

Pesticide contamination in food items: Threatening for human health and environment

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SUMMARY

In agriculture, the conditions and rules have changed in an unprecedented way over recent years. Crop protection is questioned as never before. Not only have the rules changed, but also alternative techniques are increasingly challenging the chemical approach. According to need of the food security, we have to make the point again and again that without chemically protecting our agricultural commodities, there would not be enough to eat. Farmers would also be unable to make a living producing food. To feed ever-increasing population and ensure sustainable agriculture production, the coupling of chemical technology with biotechnology seems to be the only solution if we wish so avoid mass starvation. Whatever may be the production and protection technology, quality of food we eat must be excellent, free from man made or natural toxins. It is therefore duty of producers, scientists and policy makers to make quality food available to consumer so that his confidence is not shaken. Education of farmers/users of pesticides is absolutely essential to cause awareness about hazards of pesticide residues and to bring down contamination of food commodities and environmental components.

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India became self-sufficient in food production by ushering green revolution in mid sixties. It became possible because full yield potential of varieties and hybrids of different crops was fully exploited by ensuring effective plant protection umbrella coupled with efficient soil, water and nutrient management. Among all different plant protection tools, pesticides played most significant role in enhancing crop production by ensuring security against vagaries of insect-pests and diseases. The last decade has seen change in pesticide usage pattern both in class and type of pesticides used in agriculture and public health programme. In general, percentage consumption of fungicides and herbicides has increased with simultaneous decrease in consumption of insecticides. Among insecticides, consumption of organochlorine pesticides has declined from 14 to 14.5 per cent while consumption of organophosphorus insecticides has increased from 30 to 74 per cent, carbonates from 15 to 4.5 per cent and synthetic pyrethroids from 10 to 5 per cent. A modest consumption of natural pesticides (neem

and Bt. formulations) was registered during this period. The average consumption of pesticides in Indian agriculture was 1.2 g ha⁻¹ in 1953-54, which increased to 431g. Thereafter consumption of pesticides showed declining trends up to 2000-01, however, in the recent years, average consumption of pesticides further increased due to intensive cultivation and changed scenario of environment, which generate new races of insect and pest. The average consumption of pesticides in India is much lower than consumption of the consumption of pesticides on different crops like gram, jute, rapeseed-mustard, soybean, sunflower and tobacco are less than 1 per cent. According to Harr (2002) we have to make the point again and again that without chemically protecting our agricultural commodities, there would not be enough to eat. Therefore, to feed ever-increasing population and ensure sustainable agriculture production, the coupling of chemical technology with biotechnology seems to be the only solution if we wish so avoid mass starvation. An average consumer

spends 8.5 to 70 per cent (av. 15%) of his income on food items; it is therefore need to produce of the quality food for consumers for its better health and save him from health hazards.

Food safety:

Following physical sources of dangers to the food quality can be identified:

- Microbial contamination *i.e.* *Salmonella*, *Listeria*, *Comphylobacter*, *E. coli* and others.
- Residues of pesticides and veterinary drugs in food *i.e.* organ. chlorines and antibiotics.
- Environmental contaminants *i.e.* mercury, lead and dioxins.
- Migration from material in contact with food.
- Food additives, particularly those to which significant number of people are hyper sensitive. *i.e.* sulfur dioxide, tartrazine.
- Others, e.g. mycotoxins, nitrosamins.

Keeping in view the limited space and scope of the subject, we will restrict our discussion to the magnitude if pesticides contamination of food, some facts and fears about environment by appropriate action by various agencies including regulatory agencies, users and the consumers.

Some facts about pesticides contamination of our food items:

Water:

It was reported that different categories of water analyzed all over India has wide spread contamination with DDT, HCH, lindane, chlorpyriphos and traces of herbicidal compounds. Contamination was up to 60 per cent with HCH and 30 per cent with DDT in addition to other pesticides. If judged on the basis of MRL values of EU, majority of the samples exceeded these limits.

Fruits and vegetables:

Contamination of fruits like grapes, mangoes, apples, guava, ber, sapota etc. has recently decreased from 93 per cent to 47 per cent. It was reported that about 6 per cent samples contained residues above MRLs, which declined significantly to 1.5 per cent in the recent years. In fruits, insecticides as well as fungicides residues are reported. The probable cause of relatively less residues in fruits may be long maturation time of these fruits during, which toxicants degrade to safe limits. Seasonal vegetables show high level of pesticides contamination; probably vegetable growers repeatedly spray the crops and bring it to market without observing waiting periods and

contamination has varied from 60 to 80 per cent. In the market samples of vegetables, about 62 per cent were reported contaminated and 11 per cent above MRLs were recorded. The most frequently detected residues include OC, OP, SP and Carbamates insecticides with a very few showing herbicides also.

Honey:

Monitoring studies conducted reports revealed that in Mumbai and Punjab markets showed the presence of OC insecticides in 62-100 per cent samples. Other reports exhibited that samples processed showed 55 to 100 per cent contamination with OC, OP, SP and carbamate insecticides which are because of change in usage pattern of plant protectants.

Milk:

Bovine milk:

DDT and HCH have been main pesticides contaminants of bovine milk throughout India. Mostly 30-45 per cent of total samples showed contamination with DDT above MRLs and 20 to 78 per cent samples contained HCH above MRLs in the country. DDT residues were found above MRL value in 11 per cent and HCH above MRL in 17 per cent samples. Surprisingly endosulfan, some organophosphates and synthetic pyrethroids were also detected in some of the samples as per report available.

Human milk:

Available recent reports revealed that human milk samples analyzed have constantly shown 100 per cent contamination with DDT and HCH. By and large, all samples exceeded MRL values. As reported in bovine samples, the human milk samples have been found to contain endosulfan in addition to DDT and HCH. Amount of residues is slightly on the decreasing side.

