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PROXIMATE AND MINERAL COMPOSITION IN SOME FRESHWATER FISHES IN UPPER RIVER BENUE, YOLA, NIGERIA.

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ABSTRACT
The study showed that freshwater fishes are good sources of protein, lipid and micronutrients. The proximate composition of *B. filamelosus, T. niloticus, B. niloticus, C. gariepinus* and *M, rume* revealed encouraging high crude protein contents 33.5%, 34.4%, 37.1%, 38.5% and 38.6% respectively. There was significant difference($p>0.05$) in percentage crude protein, fibre content, ether extract, ash content, NFE energy values among the fishes sampled. The mineral elements and heavy metals in fish tissues were in the following order-K>Na>Fe>Zn>Cu>Ni>Pb, but Cadmium was not detected in all the fishes sampled. Levels of heavy metals are below WHO limits for human consumption.
The aim of this work is to determine the micronutrients and proximate composition of some freshwater species from arid zone of Nigeria.

KEYWORDS: Proximate composition, mineral elements, heavy metal, freshwater fishes.

INTRODUCTION

Fish is widely accepted because of its high palatability, low cholesterol and tender flesh (Eyo, 2000). It is the cheapest source of animal protein and other essential nutrients required in human diet (Sadiku and Oladimeji, 1991). Fish may be the sole accessible and/or affordable source of animal protein for poor households in urban or semi-urban areas (Bene and Heck, 2005).The nature and quality of nutrients in most animals depend largely on their food type. More so, the feeding habit of an individual fish species greatly affects its body nutrient composition (Lagler *et.al*., 1977).

The measurement of some proximate profiles such as protein content, lipids, ash content, nitrogen free extract and crude fibre is often necessary to ensure that they meet the dietary requirements and commercial specifications (Watchman, 2000, Anon, 2000).The study of micro-nutrients present in living organisms is of biological importance because many of such micro-nutrients take part in some metabolic processes and are known to be indispensable to all living things(Shul'man,1974). Fishes contain small amount of these micro-nutrients, some of which are essential nutrients, being components of many enzymes system and metabolic mechanisms that contribute to the growth of the fish. The most important micro-nutrients in form of mineral salts include calcium, potassium, phosphorus, iron, chlorine, while many others are needed in trace amounts. The deficiency in these principal nutritional mineral elements induces a lot of malfunctioning, as it reduces productivity and causes diseases, such as inability of blood to clot, osteoporosis, anaemia, etc (Shul'man,1974 and Mills,1980). The deficiencies of these micro-nutrients, vitamins and protein result in the death of 60% of children under age 5 annually in Africa (Bene and Heck, 2005). The study of these micro-nutrients in fish will reveal the quantity available to fish consumers and prevent the resultant mortality rate due to their deficiencies.

Furthermore, one major pollution sources that pose serious health risk and environmental concern is heavy metals commonly found in fish and aquatic environment (Onyia, *et. al.,* 2007a and Milam and Onyia, 2007b). However, aquatic organisms require these mineral elements at moderate levels, but when they exceed metabolic demand or requirement they accumulate in tissues of organisms such as fish. Fish can only metabolize heavy metals to a lesser extent because most of them are non-biodegradable (Lenntech, 2006). Therefore, considering the various health risk and nutritional benefits associated with fish consumption, it has become important that, micro-nutrients and proximate composition of fish and their health status be examined in order to establish the safety level of table-sized fish species before consumption. The aim of this work is to determine the micro-nutrients and proximate composition of some freshwater species from arid zone of Nigeria.

MATERIALS AND METHODS

The fishes were collected from the fish-landing site at Vininkilang within Girei Local Government Area, Adamawa State Nigeria in May 2007. This site is very close Upper Benue River. The fishes were cut, weighed and dried to constant weight (70-80^{0}C). The dried samples were ground with mortar and pestle into fine powder and stored in labeled polythene bags until required for analysis.

Proximate Analysis.

