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DETERMINATION OF SOME MINERAL ELEMENTS IN FRESH AND SMOKED FISH OF TILAPIA (*Oreochromis noliticus*) AND CATFISH (*Clarius gariepinus*) FROM IBAJI, KOGI STATE, NIGERIA

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ABSTRACT

Catfish (Clarius gariepinus) and Tilapia fish (Oreochromis noliticus) were examined for mineral elements. Four of the mineral elements (Ca, Cu, Mn and Zn) were determined using a computer controlled solar 969 spectrophotometer while sodium and potassium were determined by flame photometry. The level of mineral elements in dry tilapia fish assayed Ca (16.2±1.3 mg/kg), Cu (4.89 ±0.53 mg/kg), Zn (2.39±0.42 mg/g) and Mn (11.7±0.7 mg/kg). These were higher than the level in fresh Tilapia fish which assayed Ca (18.1±7.3mg/kg), Cu (3.83±0.12 mg/kg), Zn (1.07±0.11 mg/kg) and Mn (2.05±0.04 mg/kg). In the same way, the level of mineral elements in dry catfish assayed Ca (53.6±1.5 mg/kg), Cu (5.81±0.16 mg/kg), Zn (2.77±0.02 mg/kg) and Mn (3.70± mg/kg) were found to be higher than the level in the fresh sample which assayed Ca (23.9±4.3 mg/kg) Cu (4.59±0.08 mg/kg) and Zn (1.70±0.11 mg/kg), manganese in fresh catfish was below detection limit. The total solids, total ash, water soluble ash and acid soluble ash were also determined.

Key words: Mineral composition; source of protein, assayed; tilapia fish; total ash.

INTRODUCTION

Minerals are inorganic substances in food and are needed for a wide range of functions. Those needed in the human diet are calcium, phosphorus/phosphate, sulphur, potassium, sodium, chlorine, magnesium and iron (Taylor *et al*, 1998). Trace nutrient can make up less than 0.01% of the dry weight of an organism and are required for its normal healthy functions and development. These elements include manganese, copper, zinc and iron (Taylor, 1996).

Fish is an important source of animal protein of high biological value, vitamin A and D also contain several minerals such as calcium, iron, cadmium, and lead which may be beneficial or toxic to man depending on the exposure level (Bowen, 1979). Fish has long known for its reputation as the established health food for most of the world's population particularly developing countries in contrast to meat, poultry and eggs. The protein content in fish mostly averages from 15 to 20 percent; hence fish provides comparatively cheap and readily available protein sources in complement with long chains of n-3 fatty acids, amino acids, vitamins and minerals that further contributes to healthier nutritional options for a balance dietary intake (Hajeb *et al*, 2009; FAO, 2010). Marine fish is an important component of protein sources being incorporated into Malaysian diet which constitutes about 60 to 70percent of protein consumed in Malaysia (Tukiman *et al*, 2006; Zuraini *et al*, 2006).

Animal protein intake by Nigerians has been very low in recent times due primarily to a decrease in income per capital, low animal production (Olaide *et al*, *1972*) and fish is a good source of protein and contains omega 3-fatty acids that help to reduce the risk of certain cancers (Terry *etal*, 2001; Terry *et al*, 2002) and cardiovascular disease (La Vecchia *et al*, 2001). As a result of the above reasons, fish is most commonly used as food. Fish may be eaten raw, and fresh, it may be salted, salted and dried, smoked, boiled, fried and made into soup and so on (Vladimir, 1997).

Most research works carried out on fish is to examine the levels of contaminant for example heavy metals in the fish. Most part of the fish examined is the liver, gill, muscle and bone. The argument among those who eat fish has been that fresh fish is better than smoked fish and this is evident when you walk into a restaurant you see rushed for fresh fish. There is need therefore to examine both fresh and smoked fish for their mineral constituents This research work, therefore examined the level of some mineral constituents present in both fresh and smoked tilapia and catfish obtained from Ajega river in Kogi State Nigeria.

MATERIALS AND METHODS

Sampling

The tilapia and catfish fish samples used for this research work were obtained from the Ajega River Idah, Kogi State, Nigeria in 2005. Eight samples each of the tilapia (*Oreochromis noliticus*) and catfish (*Clarius gariepinus*) were caught with fishing net at 8 different locations (randomly selected) along the river inside a boat. The fish samples obtained were kept on ice in the field and transported to the laboratory.

Sample Preparation

In the laboratory the samples were allowed to tor, the scales of the tilapia fish were removed using stainless steel dissecting kits and then washed with deionised water to remove any adhering contamination. The catfish was equally washed. Each species were cut into smaller pieces using stainless steel dissecting kits and mixed together. The samples were then divided into two portions. One portion of each species was smoked dried using fire wood and charcoal (as it is done locally) for two days. The dry samples were cut, shredded and grinded into finely reduced particle size using mortar and pestle. The wet digestion method was employed for this analysis. For each species, 2g of the dry sample was accurately weighed into polyethylene tubes and digested with nitric acid-perchloric acid (3:1) mixture. It was then filtered into 50ml standard flask and then made up to mark with distilled water (Pearson, 1976). This method was also employed for the fresh samples.

The mineral elements were determined using a computer controlled 969 spectrophotometer. Standards for the atomic absorption analysis were obtained as the commercial BDH stock metal standards from which working standards were prepared by appropriate dilution.

Sodium and potassium were determined with flame photometer while calcium was determined by flame atomic absorption using nitrous-oxide flame. Those of copper,

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zinc and magnesium were determined by atomic absorption spectrophotometer using air-acetylene flame. All chemicals used for sample preparation was of analytical grade and were obtained from Sigma Aldrich (London).

