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Major Elements in Fish (*Illisha africana*), Sediments and Water from Selected Dams in Ekiti State

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Abstract: Levels of sodium, potassium, magnesium and calcium were determined in water, sediments and whole fish (*Illisha africana*) from some selected dams in Ekiti State using atomic absorption spectrophotometer. The levels of these metals in water were found to be lower than those in sediment and fish samples. The values of potassium were found to be the most abundant than other elements in the water (0.16-0.22 mg/100 mL) and sediment (4.38-6.49 mg/100 g) samples; sodium (3.56-5.62 mg/10 g) and potassium (3.06-5.24 mg/100 g) were relatively equal in fish sample. It is quite evident that all element were higher in both sediment and fish samples judging from the biomagnifications factor. Sodium, potassium, magnesium and calcium factor in fish range between 25.43-49.90, 15.30-23.82, 14.14-26.56 and 15.21-43.50, respectively and those of sediments range between 30.14-37.50, 2.45-32.45, 16.35-32.60 and 25.10-50.08, respectively.

Key words: Water, fish, metals, dams

INTRODUCTION

The Ekiti State Government in the quest to provide portable water for the teeming population embarks on the maintenance of dams inherited from old Ondo State such as Ureje, Egbe, Ero and Itapaji. These dams are located in different area of the State.

Water from these dams are being supplied to the public for various purposes, mainly for domestic and secondarily for industrial and agricultural (fish farms and irrigation) purposes. Fish from these dams are being sold to the public for human consumption.

The water from these dams is subject to contamination as a result of increasing human activities in nearby towns and villages. Sources of contamination are chemical elements and compounds, which may be present in ground and surface waters; Metals may be introduced into the aquatic system as a result of weathering of rocks and soils dues to volcanic eruption (Asaolu and Olaofe, 2004). Metals after entering the water may be precipitated, adsorbed on solid surface by fauna and flora and eventually accumulated in marine organism that are consumed by human being (Ipinmoroti and Oshodi, 1993). Mineral elements are of vital concern in nutrition. Calcium, phosphorous, potassium, sulphur, sodium, chlorine and magnesium are required in relatively large amount in the body and they are known as major or macro elements (Carter and Fernnando, 1979; Adeyeye, 2000). Sodium, chlorine and potassium are major electrolytes in the body water. Despite the possibility of continuous metal exchange between a fish and its habitat which include the surrounding water and soil sediments.

The need to study the inter-relationship of metals distribution in these three matrices is necessary, similar studies have been recorded as important as results obtained have assisted in assessing the nutritional value of fish (Adeyeye *et al*., 1996).

Since the establishment of these dams, no work has been done on the chemical assessment of water, sediments and fishes from all the dams. Ekiti State being a developing one, there is a great need

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to monitor the quality of these dams and generate result that could serve as a base line data. It will also create environmental awareness in the consumption of water and fishes from the various dams.

MATERIALS AND METHODS

Sampling

Representative water samples were taken from four dams in Ekiti State (Ureje, Egbe, Ero and Itapaji) using 1 L acid-leached polythene bottles. The soil sediment samples were collected by fishermen from the point where the water samples were collected in each of the dams and stored in a polythene bags. Two pieces of fresh fish (*Illisha africana*) were caught by fishermen in each of the dams and washed with distilled water to remove any adhering contaminants and drained with filter paper. The entire samples were analyzed immediately.

Sample Treatment

About 5 cm^3 of concentrated hydrochloric acid was added to 250 cm^3 of water sample and evaporated to 25 cm^3. The concentrate was transferred to 50 mL flask and diluted to mark with distilled water (Parker, 1972). Five gram of the soil sediment were put into 150 mL conical flask, a mixture of HNO_3: $HClO_4$:HF in the ratio 5: 1: 5 was added (Nwajei and Gagophien, 2000). The mixture was placed on a hot plate for three hours at 85°. The digest was filtered into 100 mL standard flask and made to mark with distilled water. 1.5 g of the whole fish sample was digested by the addition of a mixture of concentrated HNO_3 and 72% $HClO_4$ in the ratio of 5:3 (Asaolu *et al*., 1997b). The mixture was placed on a temperature controlled water bath at 85°C for three hours. The digest was filtered into 100 mL flask and made to mark with 0.5% nitric acid. Major elements were analyzed in the three matrices by means of atomic absorption spectrophotometer (Buck model, 200A). All data generated were analyzed statistically.

RESULTS AND DISCUSSION

The value of the metal range as follows: Sodium 0.11-0.16 mg/100 mL, potassium 0.16-0.22 mg/100 mL, magnesium 0.15-0.19 mg/100 mL and calcium 0.12-0.20 mg/100 mL. Except for magnesium the values obtained for other major elements from Egbe Dam were relatively lower than what was obtained from other dams (Table 1). Potassium concentration with an average values of 0.20 mg/100 mL was the most abundant major element in the dam water while sodium with an average of 0.14 mg/100 mL the least. The relatively high value of potassium compared to other major elements in the water samples from all the dams might have resulted from the highest aqueous solubility of potassium salt from potassium contained materials in and around the dams. This could not be in agreement with the fact that potassium is a well known constituent of many plants (Liptrot, 1984). The presence of potassium and sodium in the concentration ranged reported in this work might be of assistance in the maintenance of electrolyte balance of this major element in the body plasma, thus eliminating the shock that could arise from renal insufficiency or liberation of cell potassium and sodium (Eastham, 1985). There is little variation in the concentration of metals from one dam to another. This is attested to by the percentage coefficient of variation that ranged from 6.25-25.00.

