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Residues of Chlorinated Hydrocarbon Insecticides and Chlorpyriphos in Market Samples of Mutton

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Residues of chlorinated hydrocarbon insecticides and chlorpyriphos were monitored in various body parts of goat, sampled from Coimbatore, Tamil Nadu at the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore. The results revealed that the goat liver, gizzard and fat samples were contaminated with all the four HCH isomers namely α, β, γ and δ. Heart samples were contaminated only with α (BDL - 0.208) and γ (BDL - 0.195) isomers of HCH. Whereas, γ (BDL - 0.019) and δ (BDL -0.074) isomers of HCH were present in flesh samples. Gizzard samples of goat were contaminated with chlorpyriphos, β-endosulfan (BDL - 0.417) and o, p-DDT (BDL -0.194). The maximum levels of HCH, endosulfan, DDT and chlorpyriphos residues in mutton were 0.681, 0.417, 0.194 and 0.469 µg g^{-1}, respectively. Flesh was the least contaminated part in goat. Out of ten gizzard samples analysed only one sample was contaminated with β-HCH, β-endosulfan and o, p-DDT residues and out of 15 fat samples analysed only one sample was contaminated with β-HCH above the maximum residue limit (MRL).

Key words: Chlorinated hydrocarbon insecticides, chlorpyriphos, residues, mutton

The environmental and toxicological impacts of pesticides are highly dependent not only on the parent compound, but also on their metabolites (Kulkarni and Mitra, 1990). Albeit more than 1000 pesticides are in common use around the world and at least around 150 pesticides are registered for use in India. The chlorinated hydrocarbon insecticides, created awareness regarding their use for pest control in agricultural and public health programmes. In view of their propensity to accumulate in biological systems, the use of several chlorinated hydrocarbon pesticides is either restricted or banned in several developed countries. The fear that the pesticide residues in some way may endanger plant and animal communities has encouraged the demand for systems of monitoring, which can measure pollutant levels and detect changes in these levels.

Discussing pesticides in this context, therefore, means evaluating their risk-benefit ratio; in other words, examining what they are likely to contribute to human health and what risks may result from their use. Most of the outbreaks of poisoning to human beings have resulted from the contamination of human food. Though much work has been carried out on residues of food commodities in India (Dethe *et al.*, 1989; Raj *et al.*, 1994), the study on monitoring of insecticide residues in mutton was limited, especially in Tamil Nadu. Considering these, the present study on residues of chlorinated hydrocarbon insecticides and chlorpyriphos in different body parts of goat was carried out as an attempt to assess the current level of pesticide contamination in mutton.

Materials and Methods

Residues of chlorinated hydrocarbon insecticides and chlorpyriphos in mutton samples were monitored in the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore during 2000-2001. Market samples of fresh mutton samples were collected at weekly intervals at Coimbatore. Every time 200 gram each of goat flesh, fat, heart, liver and gizzard were purchased and minced to small pieces and mixed thoroughly.

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From the well mixed samples, a subsample of 20 gram was taken for analysis. Regarding heart samples 5 gram was taken for analysis.

Samples drawn were extracted as far as possible immediately after being received. When the processing could not be done immediately, the samples were stored under refrigerated conditions at -4°C. However, the storing was not prolonged beyond one week. Subsamples equivalent to 20 g or 5 g fresh weight were churned with 3 x 50 ml acetonitrile in a waring blender for 5 minutes. The combined extract was filtered through Buchner funnel under mild suction and condensed. The acetonitrile extract was transferred to a 1 litre separating funnel. It was then diluted with 400 ml of saturated sodium chloride solution and partitioned with n-hexane by shaking thrice (3 x 50). The n-hexane portions were combined in a clean dry flask through a funnel having cotton plugged with 10-15 g of anhydrous sodium sulphate and condensed.

The concentrated n-hexane extracts were transferred to a glass separating funnel. Then 50 ml of concentrated sulphuric acid taken in another separating funnel was added dropwise @ 4 ml/minute by holding above, till the n-hexane layer became clear. The spent up sulphuric acid was discarded and the n-hexane layer was washed with 20 ml portions of distilled water repeatedly, till neutral to litmus. Then, the hexane layer was dried by passing through anhydrous sodium sulphate and concentrated to a suitable volume of 1-5 ml (Kapoor *et al.*, 1981). HCH isomers *viz.* a, g, b and d HCH, a and b endosulfan, endosulfan sulphate, DDT-R and chlorpyriphos residues in animal tissues were estimated by Chemito model 3800 gas chromatograph equipped with ^{63}Ni electron capture detector (ECD). The operating conditions were as follows:

Column	:	Chromato pack (6' long x 0.25' dia) packed with 1.5% OV 17 + 1.95% QF 1 on 80-100 mesh chw/HP.
Temperature (°C)	:	Oven -200; injector -220; detector base -240; detector source -260
Carrier gas flow rate	:	60 ml/min
Attenuation	:	8-32
Aliquot injected	:	1 µl

