



Pesticide and Drug Residues in Animal Origin Food and its Impact on Food Chain

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Pesticide residues in food and feed frequently attract the attention of the public at large. Consumers can potentially be exposed to residues via consumption of food derived from treated animals. This includes meat and meat products derived from the main food species (bovines, sheep, pigs and poultry), as well as farmed fish, milk, eggs and honey. In the main, the types of drugs used in animal treatment are also used to treat disease in humans, and the side effects of these drugs at high doses are well-known. It is therefore of critical importance that residues of such drugs are either not present in animals or animal products destined for the human food chain, or are present at such a level that adverse effects on the health of consumers cannot occur. Residues of penicillin in slaughtered animals are considered a public health hazard because of the potential for hypersensitivity reactions in people. One area of particular concern in relation to residues of animal remedies is the increasing spread of antibiotic resistance among bacterial species causing disease in humans. At the maximum residue levels in food established for approved animal remedies, health effects are not anticipated in consumers. Consumers can potentially be exposed to residues of animal remedies via consumption of food derived from treated animals. Pesticides are among the most regulated products in several countries. Before a pesticide can be used in California, it must be evaluated and licensed by both the U.S. Environmental Protection Agency (U.S. EPA) and the California Department of Pesticide Regulation (DPR). The manufacturer must present test data to show the pesticide will not pose unacceptable risks to workers, consumers, or the environment. If animal drugs were not absorbed or were metabolized to harmless products, there would be no concern. Unfortunately, this is not usually the case. It is therefore necessary to collect data on residues and their safety as a basis for establishing safe residue concentrations and withdrawal periods for food animal drugs, and, it is equally

important that slaughtered animals be monitored for possible unsafe residues. Veterinary medicines are an essential part of modern livestock production in regard to the prevention and treatment of disease, the treatment of injuries which can adversely affect the productivity, profitability and welfare of animals. It is vital though that these products are used responsibly to prevent animals suffering and to safe guard the human food chain. For these reasons the authorisation, supply and use of veterinary medicines is strictly regulated. Regulatory authorities establish maximum residue limits (MRL) or tolerances and set withdrawal times that ensure residues of the active constituent will not exceed the MRL when the label instructions for the product are followed.

Maximum residue level

The MRL or tolerance is the target concentration in a residue-depletion study. It should be established purely on the basis of safety to the person consuming the product and has no pharmacodynamic reality in the animal to which the drug has been administered. Tissue tolerances are normally established in fat, milk, muscle, liver, kidney, skin, or sometime meat by-products.

Most of the pesticides used in agriculture are herbicides (and residues of these have been reported in fruits and vegetables and occasionally in foods from animals), insecticides and fungicides have been of most concern in meat, milk and eggs. Among these, the organochlorine pesticides (such as DDT, heptachlor and hexachlorohexane or lindane) which are lipid soluble, persistent and therefore prone to bioaccumulation, cause the most concern. Although there is some suggestion that these substances are carcinogens, insufficient human and animal data exist to confirm this. Recently, the presence of organochlorine residues in blood was associated with breast cancer in a large cohort of American women. Organochlorine pesticides are sometimes found in milk and meat,

but in general, the levels detected are below those considered safe. In recent years, these compounds have been withdrawn from use in many countries, and the residue concentrations in foods have been declining steadily. Animals may become contaminated with pesticides when treated with these compounds to rid them of insect pests, or through exposure to contaminated water, buildings or pastures. Contamination of feed may also be important and heptachlor contamination of animal feed has resulted in major episodes of meat and milk contamination. Residues of these compounds in milk are of special concern because milk is consumed in relatively large quantities in vulnerable populations (children) and organochlorines tend to concentrate in the milk fat. Overall, an estimated 40% of pesticides in the human diet are found in meat, milk and eggs and this exposure has decreased in the past few decades, with the exception of occasional outbreaks, such as the heptachlor contamination of milk.