Pesticides contamination in India vis-à-vis global scene:

Six pesticides contaminations have been wide reported in India in the last 40 years. Incidence of contamination due to pesticide residues has remained unchanged (60-100%), never the less the percentage of samples with residue above maximum residue limits (MRL) has drastically decreased. Because of change of usage pattern of pesticides in agricultural and public health sectors and advancement in residue Methodology there has been perceptible change in the type and level of pesticide residues detected in food commodities, water

and soil. Up to nineties residues of organochlorine (OC) pesticides like DDT, HCH-isomers, heptachlor and its epoxide, chlordane, aldrin, dieldrin etc dominated the scene whereas presence of multi-residues consisting of OC, organophosphate, synthetic pyrethroids carbamates in addition to fungicides and herbicides have become common now a days. Multiresidues of 9-25 pesticides have been reported in fruits and vegetables sold in USA (Lippmann, 2000). Presence of 5-10 multiresidue in food items in India has become quite common. In May, 2002, the food and veterinary office of the European Commission published the report of the year 2000, Pesticide Residue Monitoring Programme. The report highlighted the results of the analysis of pesticide residues in 45000 samples of fruits, vegetables and cereals and revealed that only 4 per cent of the food samples exceeded MRLs (Kettlitz-2002). In contrast to these observations, Annual Report of All India Co-ordinated Research Project on Pesticide Residues presented during its Annual Workshop at CCS HAU, Bawal (2003) revealed that out of 2139 total samples of fruits, vegetables, cereals, honey, spices, total diet etc., pesticides contamination varied from 33-100 per cent with multi residues. However, contamination in fruits was 46 per cent and in vegetables 64 with 3 per cent fruits and 9 per cent vegetable samples above MRLs. In most of the western countries, number of food commodities exceeding MRLs varies from 1-2 per cent as against 5-35 per cent in India.

Some fears/scares about pesticide residues:

- Recent survey of consumers in U.K. revealed that more than 80 per cent viewed the pesticide residues in food as a serious hazard. This significantly exceeds concerns over drugs, hormones in meat, and nitrates in food, irradiated food, food additives or artificial colours.
- Mostly consumers think that 100 per cent crops are treated with pesticides thus residues are uniformly distributed in food commodities.
- Most people think that all pesticides are persistent and carcinogenic.
- Generally the consumers feel that true picture/facts about residues are hidden by food producers and traders. So consumers do not know the quality of food they are eating.

Implication of pesticide residues on human health:

Toxic effects of pesticides depend upon its toxicological properties, level of residues and degree of exposure to human beings to residues. The more presence

of pesticide residues in food does not mean that it is hazardous. To be toxic the residues have to be present in quantities large enough to be considered unsafe or toxic (greater than MRL) which cause some disorder or disease in the body.

Long term exposure to small amounts of residues through consumption of contaminated food commodities may lead to:

- Suppression of immune system resulting in significant reduction in resistance to bacterial, viral and parasitic infections.
- Promotion in tumor growth in animal species.
- Adverse effect on reproduction and initiation of early puberty in young girls.
- Severe effects on brain, liver and kidney.
- Impairment of nervous system.
- Exposure to residues during pregnancy may lead to deformities in newly born children.

Pesticides *vis-à-vis* cancer risk:

It is interesting to note that none of the synthetic pesticides has been classified by International Agency for Research on Cancer (IARC, 1988) France, as carcinogenic to human beings. The relative risk factor for human cancer from pesticides is about 0.00000761 as compared to 0.0770 for cancer risk due to food related constituents. On the contrary, in a landmark report, the National Resource Defense Council (NRDC) of U.S.A. report that one out of 3400 children between 1 and 5 years of age could one day get cancer because of the pesticides they are as young children (NRDC, 1989). It can be derived that in developing countries where contamination of milk (bovine as well as human) is much higher than reported in western countries, occurrence of cancer in young children can be expected manifold.

How to minimize pesticides contamination of food commodities and environment:

There is no doubt that pesticides will, as they have done for the last 50 years, continue to play a significant role globally in increasing and stabilizing food supply to future also (Caulder, 1998). The problem needs to be addressed at three different levels:

- Manufacture/Policy maker's level.
- Farmers/users level.
- Consumer's level.

Future strategies/suggestions:

- Given the challenges that are involved in the use of

pesticides in general and risk perception by consumers in particular, it is important that pesticides must be used at levels “as low as reasonably achievable”. Consequently, the use of chemicals for crop protection should be part of an integrated crop protection system.

- Specific targets should be designed at national levels to progressively achieve more stringent qualitative and quantitative reductions in the use of pesticides on specific crops and overall.
- Principles for good agricultural practices (GAP) should be developed which specifically aim at reducing the dependency of agriculture on plant protection chemicals.
- Least harmful (low risk) plant protection practices should be developed which specifically aim at reducing the dependency of agriculture on plant protection chemicals.
- Regular surveillance of pesticides residues in soil, water and food commodities as part of national programme should be carried out in different climate regions. The information thus generated will help the researchers and policy makers in future choice of safer pesticides. Additionally the information will give actual status of contamination to the consumers for avoiding exposure to toxic residues.
- Education of farmers/users of pesticides is absolutely essential to cause awareness about hazards of pesticide residues and to bring down contamination of food commodities and environmental components.
- Complete ban on use of hard pesticides like DDT, HCH and heptachlor, chlordane etc both in agriculture and public health sectors.
- To achieve this aim, all players in the chain should

have appropriate knowledge about the responsible use of pesticides and ongoing training should take place.

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