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Uses of pesticide in foods : Curse for health

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The World Health Organization and the UN Environment Programme estimate that each year, 3 million workers in agriculture in the developing world experience severe poisoning from pesticides, about 18,000 of whom die. Use of pesticides in India began in 1948 when DDT (dichlorodiphenyltrichloroethane) was imported for malaria control and BHC for locust control. India started pesticide production with manufacturing plant for DDT and benzene hexachloride (BHC) in the year 1952. Currently, there are approximately 145 pesticides registered for use, and production has increased to approximately 85,000 metric tonnes. Rampant use of these chemicals has given rise to several short-term and long-term adverse effects of these chemicals. The first report of poisoning due to pesticides in India came from Kerala in 1958 where, over 100 people died after consuming wheat flour contaminated with parathion. Subsequently several cases of pesticide-poisoning including the Bhopal disaster have been reported. Despite the fact that the consumption of pesticides in India is still very low, about 0.5 kg/ha of pesticides against 6.60 and 12.0 kg/ha in Korea and Japan, respectively, there has been a widespread contamination of food commodities with pesticide residues, basically due to non-judicious use of pesticides. In India, 51 per cent of food commodities are contaminated with pesticide residues and out of these, 20 per cent have pesticides residues above the maximum residue level values on a worldwide basis. It has been observed that their long-term, low-dose exposure are increasingly linked to human health effects such as immune-suppression, hormone disruption, diminished intelligence, reproductive abnormalities, and cancer. In this light, problems of pesticide safety, regulation of pesticide use, use of biotechnology, and biopesticides, and use of pesticides obtained from natural plant sources such as neem extracts are some of the future strategies for minimizing human exposure to pesticides.

Key words : Pesticide toxicity, Poisoning, Pesticide exposure, Health hazards

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INTRODUCTION

Ever since the dawn of civilization, it has been the major task of man to engage in a continuous endeavour to improve his living conditions. One of the main tasks in which human beings have been engaged is securing relief from hunger, one of the basic human needs. Today India is engaged in the gigantic task of feeding over 1.21 million people and a huge cattle population on which the poor farmer is dependent for his livelihood. Secondly, the control of insects, weeds, fungi and other pests of economic or public health is of utmost importance to our government. The task would have been impossible but for the Green Revolution of 1960, which has given reasonable hope for the country being not only self sufficient in the production of adequate food and fodder for feeding its teeming human and animal population but has become the largest producer of some important commodities. On the other side, pesticides have given rise to serious problems (Gupta, 1989). With a shuddering chill in the spine were call the horror of Bhopal. The catastrophe, resulting from the leakage of methyl isocyanate (MIC) gas from the pesticide factory of Union Carbide Limited at Bhopal in the morning hours of 3 December, 1984, in which thousands of animals and human beings died, will never be forgotten. Most of the chlorinated non-degradable pesticides leave residues in various living systems for prolonged periods of their life span and are presumably responsible for a variety of known and unknown toxic symptoms (Gupta, 1985). Even when present in minute quantities, their variety, toxicity, and persistence have an adverse effect on ecological systems such as birds, fish, and trees with which human welfare is inseparably bound (Gupta, 1986).

Trends in pesticide use :

The world wide consumption of pesticides is about two million tonnes per year, of which 24 per cent is consumed in

