Fishery Technology
2004, Vol. 41(2) pp : 133 - 138

Pesticide Residues in Fresh Water Fishes of Saurashtra Region

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Pesticide residues in fresh water fishes from different sources of Saurashtra region in Gujarat were estimated. Periodic samples were collected from the retail markets, and pesticides estimated by Varian GC 3700. The levels of pesticides varied in different samples collected during same period and in the same species collected during different periods. The samples from Rajkot fish market contained higher level of pesticides compared to the samples from Junagadh. However, the pesticides detected in the samples were well below the permitted levels.

Keywords : Fresh water fish, Saurashtra, pesticide residues

The sources of insecticides in aquatic systems can be diverse, from the chemicals applied directly to control various pests, from run off from treated land, from atmosphere precipitation, leaks, spillages and improper use of pesticides (Dent 1999). Presence of high levels of toxic material in fish has been noticed, which is posing serious health hazards to the consumers. Studies conducted in different parts of the world have reported the accumulation of chlorinated pesticides in fish tissue. (Geyer *et al.*, 1984, Steinvandter, 1983; Thomas *et al.*, 1984; Murthy *et al.*, 1984). Accumulation of various pesticides have been noticed in different fishes and shellfishes at various levels. Radhakrishnan *et al.* (1986) have suggested that mussels can be taken as an indicator organism to monitor the extent of pollution. Radhakrishnan (1993) reported the presence of different types of pesticides in mussel, prawn and in oyster. Fresh water fish from dams tend to accumulate high levels of pesticides in the body since the run off water from the agricultural lands carry a wide variety of pesticides in considerable quantity. Presence of pesticides in different species of marine fish has been reported by Radhakrishnan & Antony (1989). The present study was carried out to assess the levels of pesticides in fresh water fish species collected from different parts of Saurashtra region.

Materials and methods

Fresh water fishes like Catla (*Catla catla*), Rohu (*Labeo rohita*), fresh water cat fish (*Wallago attu*), and minor carp (*Puntius spp.*) were collected from Junagadh market (source: Aji Dam), Rajkot market (source: Morbi dam.) and Kodinar market (source: Una and Diu) and brought to the laboratory in iced condition and meat was manually separated from the fish. The meat was ground with anhydrous sodium sulphate for dehydration and the lipid was extracted with petroleum ether (60-80^{0}C) and vacuum flash evaporated to 1 ml. The pesticide residues were

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separated first by liquid partition using acetonitrile saturated with petroleum ether (60-80°C) and then by florisil column chromatography using petroleum ether (60-80°C) containing 6% diethyl ether followed by petroleum ether (60-80°C) containing 15% diethyl ether as eluent. This was dried by sodium sulphate and vacuum flash evaporated and dissolved in 1ml petroleum ether (60-80°C).The analysis was carried out using Varian GC 3700 fitted with EC detector and *Alltech* pesticide mega bore column 0.5µ x 30 m length FS CoT; injection temperature 250°C, detection temperature 300°C, and column 170-5'-10°C/Min 200°C. Retention times were compared with retention times of pesticide standards obtained from SUPERCO USA. The analysis was carried out in duplicate and average values reported.

Results and discussion

The levels of pesticides in samples collected from Rajkot market is given in Tables 1& 2. The catla samples collected from Rajkot during September had higher levels of pesticide residues compared to the samples collected during November. The levels of pesticides have come down in the samples collected during last week of December. The bigger fish samples had higher levels of pesticides than the smaller ones collected during the same period. In case of rohu samples also a higher level of pesticide residue was noticed during September with higher levels of Dichloro Diphenyl Trichloro Ethane (DDT) and Endrin, which decreased during December. Unlike catla from Rajkot, rohu samples had α-Benzene Hexa Chloride (α-BHC) in their muscle; where as the former samples had β-BHC. Pesticide levels in the fresh water fish samples collected from Junagadh are given in Table 3, 4 and 5. The rohu samples collected during October contained almost all the chlorinated pesticide residues with high levels of endrin and samples collected during other periods had low levels in their muscle. But in catla α- BHC was observed in substantial levels in almost all samples; and the sample collected during February, which had less weight compared to other samples, contained high levels of 2'4'