The methods for analyses were the standard procedures of AOAC (1990). Moisture content was determined by oven drying(at 105ºC) overnight, ash by incineration of 2g of each sample in a muffle furnace (Lenton Furnaces, England) at 600ºc for 2hours, protein(N x 6.25) by the Micro-Kjeldahl method, crude lipid was extracted with n-hexane in a soxhlet extractor, crude fibre by acid-base digestion using 1.25% H_2S0_4(w/v) and 1.25% NaoH(w;v) solution, while available nitrogen free extract was calculated by difference. The energy value of the sample was estimated (Kcal; 100g) by multiplying the percentage of crude protein, crude fibre and NFE by the factors of 16.7, 37.7 and 16.7 respectively (Vadivel and Janardhanan, 2004). All proximate components were analyzed in triplicate and reported as mean on %dry weight basis.

Mineral Analysis

Mineral analysis was done after triple acid digestion according to the method described by Hassan and Umar (2004). Iron, copper, magnesium, calcium, zinc, lead, cadmium and nickel were analyzed by atomic absorption spectrophotometer (Alpha 4 model), while flame photometer (Corning 400 UK) was used for Sodium and Potassium analysis. All determinations were carried out in triplicate and reported as mean mineral content in mg/100g dry matter (DM). Let us know the statistical methods used

DATA ANALYSIS

Data collected from each parameter was subjected to computation and analysis of variance (ANOVA) test followed by the least significant difference (LSD).

RESULTS

The mean percentage proximate composition (i. e. protein, fibre, ether extract, ash, moisture content, NFE and dry matter) of the analyzed samples is shown in Table 1. The food values analyzed showed varied values of their presence in the body tissue of the fishes analyzed; with the percentage dry matter, NFE and crude protein recording higher value in that order; followed by moisture content, ash content, ether extract and crude fibre. The fish samples presented a relatively higher and lower amount of proximate concentrations in the order of *M. rume> C. gariepinus>B. niloticus> T. niloticus> B. filamelosus.* The energy values of the fish samples analyzed showed a relatively higher values in fatty fishes except *M. rume*(349.49 Kcal/100g). The lean fishes had *B. niloticus* (370.12Kcal/100g) and *T. niloticus* (357.12Kcal/100g). The rest fatty fishes- *C.gariepinus* and *B. filamelosus*- recorded 393.26Kcal/100g and 363.7Kcal/100g.

The result of the means of mineral elements in the body tissue of fish samples analyzed was given in Table2. The variations observed in the values observed in the values obtained showed significant difference. All the mineral elements investigated were represented in all species analyzed except cadmium. The most abundant mineral elements in the fish samples analyzed were Potassium, Sodium, Iron, Zinc and Copper, while Nickel and Lead were in trace amount. Cadmium was not detected in all the fish sampled. *T. niloticus, C. gariepinus, B. filamelosus, M. rume* and *B. niloticus* presented a relatively higher amount of mineral content in that order with which they are listed.

DISCUSSION

Fish is a source of animal protein and the declining livestock production (Cattle and Poultry) in Nigeria has increased the relative substitution value of fish for meat. Fish is widely accepted because of its high palatability, low cholesterol and tender flesh (Eyo, 2001). However, fewer numbers of consumers eat fish because of its nutritional value. It is therefore necessary to make information available to consumers and fishery workers on the nutritional contribution of some fish species in their daily diets (Adewoye *et. al.*, 2003; Barminas, *et. al* 1998).

Concentrations of Potassium (K^+) were observed to have appreciably dominated other elements analyzed in all the fish samples examined. This tends to disagree with the work done by Fawole, *et. al*., (2007) at Asa reservoir, in Ilorin, Kwara State Nigeria; where the dominant element in the fishes sampled was sodium. It could be inferred from the high concentration of potassium (K^+) in the tissues of the fish species that the water body from which the fishes were collected is rich in potassium (K^+). This must have allowed an active movement of this ion across the gill structure, which in turn may depend on the concentration in the external medium and that the richness in potassium (K^+) concentrations would boost the osmoregulatory activities in the organisms(Bently,1971). The concentration of sodium (Na^+) in the fish samples examined ranked second among the mineral elements analyzed. The variations recorded in the concentration of mineral in fish muscles examined could be as a result of the rate in which they are available in the water body and the ability of the fish to absorb these inorganic elements from their diet and the environment where they live (Adewoye and Omotosho, 1997).

