Chapter 5

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Every effort of man is directed towards the fulfilment of his basic requirements. The growing population, relentless march towards development and subsequent unceasing needs have forced man towards urbanisation and industrialisation. Moreover the increasing population has led to ever-ending demand for food. Over use of pesticides in pest control for more production of cereals, fruits and vegetables, its uncontrolled use and its accumulation in foods, environment and ultimately in human body.

Analysis of pesticide residues in fruits, vegetables, cereals, milk etc. have shown that the pesticides which we consider biodegradable were found to be accumulated in very high amounts. Presence of pesticides in milk and egg indicate bioaccumulation. Definitely consumption of these foods will result in adverse effects in humans. No work is available on the ill effects produced by the consumption of pesticide contaminated food. Results of residue analysis of pesticides in tissues of rats which were administered with the pesticides were also alarming. Pesticides are being accumulated in most of the tissues especially in tissues, which contain higher proportion of fat.

In a country like India, even the restricted or banned pesticides are still being used in large amounts for the control of pests in fruits, vegetables, cereals and in food storages. The farmers are using these pesticides in large amounts for higher crop productions resulting in bioaccumulations and biomagnifications. One can imagine the severity when these pesticides are present even in human milk. The infants and children will be the most probable victims since milk and fruits are consumed by them in larger proportion. Reports available indicate that washing and cooking reduce the pesticide contamination.
Even in this alarming situation, the Government of India or Kerala has not taken any step either to control the use of pesticides or to control the ill effects in humans. Hence this is a problem which requires immediate attention. Hence the analysis of pesticide accumulation in tissues through the food chain were investigated and we found that sizeable proportion of pesticides are being accumulated in subjects consuming these contaminated foods. Due consideration was also given to study the ill-effects that might have produced by the accumulation of pesticides by using rats as experimental models and by using BHC and malathion as organochlorine and organophosphorous pesticide members.

Reports available indicate that acetylcholinesterase is an index of OP pesticide toxicity. But in our study, we found that not only organophosphorous pesticides but also organochlorine pesticides affect acetylcholinesterase activity. In both cases acetylcholinesterase in blood and brain were found to be inhibited. In organophosphorous toxicity, acetylcholinesterase activity was inhibited directly (see the mechanisms mentioned elsewhere). But in organochlorine pesticide-induced acetylcholinesterase inhibition might be indirect probably through cytochrome P450.

Liver enzymes, viz. AST, ALT, ALP, ACP, LDH and GGT, were found to be elevated in pesticide toxicity (BHC and malathion). From the available data, we also conclude that bioaccumulation of pesticide in liver might have caused liver necrosis.

The levels of lipids in serum and tissues (liver, heart and kidney) were also elevated in pesticide toxicity. This increase in lipids (cholesterol, triglycerides and phospholipids) in serum and tissues might be due to the liver necrosis which was supported by the increase in liver enzymes.
Results obtained in our study showed that accumulation of pesticides in tissues resulted in the overproduction of peroxides and superoxides. The antioxidant enzymes were found to be inhibited in rats fed with pesticides. Malondialdehyde was found to be elevated in all the tissues studied. Glutathione reductase was found to be inhibited. But glutathione was found to be increased contrary to the prior findings by many workers. The increase in glutathione might be due to the activation of glutathione synthase enzyme. Unfortunately we could not study this enzyme and hence no definite conclusion could be drawn. From the above observations, we could conclude that consumption of pesticide contaminated food can cause serious ill effects in humans.

Pest control is not possible without the use of pesticides. Alternative ways of pest control like biopesticides do not seem to be very effective. In this situation humans will have no other alternative except the use of chemical pesticides and hence the consumption of pesticide contaminated foods. Then how can we overcome the ill effects is a serious problem. So attempts were made to see the detoxifying action of some of the food ingredients which we generally use for making curries and dishes. So the detoxifying action of garlic, ginger and turmeric were studied in rats fed with low and high levels of pesticides. The results obtained were very promising.

The pesticide biomarker acetylcholinesterase activity inhibited by both BHC and malathion, were found to be increased significantly in blood and brain by food ingredients. The liver enzymes, AST, ALT, ALP, ACP, LDH and GGT were found to be decreased significantly by feeding garlic, ginger and turmeric. So we can definitely conclude that the liver necrosis that might have produced by pesticide accumulation would be corrected by those food ingredients. They might have prevented their accumulation via elimination by oxidation, conjugation etc. Increase in glutathione-S-transferase in rats fed with food
ingredients was an important observation suggesting activation of pesticide conjugation with glutathione by the food ingredients.

The lipids (cholesterol, triglycerides and phospholipids) in serum and tissues elevated during pesticide accumulation were decreased significantly by these food ingredients. This might be due to the hepatoprotective action of these food ingredients.

Another important observation is that the free radicals produced during pesticide toxicity were prevented by feeding of garlic, ginger and turmeric. The antioxidant enzymes were activated to scavenge the superoxides and peroxides. No work is available on the pesticide detoxifying actions of garlic, ginger and turmeric and the results of our study are very encouraging. Moreover this is the first report on the above aspects and requires more research.
References