Table 1. Pesticide in catla from Rajkot market (in ppb)

	RC1	RC2	RC3	RC4	RC5	RC6
Date of sample collection	17.09.01	17.09.01	02.11.01	02.11.01	29.12.01	29.12.01
Length (cm)	45	35	28	38	30	30
Weight (g)	2000	1250	470	1300	650	540
α BHC	ND	ND	ND	ND	ND	48.18
β BHC	19.03	5.82	3.30	15.21	ND	ND
Heptachlor	12.09	27.07	ND	60.86	113.13	ND
Aldrin	10.75	1.18	2.35	ND	22.11	1.18
Hepta epoxide	7.39	2.67	ND	ND	1.70	11.27
α Endosulfan	0.23	ND	ND	ND	ND	ND
24'DDT	59.28	44.10	ND	ND	ND	ND
44'DDT	57.21	ND	ND	ND	95.42	20.14

RC1, RC2, RC3, RC4, RC5 RC6: Catla samples from Rajkot.

Table 2. Pesticide in rohu from Rajkot market (in ppb)

	RR1	RR2	RR3	RR4	RR5
Date of sample collection	17.09.01	17.09.01	02.11.01	29.12.01	29.12.01
Length (cm)	25	28	40	50	48
Weight (g)	260	325	800	1800	1650
α BHC	7.71	92.34	ND	36.11	16.29
β BHC	ND	14.77	ND	ND	ND
Heptachlor	ND	ND	3.90	18.39	11.67
Aldrin	ND	ND	1.94	6.13	1.17
Hepta epoxide	161.50	ND	ND	2.03	ND
α Endosulfan	ND	2.73	0.005	0.63	ND
24'DDT	966.04	ND	4.73	ND	ND
44'DDT	63.57	ND	ND	ND	ND
Endrin	ND	235.92	ND	ND	ND

RR1, RR2, RR3, RR4, RR5: Rohu samples from Rajkot.

Dichloro Diphenyl Dichloro Ethane (2'4'DDD). In fresh water catfish the levels of pesticides noticed was comparatively less except in one sample, which had high levels of endrin. A higher level of heptachlor was also noticed in the same sample. The catla samples from Rajkot had high levels of heptachlor and DDT, whereas the same fish from Junagadh had high levels of BHC and heptachlor. One sample of catla from Junagadh had exceptionally high content of 24 DDD. In the case of Rohu samples from Rajkot, α-BHC, Heptachlor, Aldrin etc., were the main pesticides. One sample had very high level of 2'4'DDT and another had substantial quantity of endrin. In samples

Table 3. Pesticide in catla from Junagadh market (in ppb)

	JC1	JC2	JC3	JC4	JC5
Date of sample collection	04.09.01	04.09.01	19.01.02	05.02.02	05.02.02
Length (cm)	23	28	25.3	25	30
Weight (g)	170	340	350	150	250
α BHC	177.95	90.65	ND	123.77	9.73
β BHC	ND	ND	21.19	ND	1.33
Heptachlor	80.94	58.35	ND	79.08	ND
Aldrin	ND	14.0	1.98	ND	ND
Hepta epoxide	ND	ND	7.51	4.63	ND
α Endosulfan	ND	ND	4.87	ND	1.22
44'DDE	1.30	ND	ND	19.20	2.17
24'DDD	ND	ND	ND	408.80	ND

JC1, JC2, JC3, JC4, JC5:Catla samples from Junagadh.

Table 4. Pesticide in fresh water cat fish from Junagadh market (in ppb)

	JCF1	JCF2	JCF3	JCF4	JCF5
Date of sample collection	13.09.01	13.09.01	29.09.01	29.09.01	12.02.02
Length (cm)	65	51	46	47	46
Weight (g)	1200	800	530	603	429
α BHC	ND	12.42	ND	22.95	6.84
β BHC	ND	ND	ND	4.96	ND
Heptachlor	ND	ND	39.30	6.10	ND
Aldrin	ND	4.86	ND	ND	ND
Hepta epoxide	ND	ND	1.31	ND	ND
α Endosulfan	0.34	0.082	1.51	ND	ND
24'DDD	ND	12.09	ND	ND	ND
44'DDD	ND	7.97	7.82	ND	ND
44'DDT	ND	ND	13.28	ND	ND
Endrin	ND	ND	350.95	ND	ND

