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EFFECT OF COOKING PROCESS ON PESTICIDE RESIDUES IN POULTRY TISSUES

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SUMMARY

150 Hybro chicken 40 weeks old were divided into three groups, the first group served as a control, the second was given orally a mixture of chlorinated pesticides (lindane, dieldrin, DDT, DDE, DDD, heptachlor and heptachlor Epoxide) and the third gorup was given orally chlorpyrifos (organo phosphate insesticides). The levels of the residues of the chlorinated pesticides in abdominal fat, Drumstick, Breast and liver of coocked chicken were compared with the levels in the raw samples. The different cooking methods lead to great reduction in pesticide residues. The greatest reduction was done by pressure, followed by frying and least by boiling. Also, the different coking methods lead to great reduction of chlorpyrifos in the examined samples.

INTRODUCTION

Consumers are often concerned about the contamination of food with residues of pesticides, as such contaminations are associated with the possible toxicological or carcinogenic effects (Mead and Jones, 1994).

The presence of these chemicals in human food, even in extremly small quantities, is considered to present a potential hazards to human health. It has been assumed that up to 50% of the chlorinated hydrocarbons ingested by human are derived from foods of animal and poultry origin (GrossKlaus, 1978 and, Kaphalia & Seth, 1981). Chlorinated hydrocarbons are the only group of pesticides which have been proved to cause residues in animals tissues as they are slowly excreted, while the organophosphates and the carbamate pesticides are readily metabolized, rapidely excreted and of negligable residues (Spaulding, 1975). Feed stuffs are the main factors for the contamination of

animals with the different types of pesticides. Pesticides may gain their way to feed stuffs from soil, air and water (Harrison et al., 1970 and Hashemy Tonkabony & Mosstofian, 1979). The residues of chlorinated hydrocarbon pesticides accumulated in chicken tissues and fat levels reflecting the source of contamination (Cummings et al., 1967). Cooking of chicken meat contaminated with " chlorinated hydrocarbons has a marked effect on the reduction of residual pesticides (Liska et al., 1967, Ritchey et al., 1972).

The present investigation was conducted to determine the effect of the different cooking processes on the pesticide residues in meat and lipid of chicken adminstrated selected pesticides in their diets.

MATERIAL AND METHODS

150 Hybro chicken, 40 weeks old were divided into 3 gorups each of 50 chicken. The 1st group served as a control. The 2nd group was orally adminstered a daily dose level of 25 mg/Kg. B.Wt. from a mixture of organochlorine pesticides (equal concentrations of lindane, dieldrin, endrin, heptachlor and DDT) for 10 successive days. The 3rd group was given orally a daily dose of 1/10 LD_{50} of the organophosphate insecticides chlorpyrifos (3.2mg/kg. B.Wt.)/ for 10 succesive days, the chicken were sacrified 3 days after the end of treatment, and the carcasses and their content (abdominal fat and liver) were divided into 2 halves. The 1st half of each carcass with its content was wrapped in aluminium foil and stored frozen at -20°C for further analysis of the pesticides residues in the raw tissues. The 2nd half of the carcasses with their contents were cooked by either frying, boiling or steaming under pressure (110°C) for 15 minutes and after that were analyzed for pesticides.

The residues of the chlorinated pesticides were determined in the examined samples by the gas liquid chomatography (AOAC, 1984). 2 gms of melted fat samples and 35 gms of ground mixed meat samples were used for analysis. Samples were separately mixed with 70 gm anhydrous sodium sulphate and extracted with petroleum, ether in a soxhlet apparatus for 6 hours. The residues of chlorinated pesticides were determined in the examined samples by the gas liquid chromatography (AOAC, 1984). Meat samples were ground, mixed and 35gm were mixed with 70 gm anhydrous sodium suphate. The mixture was extracted with petroleum ether in soxhlet apparatus for 6 hours. Fat samples were melted and 2 gm portion was dissolved in pet. ether partitioned with acetonitrile and back-extracted with pet. Ether. Finally solvent were evaporated from both meat and fat samples by using the kunderno-Danish evaporator. 5 ml of each mixture was transferred to florisil column with anhydrous sod. Sulphate and eluted with 200 ml of each of 6% and 15% diethyl ether in petroleum ether. The 6% elution contained lindane, DDT, DDE and DDD, where the 15% elution contained dieldrin, heptachlor epoxide. Finally, 5ul of each of different elutes (6% & 15%) were injected into the gas chromatograph.