the USA alone, 45 per cent in Europe and 25 per cent in the rest of the world. India's share is just 3.75 per cent. The usage of pesticides in India is only 0.5 kg/ha, while in Korea and Japan, it is 6.6 and 12.0 kg/ha, respectively. Currently, the pesticides are being used on 25 per cent of the cultivated area. The three commonly used pesticides, HCH (only gamma-HCH is allowed), DDT and malathion account for 70 per cent of the total pesticides consumption. These pesticides are still preferred by the small farmers because they are cost effective, easily available, and display a wide spectrum of bioactivity. Out of the total consumption of pesticides, 80 per cent are in the form of insecticides, 15 per cent are herbicides, 1.46 per cent is fungicide and less than 3 per cent are others. In comparison, the worldwide consumption of herbicides is 47.5 per cent, insecticides is, 29.5 per cent, and fungicides, 17.5 per cent and others account for 5.5 per cent only. The consumption of herbicides in India is probably low, because weed control is mainly done by hand weeding. In addition to public health and agricultural use, pesticides also find their use in other sectors as well. Presently, there are encouraging trends toward phasing out the toxic and persistent type of pesticides. Some new molecules are being developed which are biodegradable and having low mammalian toxicity, low residual life, and better compatibility with non-target organisms. Some of the other alternatives include the following:

- Regulating pesticide use.
- Use of biotechnology *i.e.*, transgenic technology using bacteria, fungi, viruses, etc.
- Use of biopesticides *i.e.*, use of enemies of insect pests such as parasitoids, predators, and insect pathogens.
- Use of pesticides obtained from natural plant products such as neem extracts and other natural sources.

Poisoning from pesticides :

The rampant use of pesticides has played havoc with human and other life forms. There is a serious hurdle in documentation because of lack of systematic and authentic data on poisonings. Pesticides account for a small but significant fraction of acute human poisonings. There has been a number of outbreaks of accidental poisoning by pesticides that deserve special mention. In India, the first report of poisoning due to pesticides was from Kerala in 1958, where over 100 people died after consuming wheat flour contaminated with parathion (Karunakaran, 1958). The chemical used was ethyl parathion known as Folidol E 605, was introduced by Bayer. In the same year poisoning in Kerala caused deaths of 102 people. This was mainly due to careless handling and storage of wheat. Subsequently, several cases of human and animal poisonings, besides deaths of birds and fishes, have been reported (Sethuraman, 1977; Banerjee, 1979). In Indore, out of the 35 cases of malathion (diazole) poisoning reported during 1967–1968, five died. ECG changes were recorded in all the cases. Autopsy and histopathological studies revealed damage to the myocardium (Karunakaram, 1958). In another report from Madhya Pradesh, 12 humans who consumed wheat for 6–12 months contaminated with aldrin dust and gammexane developed symptoms of poisoning which consisted of myoclonic jerks, generalized clonic convulsions, and weakness in the extremities. Two dogs and two bullocks were also affected with generalized seizers and myoclonic jerks. In another outbreak in 1977, eight cases of grand mal seizers were reported from a village of Uttar Pradesh following accidental ingestion of HCH-contaminated wheat (Nag *et al.*, 1997; Agnihotri, 1999). From time-to-time, several such cases of poisonings have been reported in human being, cows, buffaloes, and heifer calf. In the year 1978, six persons died in Bhopal, due to exposure to phosgene gas (Gupta *et al.*, 1986). There have been numerous suicidal deaths due to consumption of aluminium phosphide but no documented reports are available in the literature, that can be cited. In 1984, the horror at Bhopal is well known. This aspect will be dealt with later in this article. Since then several isolated cases of suicide poisonings have been reported. In the year 1992, six deaths due to aluminium phosphide have been recorded.

Health effects of pesticides :

Health effects of pesticides may be acute or delayed in workers who are exposed (U.S. Environmental Protection Agency, 2007). A 2007 systematic review found that "most studies on non-Hodgkin lymphoma and leukemia showed positive associations with pesticide exposure" and thus concluded that cosmetic use of pesticides should be decreased (Bassil *et al.*, 2007). Strong evidence also exists for other negative outcomes from pesticide exposure including neurological, birth defects, fetal death, and neuro developmental disorder (Jurewicz and Hanke, 2008). According to The Stockholm Convention on Persistent Organic Pollutants, 9 of the 12 most dangerous and persistent chemicals are pesticides

Acute effects :

Acute health problems may occur in workers that handle pesticides, such as abdominal pain, dizziness, headaches, nausea, vomiting, as well as skin and eye problems (Ecobichon, 1996). In China, an estimated half million people are poisoned by pesticides each year, 500 of whom die (Lawrence, 2007). Pyrethrins, insecticides commonly used in common bug killers, can cause a potentially deadly condition if breathed in medicine plus (2006).