Sodium values range between 3.73-6.00 mg with an average values of 4.57 mg/100 g, potassium 4.38-6.49 mg with an average value of 5.51 mg/100 g, magnesium 2.78-4.89 mg with an average value of 3.86 mg/100 g and calcium 4.00-6.48 mg with an average value of 5.38 mg/100 g (Table 2). Potassium has the highest value in the sediment from all the dams; this might be due to the fact that the element is well known as the most abundant major element in fruits and plant (Olaofe *et al*., 1994). Its level would be enhanced by dead plant residue. This is in agreement with the report of

Table 1: Major elements (mg/100 mL) in water samples from the selected dams

Dams	Sodium	Potassium	Magnesium	Calcium
Ureje	0.16	0.22	0.16	0.20
Egbe	0.11	0.16	0.19	0.12
Ero	0.14	0.20	0.17	0.19
Itapaji	0.14	0.21	0.15	0.12
Means	0.14	0.20	0.16	0.16
±SD	0.02	0.03	0.01	0.04
CV%	14.29	15.00	6.25	25.00

Table 2: Major elements (mg/100 g) in sediment samples from the selected dams

Dams	Sodium	Potassium	Magnesium	Calcium
Ureje	6.00	5.16	4.59	5.02
Egbe	3.73	4.38	3.19	4.00
Ero	4.22	6.49	2.78	6.48
Itapaji	4.34	6.01	4.89	6.01
Means	4.57	5.51	3.86	5.38
±SD	0.99	0.93	1.03	1.08
CV%	21.66	16.88	26.68	20.07

Table 3: Major elements (mg/100 g) in fish samples from the selected dams

Dams	Sodium	Potassium	Magnesium	Calcium
Ureje	5.62	5.24	4.25	5.03
Egbe	5.49	5.04	4.16	5.22
Ero	3.56	3.06	2.45	3.89
Itapaji	4.56	4.98	3.86	4.04
Means	4.73	4.58	3.68	4.30
±SD	0.99	1.02	0.84	1.07
CV%	20.93	22.27	22.83	24.88

Adeyeye *et al.* (1996). There is little variation in the concentration of the major element in the sediment sample from one dam to the other. This is attested to by the percentage coefficient of variation that ranged between, 16.88 and 26.68. This is in good agreement with the observation of Asaolu *et al.* (1997a).

Sodium has value ranging from 3.56-5.62 mg with an average value of 4.73 mg/100 g, potassium value is 3.06-5.24 mg with an average value of 4.58 mg/100 g, Magnesium 2.45-4.25 mg with an average value of 3.68 mg/100 g and calcium 3.89-5.22 mg with an average value of 4.30 mg/100 g. The value of the major elements in fishes from all the dams are relatively similar except for samples from Ero dams which has low value for all the elements (Table 3). This might be due to the age of the fish sample from the dam. Sodium (3.56-5.62 mg/100 g) and potassium (3.06-5.24 mg/100 g) were higher than other major elements in fishes from other dams, this has been reported by Adeyeye *et al.* (1996). Potassium form loose association with proteins and is an activator of pyruvate kinase and numerous other enzymes; over 40 enzymes are known which require a univalent cation for maximum activity, potassium is usually the most effective. Calcium ATP-ase from animal's sources requires sodium as well as potassium ions for maximum activities: Sodium influence osmotic pressure and contribute to normal pH equilibrium (Stansstead, 1967; Sutcliffe and Baker, 1974). All the fishes under discussion are good sources of Sodium and potassium, which might be of advantage with respect to their various functions.

Calcium shows the highest value in sediment sample and the least value is magnesium (Table 4). Sodium is the principal cation in extra cellular fluid (Pike and Brown, 1967). It contributes to normal pH equilibrium among important joint functions, which may explain why it is highly concentrated in the fish sample.

Generally, the concentration of sediment samples were higher than those of the fish and water samples, while those of the water sample was the lowest which indicate that in aquatic environment the depository is the sediment. These trends are expected in aquatic system (Ipinmoroti and Oshodi, 1993; Adeyeye, 1996, 2000; Asaolu and Olaofe, 2004).

Table 4: Biomagnifications factor of the major elements in sediments and fish samples

	Sodium		Potassium		Magnesium		Calcium	
Dams	Sediment	Fish	Sediment	Fish	Sediment	Fish	Sediment	Fish
Ureje	37.50	35.16	23.45	28.82	28.69	26.56	25.10	25.15
Egbe	33.91	49.90	27.18	34.50	18.76	24.47	33.33	43.50
Ero	30.14	25.43	32.45	15.30	16.35	14.41	34.11	15.21
Itapaji	31.00	30.36	28.62	23.71	32.60	25.73	50.08	33.67
Mean	33.14	35.21	27.98	23.58	24.10	22.79	35.66	29.38
±SD	3.34	10.57	3.71	6.62	7.79	5.65	10.44	12.06
CV%	10.08	30.02	13.26	28.07	32.32	24.79	29.28	41.05

Conclusively, the metals under investigation can not cause hardness in water from all the dams because all the values are below the limit of WHO (1993) standard and it is also gratifying that the fish studied in this report contain reasonable levels of beneficial metals (Na, K, Mg and Ca) and the levels are well below the safety limits. This suggests the suitability of the water from the dams for domestic and industrial purposes and fish from the dam will contribute to the nutritional qualities and growth of human being if consumed. It is however recommended that there should be a constant monitoring of the studied area more so that there is an increase in human activities in the area which can have impact on the levels of some these metals.

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