Reasons for more pesticide residues in India:

- **Indiscriminate use of pesticides:** The farmers use pesticides more frequently and in increased doses than the recommended doses or procedures. It leads to the presence of high amount of residues in food commodities.
- **Lack of education:** Most of the farmers working in the agricultural fields are either illiterate or having low formal education. They are not able to understand and read the instructions mentioned on pesticide containers or in the literature supplied with them. Their tendency is to use comparatively higher quantity of pesticides than recommended by the scientists/manufacturers. They ignore the required dilution factor and use much higher concentration of the pesticides. They are even not aware of the harmful effects of the pesticides and do not properly dispose the used containers of the pesticides.
- **For increased production and profit:** Most of the farmers have impression in their mind that spray/use of more pesticide will lead to higher production. Therefore, the desire of more production and profit leads to indiscriminate use of pesticides in crops which ultimately enters in the food chain.
- **Lack of safer pesticides:** So far very few pesticides have been discovered which are harmless to human being or other domestic animals. Therefore, farmers have to use the available pesticides only which have a very narrow safety margin.
- **Use of banned pesticides:** In our country most of the banned pesticides are available in market and are used in various agricultural operations. This is primary because of

the failure of Govt. to formulate and implement effective policies regarding the use of pesticides. Secondly, the socioeconomic condition of farmers does not allow to strictly monitoring the use of dangerous pesticides in agriculture and animal husbandry. These pesticides have been banned because of their acute/chronic harmful effects on the animal/human health. Thus, their use adds to the misery and poor health of farmers and consumers. In spite of ban, DDT and BHC are still produced in India and we have 77% DDT and 95% BHC in India out of their total production in world.

- **Man is ultimate consumer:** Man is the ultimate consumer of pesticide residues in the food chain. These pesticide residues ultimately get accumulated in the man especially in the adipose tissue, blood and lymphoid organs. Pesticide residues reaches in animals through fodder, water, air and other feed stuffs and then accumulates in human being through milk, meat, egg and other animal products. Residues of various pesticide like DDT, Carbaryl, Heptachlor, PCB etc have been reported from animal products in our country. Most of research on pesticide toxicity has been directed towards the assessment of their acute effects. When fed to man or animals at very low doses daily for months or years, these accumulated pesticides in body, may harm the normal functions causing various diseases in man and animals.

Hazards of Drug Residues: Potentially, there are two types of hazards relating to drug residues:

1. Direct and short term hazards.
2. Indirect and long term hazards.

Direct and short term hazards: Public health can be affected by the drugs used in food animals because of their secretion in edible animal tissues in trace amounts usually called residues. For example, oxytetracycline [1] and enrofloxacin residues [2] have been found above the maximum residual level in chicken tissues. Similarly, diclofenac residues were reported to be the cause of vulture population decline in Pakistan [3]. Some drugs have the potential to produce toxic reactions in consumers directly; for example, clenbuterol caused illness in 135 peoples as a result of eating contaminated beef in Spain in 1990. Other types of drugs are able to produce allergic or hypersensitivity reactions. For example, 2- β lactam antibiotics can cause cutaneous eruptions, dermatitis, gastro-intestinal symptoms and anaphylaxis at very low doses. Such drugs include the penicillin and cephalosporin groups of antibiotics [4].

Indirect and long term hazards: Indirect and long term hazards include microbiological effects, carcinogenicity, immunopathological, reproductive effects and teratogenicity. Microbiological effects are one of the major health hazards in human beings. Antibiotic residues consumed along with edible tissues like milk, meat and eggs can produce resistance in bacterial populations in the consumers. This is one of the major reasons of therapeutic failures amongst such peoples. Certain drugs like 3-nitrofurans and nitroimidazoles can cause cancer in human population. Similarly, some drugs can produce reproductive and teratogenic effects at very low doses consumed for a prolonged period of time. One such example is vaginal clear cell adenocarcinoma and benign structural abnormalities of uterus with diethyl stilbesterol [5].

Transmission of disease by food animals

In order for a food animal to act as a vehicle for the transmission of a disease or chemical agent, the disease or chemical agent must:

- Either be present in the animal at the time of slaughter;
- Survive or remain within the product during any subsequent processing and storage;
- Be capable of infecting or affecting humans at the point of consumption.

Early detection of any diseased animals during primary production, where possible, and the correct use and monitoring of any chemicals used are important steps that can ensure a food animal does not become a means of transmitting a disease or chemical residue to the human population. Meat inspection systems are also in place at domestic and export meat processing establishments to detect any diseased animals and monitor any chemical contamination of products to ensure correct use of chemicals. These systems are intended to protect public health by ensuring diseased animals are not used for human consumption and any chemical contamination is within permitted levels.

Conclusion

Veterinarians must be well aware of the importance of drug/chemical residues in the food animals as these residue enters to food chain and their possible risk to the general public. They should have updated information about the proper withdrawal times of all the drugs/chemicals used in their areas of practice. They must extend this information to the livestock and poultry farmers for the production of residue free edible animal products like milk, meet and eggs. Basic education should be given to the farmers to reduce the risk of pesticide residue in the food chain.

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