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A SURVEY OF THE MERCURY LEVELS IN THE FISH OF THE FEDERAL CAPITAL TERRITORY OF NIGERIA

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ABSTRACT

The mercury content of the freshwater fish of the Federal Capital Territory of Nigeria was determined. The mean Hg content in the fish was 215 ± 57 (80 – 350) ng g^{-1} wet weight. Generally the levels of mercury in the samples were low with over 78% of the samples recording a total Hg level of less than 200 ng g^{-1} wet weight in the muscle tissue. These levels were lower than levels found in canned fish (titus sardines) imported into the country. The results showed that the area is not contaminated with Hg and that residents would not exceed the tolerable weekly 350 ngg^{-1}Hg by eating the fish.

KeyWords: Mercury, environmental samples, baseline, Abuja.

INTRODUCTION

Mercury is one of the heavy metals present in the environment, though there is no evidence to show that it is essential to any life form, yet its presence in plant and animal tissues is assumed to be related to its occurrence in air, soil and be related to water. Mercury contamination of aquatic foods has been observed to constitute a considerable hazard to many fish eating vertebrates including man (Ackefors *et al*, 1970; Moore and Moore 1976). Mercury occurs in the biota as bioaccumulating methylmercury which has severe neuropathological and physiological properties (Peakall and Loveth 1972; Holden, 1973). As one of the most toxic metals known, mercury has attracted global attention as a pollutant especially after the catastrophy in Japan in which severe mercury intoxication originating from the ingestion of fish and shell fish resulted in the death of several people (Kurland *et al*, 1960).

Mercury is injected into the environment through mercury compounds which are components of fungicides, wastes from dental clinics and hospitals and chemical industries (Ackefors *et al*, 1970; Moore and Moore 1976, Holden 1973). In view of the great importance of methylmercury pollution, the occurrence of mercury has been studied in a number of aquatic species in various parts of the world (Hattula *et al* 1978, Phillips *et al* 1982, Kehring and Malm 1999), Data on this subject is scanty in Nigeria (Ndiokwere 1983, Kakulu and Osibanjo 1986, Anetekhai 1991).

The present study attempts to establish the current levels of mercury in fish species from the waters of Federal Capital Territory of Nigeria and endeavour to trace the possible sources of this substance in the environment.

MATERIALS AND METHODS

Collection of samples and preservation.

Sixty-seven samples of species of *Tilapia nilotica* and *Heterotis niloticus* were purchased from Gwagwalada, Wuse and Karimo Markets in the Federal Capital Territory of Nigeria. The fresh

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fish samples were wrapped with polythene bags and frozen until they were ready for analysis.

Analytical Procedure

All the reagents used were of analytical grade manufactured by BDH, England and were not subjected to further purification before use. The muscle, gills and intestines of the fish were analysed for their mercury levels. The Analytical Methods Committee method (1965) was used in the preparation of samples for the determination of total mercury content. 30g. of fresh fish tissue was placed in a round bottomed flask and 25 cm^3 of $HNO_3 - H_2SO_4$ (2:1) mixture was added and allowed to predigest at room temperature for about two hours. This was refluxed for about four hours and the contents were transferred quantitatively into a $100cm^3$ volumetric flask and diluted to volume with distilled water.

The efficacy of the digestion process was assessed by the analysis of ten replicates of a sample of *Tilapia nilotica* and some spiked samples of known mercury concentrations. In all cases, blanks were prepared to determine the effect of reagents purity on metal levels. A precision of 12.3% was obtained for the digestion procedure in the determination of total mercury in the fish samples and the average % recovery and a coefficient of variation for the runs of recovery were 91.3 ± 10.4.4% (Table 1).

Instrumentation and determination.

The total mercury content in the fish digests was determined spectrophotometrically by the dithizone method (APHA, 1980) using a Jenway 6105 UV-VIS spectrophotometer at a wavelength of 492 nm.