The amount of residues was measured by comparing the sample response with the response of the standard using the formula:

$$\text{Residues in ppm} = \frac{H_s}{H_{std}} \times \frac{M}{M_1} \times \frac{V}{V_1}$$

Where,

H_s - Peak height of the sample

H_{std}- Peak height of the standard

M - Weight of the standard in ng

M_1- Weight of the sample in g ml^{-1}

V - Volume of the final extract in ml

V_1 - Quantity of the sample injected in µl

Results and Discussion

The results of residue analysis revealed that goat liver, gizzard and fat samples were contaminated with all the four HCH isomers (α, γ, β and δ). While, heart samples were contaminated only with α (BDL - 0.208) and γ (BDL - 0.195) isomers of HCH. Whereas, γ (BDL - 0.019) and δ (BDL - 0.074) isomers of HCH were present in flesh samples. Except the four isomers of HCH, fat samples were free from other organochlorine and chlorpyriphos residues. Metabolites of DDT and endosulfan residues were not detected in goat heart, flesh, liver and fat samples. A part from HCH isomers, gizzard samples of goat were contaminated with β-endosulfan (BDL - 0.417), o, p'-DDT (BDL - 0.194) and chlorpyriphos residues (BDL - 0.469). Except fat samples, all others were contaminated with chlorpyriphos residues, with the maximum of 0.469 µg g^{-1} in both heart and gizzard samples (Table 1). The maximum level of HCH, endosulfan, DDT and chlorpyriphos residues detected in mutton was 0.681, 0.417, 0.194 and 0.469 µg g^{-1}, respectively. Flesh was the least contaminated part in goat. Out of ten gizzard samples analysed only one sample was contaminated with β-HCH, β-endosulfan and o,

Table 1. Residues of chlorinated hydrocarbon insecticides and chlorpyriphos in various parts of goat (µg/g, fresh weight basis)

Residue	Heart (n = 10)	Flesh (n = 5)	Liver (n = 15)	Gizzard (n = 10)	Fat (n = 15)
α - HCH	BDL-0.208 c = 7	BDL	BDL-0.052 c = 3	BDL-0.052 c = 5	BDL-0.052 c = 8
γ - HCH	BDL-0.195 c = 7	BDL-0.019 c = 4	BDL-0.019 c = 13	BDL-0.029 c = 5	BDL-0.038 c = 9
β - HCH	BDL	BDL	BDL-0.227 c = 2	BDL-0.455 c = 1	BDL-0.681 c = 1
δ - HCH	BDL	BDL-0.074 c =1	BDL-0.037 c = 1	BDL-0.454 c = 3	BDL-0.074 c = 3
α - Endosulfan	BDL	BDL	BDL	BDL	BDL
β - Endosulfan	BDL	BDL	BDL	BDL-0.417 c = 1	BDL
Endosulfan sulphate	BDL	BDL	BDL	BDL	BDL
o, p' -DDE	BDL	BDL	BDL	BDL	BDL
o, p' -DDT	BDL	BDL	BDL	BDL-0.194 c = 1	BDL
p, p' -DDD	BDL	BDL	BDL	BDL	BDL
p, p' -DDT	BDL	BDL	BDL	BDL	BDL
Chlorpyriphos	BDL-0.469 c = 4	BDL-0.039 c = 1	BDL-0.078 c = 4	BDL-0.469 c = 4	BDL

n - Number of samples analysed
c - Number of samples contaminated
BDL - Below Detectable Limit

p-DDT residues and out of 15 fat samples analysed only one sample was contaminated with β-HCH above the maximum residue limit (MRL).

Results of present study were in accordance with the findings of Tripathi (1966) who has reported that 61 of the 63 samples of mutton from Pantnagar (U.P.) were contaminated with DDT residues at a mean level of 0.538 ppm. According to Lakshminarayana (1980), 15 of the 22 samples of mutton from Hyderabad (Andhra Pradesh) contained DDT residues with a maximum level of 0.15 ppm. In Delhi, all the 10 samples of goat fat were contaminated with DDT residues ranging from 0.5 to 1.6 ppm (Sharma *et al.*, 1979). Kaphalia and Seth (1981) also reported the presence of both DDT and BHC in various body tissues of goat, buffalo and chicken collected from slaughter houses situated in and around the city of Lucknow (Uttar Pradesh). Battu *et al*. (1984) reported that almost all the samples of meat of pig, chicken, sheep and goat were contaminated with residues of DDT and BHC. The present as well as the earlier studies suggest that the chicken sources in India in general, are contaminated with organochlorine insecticide residues at levels lower than those reported from western countries (Duggan and Duggan, 1973).

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