Apparatus:- Gas chromatograph, equiped with 63 Ni electron capture detector, glass column of 15

18 *3.2nm od packed with 5% DC 200 on chromosorbw (60/80 mesh). the operating conditions were 230°C, 180°C & 240°C for injector, columns and detector respectivley Nitrogen flow rate 40 & 60 ml/minute.

Residues of the organophosphorous insecticide "chlorpyrifos" were determined according to the technique of WATERS, 1988, and by using the liquid chromotographic method (HPLC) as follows: 100 gm of the sample was grounded and mixed with 10g celite and 25ml acetonitrile. The mixture was filtrated and the filter cake was washed with 10ml acetonitrite. The acetonitrile filtrate. Extracted with 150 ml dichlromethane after addition of 25 ml 20% sodium chloride solution. The total dichloromethane phase was dried over 20g sodium sulphate. Dichloromethane phase was evaporated to about 1ml. One ml 50% propylene glycol in methanol was added as a keeper. The rest of the sample was disolved into methanol to 10 ml and filtered through 0.45u FH. filter and 10ul of this solution was injected in HPLC for analysis. The operating conditions were: column Nova pack c 18 3.9 150nm, mobile phase A: 40/60, methanol/water, Mobile phase B: 70/30, methanol/water, gradient: 100% A to 100% B in 20 minutes flow rate: 1.5ml/min, detector: UV@, 255, 247 nm and inject volume was 10ul.

RESULTS AND DISCUSSION

The results presents in table (1) showed that chicken fat contained the highest residues level of the chlorinated pesticides (lindane, DDT with its metabolites, heptachlor and heptachlor Epoxide) followed by liver, drumstick and finally the breast meat. The liver tissue contained the highest residues of dieldrin and DDDpp Nearly similar results were recorded by Terriere et al. (1969), Boates (1962), Wrigh et al. (1972) Rouseav et al. (1975), Woadhan et al. (1975), Danny et al. (1977), Gawaecka and Maczynski (1977), Dunn et al. (1979) Smoczgnskietar (1979), Delak et al. (1980) and Ault et al. (1984). It was also clear from table (1) that the residues levels of the DDT with its metabolites were higher than any other pesticide and reaching 1450. 16ppb, followed by heptachlor 1005.06ppb, dieldrin 1090.25 ppb and lindane 1001.53 ppb. In this regard Mccaskey et al. (1968), Singh et al. (1970) and Morgan et al. (1972), reported similar findings. Conrad (1978) and Hashemy et al. (1981) stated that the DDE was detected in higher concentrations in different tissues and organs of animals and birds than other DDT metabolites.

The results of table (1) showed that the residues of Heptachlor and Heptachlor Epoxide were abundant in chicken fat. Nearly similar results were reported by Radeleff (1970) and Only et al. (1975), as they mentioned that heptachlor when administered orally appears to be cumulative in its effect and after being absorbed, heptachlor was metabolized to its epoxide and stored in the tissues in that form. Concerning dieldrin residue which is one of the cyclodiene group of organochlorine pesticides, it was shown that the liver, drumstick meat, breast meat contained dieldrin residues. Gannon et al. (1959), recovered dieldrin residue from poultry (fat and meat) 15 times higher than the respective levels in the feed. Also our

Table (1): Residues level of chlorinated pesticides in raw chicken samples (ppb)

Samples	Average pesticide residues (PPb)/50 sample						
	Lindane	Dieldrin	P, P DDT	P, P DDE	P, P DDD	Heptochlor	Chlor epoxid
Drumstick	503.60	1001.53	998.22	199.56	103.09	898.16	116.53
Breast	186.43	426.15	288.09	46.13	27.73	172.16	47.83
Abdominal fat	936.16	100.60	1450.16	274.16	198.58	1005.06	142.60
Liver	701.16	1090.25	1002.16	256.53	146.18	980.26	111.33

Table (2): Residues level of chlorinated pesticides in cooked chicken samples (ppb).