Long term effects :

Cancer :

Many studies have examined the effects of pesticide

exposure on the risk of cancer. Associations have been found with: leukemia, lymphoma, brain, kidney, breast, prostate, pancreas, liver, lung, and skin cancers (Gilden *et al.,* 2010). This increased risk occurs with both residential and occupational exposures (Gilden *et al.,* 2010). Increased rates of cancer have been found among farm workers who apply these chemicals (McCauley *et al.,* 2006). A mother's occupational exposure to pesticides during pregnancy is associated with increases in her child's risk of leukemia, Wilms' tumor, and brain cancer (Gilden *et al.,* 2010; Van maele-Fabri *et al.,* 2010).

Neurological :

Strong evidence links pesticide exposure to worsened neurological outcomes. The risk of developing Parkinson's disease is 70 per cent greater in those exposed to even low levels of pesticides. People with Parkinson's were 61 per cent more likely to report direct pesticide application than were healthy relatives. Both insecticides and herbicides significantly increased the risk of Parkinson's disease. There are also concerns that long term exposures may increase the risk of dementia (Baldi *et al.,* 2010). The United States Environmental Protection Agency finished a 10 year review of the organophosphate pesticides following the 1996 Food Quality Protection Act, but did little to account for developmental neurotoxic effects, drawing strong criticism from within the agency and from outside researchers (Phillips, 2006).

Reproductive effects :

Strong evidence links pesticide exposure to birth defects, fetal death and altered fetal growth. In the United States, increase in birth defects is associated with conceiving in the same period of the year when agrochemicals are in elevated concentrations in surface water (Winchester *et al.,* 2009) Agent orange, a 50:50 mixture of 2,4,5-T and 2,4-D, has been associated with increased birth defects in Vietnam (Ngo *et al.,* 2010 and 2006).

Fertility :

A number of pesticides including dibromochlorophane and 2,4-D has been associated with impaired fertility in males (Sheiner *et al.,* 2003).

Other :

Some studies have found increased risks of dermatitis in those exposed. Additionally, studies have indicated that pesticide exposure is associated with long-term health problems such as respiratory problems, memory disorders and depression (Beseler, *et al.,* 2008). Summaries of peer-reviewed research have examined the link between pesticide exposure and neurologic outcomes and cancer, perhaps the two most significant things resulting in organophosphate-exposed workers (Alavanja *et al.,* 2004; Kamel and Hoppin, 2004). According to researchers from the National Institutes of Health (NIH), licensed pesticide applicators who used chlorinated pesticides on more than 100 days in their lifetime were at greater risk of diabetes. One study found that associations between specific pesticides and incident diabetes ranged from a 20 per cent to a 200 per cent increase in risk. New cases of diabetes were reported by 3.4 per cent of those in the lowest pesticide use category compared with 4.6 per cent of those in the highest category. Risks were greater when users of specific pesticides were compared with applicators who never applied that chemical (*http;//newswise.com/articles/view/541427/*).

Route of exposure of pesticide :