RESULTS

Tables 1 and 2 present data on some physicochemical properties of fresh and dry (tilapia and catfish) fish. The total solid and total ash level of tilapia ranged from 576 to 676 and 118 to 703 respectively. Corresponding level in catfish ranged from 574 to 706 and 131 to 584 respectively. The acid insoluble ash of fresh tilapia fish was 6.0 mg/kg while that of fresh catfish was 39 mg/kg. Dry samples of tilapia and catfish have significantly higher amount of acid insoluble ash of 163 and 140 respectively.

The concentration of mineral elements in fresh and dry tilapia and catfish are given in Tables 3 and 4. Results show that sodium has high values of 6250±12 mg/kg and 4625±11 mg/kg in fresh tilapia and catfish respectively. Corresponding values in dry samples were lower. The level of potassium ranged from 100±12 mg/kg (dry) to 362.5±2.4 mg/kg(fresh) in catfish. Potassium concentration of 126 mg/kg in *malapterurus electricus* has also been reported (Adeneyin *et al*., 2012). Potassium level in tilapia was not significantly different. Copper, zinc and manganese recorded low concentrations. The highest amount of calcium was 53.6±1.5 mg/kg in dry catfish while the lowest amount was 16.2±1.3 mg/kg in dry sample of tilapia. Manganese was below detection limit in fresh catfish while in dry sample was 3.70±0.10 mg/kg. Corresponding level of manganese in tilapia was 2.05±0.04 mg/kg and 11.7±0.7 mg/kg in fresh and dry samples

Table 1: Total solid, total ash, water soluble ash and acid insoluble ash of fresh catfish and tilapia in mg/kg

	Tilapia	Catfish
Total solid	676	706
Total ash	118	131
Water soluble ash	36	48
Acid insoluble ash	6.0	39

Table 2: Total solid, total ash, water soluble ash and acid insoluble ash of dry tilapia and dry catfish in mg/kg.

	Tilapia	Catfish
Total solid	576	574
Total ash	703	584
Water soluble ash	43	44
Acid insoluble ash	163	140

Table 3: Level of mineral elements in fresh sample of tilapia and catfish in mkg/g.

Metal	Tilapia	Catfish
Na	6250±12	4625±11
K	137.5±1.6	362.5±2.4
Ca	18.1±7.3	23.9±4.3
Cu	3.83±0.12	4.59±0.08
Zn	1.07±0.03	1.70±0.11
Mn	2.05±0.04	BDL

BDL: Below detection limit.

Results are mean of triplicate determinations on dry weight ± standard deviation

Table 4: Level of mineral elements in dry sample of tilapia and catfish (mg/kg)

Metal	Tilapia	Catfish
Na	3000±11	4375±13
K	138.0±1.2	100±12
Ca	16.2±1.3	53.6±1.5
Cu	4.89±0.53	5.84±0.16
Zn	2.39±0.42	2.77±0.02
Mn	11.7±0.7	3.70±0.10

Results are mean of triplicate determinations on dry weight ± standard deviation

respectively. The differences in the level of copper and zinc in tilapia and catfish were significant different. The results indicated that sodium was the most abundant element ranging from 3000±11 mg/kg to 6250±12 mg/kg followed by potassium in both species.

DISCUSSION

The ash content of any sample is an indication of its mineral content (Adeyeye, 1997). The total ash content of fresh catfish (*Clarius garrepinus*) was higher than of fresh tilapia fish (*Oreochromis noliticus*). Statistical analysis showed that there was no significant difference ($P>0.05$) in the ash content of the dry samples of both species. However, the difference observed in the total ash of dry tilapia and catfish was statistically significant ($P<0.05$).

The dry and fresh samples of tilapia and catfish determined contained reasonable concentrations of sodium, potassium, calcium, copper, manganese and zinc. This means that either dry or fresh fish of tilapia and catfish could serve as good sources of minerals. Sodium was the most dominant mineral in both species. The relatively high concentration of sodium and the other minerals would suggest that the fish was capable of concentrating these mineral elements in their body from the aquatic environment. The variations in the concentration of the different nutritional components in both species could have been as a result of the rate in which these components are available in the water body (Yeannes and Almandos, 2003) and the ability of the fish to absorb and convert the essential nutrients from diet or the water bodies where they live. This is supported by the findings of other researchers (Ricardo *et al*., 2002; Adewoye *et al.*, 2003; Fawole *et al*., 2007).

Except for sodium, the level of calcium, zinc and manganese in dry catfish are slightly higher than the fresh catfish. There was no significant

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difference in the level of sodium in both fresh and dry catfish. Sodium is an activator of transport ATP–ases in animals and possibly also in plants (Adeyeye, 2005). Calcium is good for growth and maintenance of bones, teeth and muscles (Turan *et al*., 2003). Normal extra cellular calcium concentrations are necessary for blood coagulation and for the integrity, intracellular cement substances (Okaka and Okaka, 2001). Manganese functions as an essential constituent for bone structure, for reproduction and for normal functioning of the nervous system. It is also part of the enzyme system (Fleck, 1976). Zinc is a micro element and the concentration determined in catfish and tilapia was valuable. Zinc plays important role in the management of diabetes, which result from insulin malfunction (Okaka and Okaka, 2001).

There were not much variations on the level of mineral elements determined in both dry and fresh samples of catfish and tilapia fish. Depending on the kind of mineral constituents needed, one can take either fresh fish or dry fish of both tilapia and catfish. But one may be quick to add that the dry tilapia and catfish contain high level of mineral elements examined except for sodium and potassium which are more in fresh tilapia. But for catfish it is more for potassium. So it is a matter of choice for an individual to take either fresh or dry fish of these species, since the desired mineral nutrients will still be achieved.

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