Samples		Average pesticide residues (PPb)/50 sample						
		Lindane	Dieldrin	P, P DDT	P, P DDE	P, P DDD	Heptochlor	Chlor epoxid
Drumstick	Boiled	36.12	98.22	101.56	21.16	152.43	62.53	12.55
	Fried	21.14	54.83	76.50	11.18	101.11	31.16	1.16
	Pressure	11.56	32.16	51.11	4.06	61.16	11.14	0.20
Breast	Boiled	8.03	39.45	11.12	8.36	38.16	51.26	7.61
	Fried	1.21	14.58	1.36	0.20	14.16	14.11	0.21
	Pressure	0.2	2.76	0.2	0.00	3.15	4.20	0.00
Abdominal fat	Boiled	100.14	8.08	199.03	36.14	261.19	81.36	19.56
	Fried	48.16	1.2	78.16	8.16	78.16	14.56	3.40
	Pressure	33.45	0.21	14.14	2.30	16.61	8.26	0.340
Liver	Boiled	60.13	121.08	123.14	25.16	249.35	94.07	12.12
	Fried	21.11	38.36	41.56	2.56	101.16	33.16	2.53
	Pressure	3.56	12.11	13.80	1.40	1.40	16.11	0.20

Table (3): Residue level of the organophosphate Insecticide "chlorpyrifos" In raw chicken samples (PPb).

Samples	Average pesticide residues (PPb)/50 sample
	Chlorpyrifos
Drumstick muscle	189.12
Breast muscle	101.16
Abdominal fat	22.53
Liver	493.51

result were in a good agreement with those reported by Cho et al. (1976) Who stated that dieldrin was readily accumulated in meat than in adipose tissues. The relatively lower levels of lindane residues (gamma isomer of benzene hexachloride) in examined tissues agreed with the findings of Egan (1965) who stated that, in comparison with DDT, lindane accumulated less readily in the body fat of meat animals and that it is eliminated more rapidly from storage when exposure to insecticide ceases. Also the results in table (1) showed that the chicken fat contained the highest residual levels of the chlorinated pesticides Mccasky et al. (1968) attributed such finding to the smaller percentage of body fat in comparison with meat and internal organs. Also the results cleared that the breast meat contained less amounts of pesticides residues than the drumstick meat. this also could be explained by fact that the drumstick meat contains high fat percentage than the breast meat.

The effect of the different cooking processes on the residues of the chlorinated pesticides in illustrated in table (2). Cooking under pressure was found to induse great reduction in the pesticides residues, and this was followed by frying and lastely by boiling, Reduction in the residual amounts of pesticide residues under the effect of cooking process had been also reported by Liska et al. (1967), Ritchey et al. (1967), Ritchey et al. (1972), Lane et al. (1978) and Mostafa (1991). The increase in the level of DDD after cooking than the level in raw tissues, could be explained by the concept held by Ritchey et al. (1967 & 1969) and Morgan et al. (1972) who stated that some of the DDT was simply converted to dechlorinated isomer DDD during cooking process. Wherease, French & Jefferies (1969) pointed out that DDT o,p is broken down to DDTp, p then to

Table (4): Residue level of the organophosphate Insecticide "chlorpyrifos" In cooked chicken samples (PPb).

Samples		Average pesticide residues (PPb)/50 sample
		Chlorpyrifos
Drumstick muscle	Boiled	0.50
	Fried	0.00
	Pressure	0.00
Breast muscle	Boiled	0.00
	Fried	0.00
	Pressure	0.00
Abdominal fat	Boiled	0.00
	Fried	0.00
	Pressure	0.00
Liver	Boiled	18.96
	Fried	3.40
	Pressure	0.00

DDE in living tissues, while in dead tissues the DDT o, p is metabolized finally to DDD.

The higher residue levels of organochlorine pesticides that the organochlorine pesticides that the organophosphate ones (table 3), could be attributed to the slowly excertion and lipophilic characters of the organochlorine pesticides. On the other hand, the organophosphates are readily metabolized rapidly excerted and hydrophilic, and therefore negligable amount of residues were found (Macdougal, 1972) Spaulding, 1975; Frank et al., 1977; Conrad, 1978; Delak, 1981; Ivey and Palmer, 1981; Osman et al., 1982 and Mostafa, 1991).

The residual amounts of the organophosphate insecticides "chlorpyrifos" in raw chicken tissues are presented in table (4). Liver tissues was found to contain the highest residual amounts followed by the drumstick and breast muscles. Abdominal fat contained the lowest concentrations of chlorpyrifos.

The higher residue levels of the organo chlorine pesticides in table (1) than the organophosphorus insecticides "chloryprifos" table (2), could be attributed to the slowly excertion and lipophilic characters of the organochlorine pesticides. On the other hand, the organophosphrous insecticides are readily metabolized, rapidly excerted & hydrophilic.

Finally, it is of interest to realize that cooking under pressure imported the great reduction effect on the pesticide residues table (4), followed by frying, while boiling had the lowest destructive effect, Ritchey et al. (1969), attributed such losses in chicken tissues to the leaching of fat and water during heating.

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