure. The book documented various adverse impacts of pesticide usage; pollution, dietary intake and health effects such as birth defects, neurological disorders, cancer and hormone disruption. Risk assessment methods and the involvement of molecular modeling to the knowledge of pesticide are highlighted.

Azmi and Naqvi (2011) written a chapter on "*Pesticide pollution, resistance and health hazards"* in a Book entitled, "Pesticide –The Impact of pesticides exposure". The book documented the various adverse impacts of pesticide usage; pollution, dietary intake and health effects such as birth defects, neurological disorders, cancer and hormone disruption. Risk assessment methods and the involvement of molecular modeling to the knowledge of pesticides are highlighted.

Ali *et al*., (2012) investigated the floor dust collected from the rural areas of district Gujrat, Punjab, Pakistan for organic contaminants including organochlorine pesticides (OCP). The low concentrations were reported for most of the contaminants. Typical high and median levels at high dust ingestion exposure for adults was 0.03 ηg/kg bw/day and for toddlers 0.6 ηg/kg bw/day for ∑OCPs. Besides other chemical exposure values were estimated to be several orders of magnitude lower than those reference dose (RfD) values or than those reported from other countries like UK, China, Singapore and Belgium.

CONCLUSION

Government of Pakistan would have to establish a vigilant monitoring system and a training centre for farmers and for epidemiological studies on pesticide poisoning. Unless farmers would be aware of the hazardous effects of these toxic chemicals and would not take strict precautionary measures their life and health would continue to be at risk. Similarly continuous monitoring of the pesticide residues of farmers products would not only make our life and health secured but our agricultural products would also continue to find access for export to international markets.

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