RESULTS AND DISCUSSION

The mercury content in the edible portions (muscle), gills and other internal organs of the fish species analysed and results are presented in

TABLE 1: Average % Recovery of Total Mercury in *Tilapia nilotica*

Sample No.	Amount of Hg (ug)				% recovery
	Amount in fish	Standard added	Total Amount detected	Amount recovered	
T_1	0.361	1.750	1.986	1.625	93
T_2	0.165	2.000	1.932	1.777	89
T_3	0.092	2.500	2.567	2.475	99
T_4	0.325	3.750	4.037	3.712	95
T_5	0.234	5.000	5.735	4.501	90
T_6	0.133	5.000	5.321	5.185	104
T_7	0.088	2.500	1.890	1.802	72
T_8	0.161	3.000	2.411	2.250	75
T_9	0.116	3.500	3.407	3.291	94
T_{10}	0.208	4.000	4.010	3.802	95

Table 2. The mercury levels in the edible muscle ranged from 80-280 ng g^{-1} with a mean level of 195 ± 65 ng gn^{-1} wet weight. For most samples (78%), the total muscle (edible portion) mercury content was less than 200 ng g^{-1} wet weight. The levels of mercury in these fishes were much lower than the levels found in canned fish (titus sardines) imported into the country (Table 2). For instance, canned fish (titus Sardines) imported into the country were found to contain a mean Hg

TABLE 2: Hg content of fish from the Federal Capital Territory of Nigeria.

Concentration in ng g^{-1} wet weight.

	No. of Species	Mean	Range
Tilapia nilotica (m)	42	150 ± 55	80-280
Heterotis niloticus (m)	25	170 ± 60	100 – 260
Gills of *Tilapia nilotica*	20	270 ± 113	220 – 350
Gills of *Heterotis niloticus*	17	240 ± 96	140-330
Intestine of *Tilapia nilotica*	20	230 ± 110	175 – 345
Intestine of *Heterotis nilotica*	13	263 ± 126	160 – 330
Imported canned fish (Titus Sardines)	9	434 ± 167	309 – 525.

m = muscle.

TABLE 3: Comparison of Hg Levels in the Federal Capital Territory with some other regions of the world. Concentrations in ng g^{-1}.

Region	Fish and Shellfish	Reference
This study	80 – 350	
Asejire Lake, Ibadan,	<10 – 39	Anetekhai, 1991
Niger Delta Area	$\leq$ 10 – 410	Kakulu *et al*, 1986.
Amazon Basin, Brazil	10 – 1390	Kehring *et al*, 1999
Abu Qir bay, (Egypt, Mediterranean)	80 – 950	El-Nabawi *et al*, 1987
Lake Mellwaine, Zimbabwe	230*	Greichus *et al* 1978a
Lake Nakuru, Kenya	220*	Creichus *et al*, 1978b

* = Means values.

level of 434 ± 55ng g^{-1}. The mercury content in all the tissues of the fish ranged from 80 – 350 ng g^{-1} with a mean of 215 ± 57 ng g^{-1} wet weight. Different concentrations of mercury were measured in the different tissues of the fishes (Table 2). The highest concentrations were determined in the gills which is probably the principal organ for the uptake and release of mercury (Korringa 1952). The mean Hg levels in the gills and intestines were 257 ± 78 (140 – 350) and 240 ± 58 (160 – 345) ng g^{-1} wet weight respectively.

Comparism of the levels of mercury in the fish obtained in the present study to levels found in other regions showed that the fishes of the Federal Capital Territory of Nigeria are not polluted with mercury (Table 3). This could be due to the fact that the area is yet to be industrialized when compared to other areas especially the Abu Qir bay in Egypt in which Hg levels of 80 – 950 ng g^{-1} levels were recorded in fishes from the area (El-Nabawi *et al* 1987). Secondly, the levels found in this study are less than the maximum acceptable limits of 500 ng g^{-1} in fish for most countries and the World Health Organisation standards (Kehring and Malm 1999, Phillips *et al* 1982). The results presented in this study are consistent with known standards for freshwater fish from areas from unpolluted waters. Level of mercury from such areas is reported to be lower than 200 ng Hg g^{-1} (Forstner and Wittman 1979), UNEP 1982).

CONCLUSION

The concentrations of mercury in fishes obtained from this study are taken as indicators for the quality of the freshwater environment in which these organisms thrive as well as the significant relation to the use of the edible parts of aquatic animals in the area as food for man. The results showed that the area is not contaminated by mercury and therefore the tolerable, weekly intake value of 350ng g^{-1}recommended by WHO (1987) would not be exceeded by residents who take fish as a major source of protein in the area. As the Federal Capital Territory is undergoing increased urbanization, population and development, this study would serve as a baseline level for future studies. The waters in the Federal Capital Territory of Nigeria is yet to be polluted or contaminated by mercury and the fishes in these waters are safe for human consumption, since the mercury levels in the fishes are below international standards for intoxication by mercury.

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