JCF1, JCF2, JCF3, JCF4, JCF5: Fresh water catfish samples from Junagadh

from Junagadh also, the major pesticides associated were BHC; endosulphan being the next important one. The level of endrin was found to be high in one sample. One sample collected during the month of July with 50 cm length and 1.25 kg weight contained most of the chlorinated pesticide residues. In case of Kodinar fish samples, the minor carp contained almost all the

Table 5. Pesticide in rohu from Junagadh market (in ppb)

Pesticide	JR1	JR2	JR3	JR4
Date	20.06.01	05.10.01	12.02.02	12.02.02
Length (cm)	50	35	35	30
Weight (g)	1250	900	860	650
α BHC	5.66	ND	8.65	ND
β BHC	0.43	8.91	8.91	0.89
Aldrin	1.26	1.44	0.61	ND
Hepta epoxide	50.30	6.55	ND	ND
α Endosulfan	0.07	0.90	ND	ND
44'DDE	ND	7.45	ND	ND
24'DDT	ND	20.35	ND	ND
44'DDD	ND	13.89	ND	ND
44'DDT	ND	13.88	ND	ND
Endrin	ND	263.56	ND	ND

JR1, JR2, JR3, JR4: Rohu samples from Junagadh

Table 6. Pesticide in rohu and minor carp (*Puntius sp.*) from Kodinar market (in ppb)

Pesticide	KR1	KR2	KMC1	KMC2
Date of sample collection	27.09.01	12.02.02	27.09.01	12.02.02
Length (cm)	63	38	13.5	13
Weight (g)	4200	950	42	38
α BHC	24.94	ND	ND	14.71
β BHC	ND	5.38	8.23	16.36
Hepta epoxide	ND	3.42	ND	ND
α Endosulfan	2.709	ND	ND	3.40
44'DDE	ND	ND	12.20	15.42
24'DDT	ND	ND	22.10	28.49
44'DDD	ND	ND	13.24	54.91
44'DDT	ND	ND	3.11	8.67
Methoxychlor	ND	ND	25.51	123.71

KR1, KR2: Rohu samples from Kodinar

KMC1, KMC2: Minor carp samples from Kodinar

Table 7. Permissible levels of pesticide residues in fish*

Sl. No	Pesticides	Max. Permissible limit in ppm
1	BHC	0.3
2	Aldrin	0.3
3	Dieldrin	0.3
4	Endrin	0.3
5	DDT	5.0

* Source: The Gazette of India No. 614, July 10, 2002

chlorinated pesticides whereas Rohu muscle had very less quantity of pestcides. Rao (2002) reported the presence of BHC, endosulphan and DDT in the muscles of major carps collected from various farms in Kolleru Andhra Pradesh. In general the samples collected from Rajkot fish market contained more pesticides compared to the samples collected from Junagadh. But one sample each of catla and fresh water catfish from Junagadh had 2'4'DDD and endrin in higher levels. Rajkot samples had shown the presence of BHC and aldrin in almost all the samples analysed. Rohu samples collected from Junagadh had more number of pesticides in lesser quantities. Since the levels of pesticides in fresh water cat fish was comparatively less it can be assumed that the herbivorous fishes had accumulated the pesticides than the carnivorous species. Radhakrishnan (1993) reported the presence of pesticides in various marine species were well below the permitted levels in different countries. Radhakrishnan & Anandan (2002) have studied the presence of organochlorine pesticides in locally marketed marine fishes and found that it was well below the toxicity limits. When compared to the permitted levels of pesticides in fish as given in Table 7, the levels detected were very low. But a few samples had high levels of endrin in the meat, which need to be investigated in detail.

The authors express their sincere thanks to Director, Central Institute of Fisheries Technology for granting permission to publish the paper. The help rendered by Mr. K.U Sheikh, Technical staff of Veraval Research Centre of CIFT is duly acknowledged.

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