People can be exposed to pesticides by a number of different routes including: occupation, in the home, at school and in their food. There are concerns that pesticides used to control pests on food crops are dangerous to people who consume those foods. These concerns are one reason for the organic food movement. Many food crops, including fruits and vegetables, contain pesticide residues after being washed or peeled. Chemicals that are no longer used but that are resistant to breakdown for long periods may remain in soil and water and thus in food (Cornel University, College of Veterinary Medicine, 1999). Strawberries and tomatoes are the two crops with the most intensive use of soil fumigants. They are particularly vulnerable to several types of diseases, insects, mites, and parasitic worms. In 2003, in California alone, 3.7 million pounds (1,700 metric tons) of metam sodium were used on tomatoes. In recent years other farmers have demonstrated that it is possible to produce strawberries and tomatoes without the use of harmful chemicals and in a cost effective way (Lerine Marvin, 2007). Exposure routes other than consuming food that contains residues, in particular pesticide drift, are potentially significant to the general public (US Environmental Protection Agency, 1999). Some pesticides can remain in the environment for prolonged periods of time. For example, most people in the United States still have detectable levels of DDT in their bodies even though it was banned in the US in 1972 (Lockwood, 2000).

Assessment of human exposure :

Pesticides have been primarily criticized for the presence of their residues in various samples of human blood, human fat, human milk, and fat samples, and food commodities. There is no denial of the fact that there is some element of risk involved in the use of pesticides like in any other product or service. Therefore, the pesticide-residue level is an indicator of the accidental exposure and/or average measure of body burden to persistent pesticides. This could either be due to direct exposure

or indirectly through the food chain. In India, National Occupational Health Centre (NIOH) and Indian Council of Agricultural Research Institute (ICAR) are responsible for monitoring of health status and pesticide-residues in various samples. Analysis of samples of human blood, human fat, human milk, and fat samples was carried out by the National Institute of Occupational Health, Ahmadabad. Residues of organochlorine insecticides, especially DDT and HCH have been detected in man and his environment the world over. However, by comparison very high levels of these have been reported in human blood, fat, and milk samples in India (Bhatnagar, 2001). Higher level of these chemicals in human samples and in mother's milk is a reflection of their increased burden and their translactation passage. The toxicological implications of these findings could not be assessed precisely, however, preventive measures are warranted to reduce their body burden to avoid any potential health effect. Residues of pesticides from food commodities were monitored by All India Co-coordinated Research Project on Pesticide Residues under the Indian Council of Agricultural Research, New Delhi, through their centers located in different parts of the country. It was found that 51 per cent of food commodities were contaminated with pesticide residues and out of these 20 per cent had pesticide residues above the MRL values, as compared to 21 per cent contamination with only 2 per cent above the MRL on worldwide basis. Recently, analysis of bottled water, colas and other soft drinks carried out by the Centre for Science and Environment, New Delhi revealed very high content of pesticide residues (Anonymous, 1981 and 2003).

Conclusion :

We need to make our food, our air, our water, and our soil free from toxic chemicals. The real solution to our pest and weed problems lies in non-toxic and cultural methods of agriculture, not in pulling the pesticide trigger. Organically grown foods and sustainable methods of pest control are key to our families' health and the health of the environment. State and federal agencies should require stricter independent testing, including testing of synergistic effects of pesticides. Pesticides known or suspected of causing human health problems should be phased out. Protect our children. Because our children are the most vulnerable population to pesticides, pesticide use should be prohibited in places where our children live and play, including schools, parks, and playgrounds. Require strict non-toxic pest management programs for such places. Pesticide Use Reduction. Provide technical assistance to farmers, local governments, businesses, and homeowners on non-toxic alternatives to pesticide use. This includes alternatives to nuisance spraying for mosquitoes and controlling West Nile virus and other pest problems. Prohibit pollution of our water and poisoning of our communities. Ensure that aerial pesticide use does not pollute our waterways through strict rules governing spraying and buffer zones that prevent the harmful effects of drift. Prohibit the use of pesticides for purely aesthetic reasons. Prevent pesticide applications to water bodies, instead using non-chemical methods of managing aquatic invasive weeds. To sum up, based on limited knowledge with inferential information on pesticides, there is a certain ambiguity of a situationin which people are undergoing life-long exposure. Therefore, there is every reason to properly educate farmers for judicious use of pesticides. Other alternatives such as use of biotechnology, use of biopesticides, and use of pesticides obtained from natural products such as neem should be encouraged.

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