Other elements (such as iron, copper, nickel, zinc, lead and cadmium) composition of the fish samples recorded variations in their concentrations both within and between the selected species sampled. This variation in concentrations of the mineral elements in sampled fish tissues agree with the work of Windom *et. al.*, (1987) which stated that such variation was due to the chemical forms of the elements and their concentrations in the environment. The concentrations of the mineral elements in the fish tissues are in the following order (i.e. Fe>Zn>Cu.>Ni.> Pb). Cadmium was not detected in any of the fish tissues. This report is in agreement with the one obtained by Ako and Salihu (2004). The levels of most of these mineral elements present are in trace amount and are still below World Health Organization limits for human consumption.

The proximate composition of *B. filamelosus, T. niloticus, B. niloticus, C. gariepinus* and *M. rume* reveal encouraging high crude protein contents of 33.5%, 34.4%, 37.1%, 38.5% and 38.6% respectively(Table 1).The relatively high to moderate percentage crude protein may be attributed to the fact that fishes are good source of pure protein, but the differences observed , in values obtained could also be as a result of fish consumption or absorption capability and conversion potentials of essential nutrients from their diets or their local environment into such biochemical attributes needed the organisms body(Burgress, 1975; and Adewoye and Omotosho, 1997). The fatty fishes recorded high ether extract (9.1% and 7.7%). Fish contain essential fatty acids that are useful to human body (). The ether extract level in the fish tissues could have been due to the influence of food (Reinitz, 1983; Degani Dosoretz, 1988). The percentage ash in *B. filamelosus, M. rume* and *T. niloticus* was within the stipulated levels of 10-15 % (Emokpae and Ajayi, 1989). *B. niloticus* and *C. gariepinus* had percentage ash level of 5%. This result was far lower (for *C. gariepinus*) than the result obtained from Lake Geriyo (Edward, 2007). The percentage ash content in the fishes analyzed is an indication of ample mineral content in fish. Percentage moisture in fish muscles was within the acceptable level in all the samples without any significant difference (P>0.05) could be due to the stable water levels in the environmental location where the fish were collected. There is significant difference in the energy value (kcal/100g) of the fish samples.

The study therefore, showed that freshwater fishes are good sources of minerals. It could be inferred that the mineral elemental levels of each species is a function of the availability preferential accumulation. However, it was revealed from the study that, micro-nutrients were not low, which could be due to the fact that the body needs of the fish are met and the concentrations in the water body is high. It therefore becomes necessary to equally consider the mineral status of the fish and the persistent food safety of the fish prior to consumption in addition to the prevailing choice for fish as a high protein source. This work has unveiled the importance of freshwater fishes as good sources of protein and micro-nutrients. Since nutritional value of freshwater fishes examined are now known, consumers can now know what benefits to derive when these fish species are eaten.

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Table1: The percentage means proximate composition in the body of fish species from Upper Benue River.

Fish sample	Crude protein	Crude fibre	Ether extract	Ash content	Moisture content	NFE	Energy value (Kcal/100g)	Dry matter
B. niloticus	37.1	0.42	4.76	5.0	8.0	44.72	370.12	92
B. filamelosus	33.5	0,4	7.7	10.0	8.3	40.1	363.7	91.7
C.gariepinus	38.57	0.24	9.1	5.0	7.82	39.34	393.26	92.18
M. rume	38.6	0.34	4.17	10.0	7.50	39.39	349.49	92.3
T.niloticus	34.4	0.37	5.88	10.0	7.7	41.65	357.12	92.3

Table2: Means of mineral elements in the body tissue of from Upper Benue River (mg/g).

Elements	BN	MR	BF	TL	CL
Fe	0.086	0.074	0.009	0.14	0.07
Cu	0.042	0.034	0.038	0.036	0.04
Ni	0.02	0.028	0.024	0.036	0.032
Na	3.7	3.0	3.7	3.6	3.6
K	8.4	6.8	7.2	9.4	9.2
Zn	0.082	0.07	0.074	0.080	0.073
Pb	0.017	0.018	0.028	0.018	0.014
Cd	ND	ND	ND	ND	ND

Key:
BN- B. niloticus, MR- M. rume, BF- B, filamelosus, TL- T. niloticus, CL-C.gariepinus, ND-Not detected.

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