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Proximate compositions of some fish species and heavy metal concentrations in Surface water from Oguta Lake

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ABSTRACT

Fish is one of the essential foods necessary for growth and tissue repairs in animals and humans in particular. This work focused on the study of chemical composition of various fish species namely tilapia, eel, cat and channa fish as well as heavy metal concentration in surface water from Oguta Lake. The different species of fish were caught with standard fishing nets and analysed for moisture, protein, ash, lipid and carbohydrate contents. The results of the analysis showed highest moisture content of 75.95±0.005 in Tilapia, highest protein content of 46.25±0.005 in Channa, highest ash content of 4.00±0.005 in Eel, highest lipid content of 8.25±0.006 in Channa and highest carbohydrate content of 7.36±0.005 in Eel fish. Channa fish is therefore recommended for its high protein and lipid contents. The result of the Oguta lake surface water showed higher concentrations of lead and mercury than recommended by the Regulatory Bodies WHO, NAFDAC and SON.

Keywords: Ash content, Fish, heavy metals, moisture content, proximate composition

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INTRODUCTION

Increased awareness and knowledge about the nutritional and functional properties of fish have resulted to increase in its level of consumption. Fish is soft, easy to cook and more easily digested than meat. Fish makes a vital contribution to the survival and health of a significant portion of the world's population.

Often referred to as a rich food for poor people, "fish and fish products provide essential nourishment especially quality proteins of about 15 to 20%; in addition provides fat. The fat content of fish varies depending on the species as well as the season but in general fish has less fat than red meat[1]. The fat content ranges from 0.2 to 25%. However, fats from fatty fish species contain the polyunsaturated fatty acids (PUFAs) namely EPA (eicosapentanoic acid) and DHA (decosahexanoic acid) (omega 3 fatty acids), which are not associated with the occurrence of cardiovascular heart diseases such as coronary heart disease [1]. Fish also contain essential vitamins and minerals for healthy growth. These nutrients are particularly efficient in supplementing the cereal and tuber diets widely consumed in Africa [2]. Fish is a highly proteinous food consumed by a larger percentage of the populace because of its availability [3]; when compared to other protein sources like goat and chicken meat and is safer, healthier and is known to be an excellent source of protein from amino acid composition and protein digestibility [4]. As one of the main sources of protein in developing countries, it has high protein retention in the body [5, 6]. In West Africa, fish accounts for 30% in animal protein intake and this number will be larger if the poor could afford to buy more. In Nigeria, fish is eaten fresh, smoked and fried and form a much cherished delicacy that cuts across socio-economic, age, religious and educational barriers [7]. Fish and its products constitute more than 60% of the total protein intake

in adults especially in rural areas [8]. Fish can contribute significantly to the nutritional regime of those living with HIV particularly in terms of their high quality protein and micro nutrients that they provide in a readily accessible form.

Economically, Fish provide a source of income which can be used to purchase other additional food items thereby contributing to food security. The minerals present in fish include, iron, calcium, zinc, phosphorus, selenium and fluorides. These minerals are highly bioavailable but when they exceed metabolic demands or requirements, they tend to become accumulated.

Fish mineral and metal contents may vary according to the surrounding environment [9,10]. As the importance of fish cannot be overemphasized, there is much need to study fish nutrient composition in various fish species to ascertain the specie that is more nutritious and beneficial to the populace. This therefore is the crux of this study.

MATERIALS AND METHODS

Four species of fresh water fish viz; Tilapia *(Orenchromis niloticus*), Eel (*Auguilla rostratra*), cat (*Clarias gariepinus)* and channa (*Channa argus*) were collected from Oguta lake using standard fishing net, put in a bucket containing water from the lake and carried to the laboratory. The surface water was collected in three different places each into a $1dm^3$ plastic container washed with distilled and deionized water and rinsed with the surface water. The surface water samples were thoroughly mixed and 100 cm^3 carefully measured into a 200 cm^3 beaker. Concentrated HNO_3 (5ml) was gradually added and heated in a fume cupboard till the volume reduced to 15-20 ml. Concentrated HNO_3 (5 ml) was carefully added twice with each addition followed by heating on the digestion block inside the fume cupboard until nearly dry. The mixture was filtered into a 50 cm^3 volumetric flask and made up to mark with water [11].

Analytical Methods

Proximate Analysis: Moisture content was determined by oven-drying to a constant weight at 105^0C. Crude fat content was determined on 5 g sample using Soxhlet extraction apparatus. Crude protein was calculated by multiplying the nitrogen by a conversion factor of 6.25 in a Kjelder distillation. Ash content was determined by the AOAC methods[11], carbohydrate was calculated by difference (100- (% moisture + % protein + % fat + % ash). Surface water was digested and analysed for heavy metals using atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

Proximate composition

Table 1 shows the mean values for the percentage proximate composition of the four fish species. The moisture content varied from 75.95 to 35.20 with Tilapia having the highest value of 75.95 followed by catfish 74.90, eel having a value of 36.60 and Channa fish having the lowest value of 35.20. Fawole *et al.* [12] reported a range of 81.43 to 57.57 for five fish species. For the protein content of the different species of fish, the value ranged from 46.25 in Channa fish to 44.28 in eel, 20.20 in cat and 18.88 in Tilapia. A range of 82.5 to 71.9 protein content was reported for two species of fish by Onimawo [13], and a range of 26.38 to 11.72 was reported by Fawole *et al.* [8] while a range of 37.2 to 34.5 protein content was reported by Akubor and Yusuf [14]. The variation in protein content was probably due to the differences in fish species, physiological and feeding habits of the fish. Ash content of the fish species varied from 4.0 in eel, 3.46 in channa, 1.28 in cat and 1.25 in Tilapia. The ash content was lower than the values 14.0-12.5 reported by Akubor and Yusuf [14] and higher than the values of 1.48 to 1.11 reported by Fawole [12]. The variations in the ash contents may be due to the methods of ashing and size of fish. For the lipid content of the fish species, channa fish had the highest value of 8.25% followed by eel 7.8%, tilapia 3.56 while cat had the lowest value of 3.13%. The fat contents were lower than 10.9 to 6.8 reported by Oniwawo [13], 27.5 to 17.5 reported by Akubor [14] but related to the value of 7.62 to 2.51 reported by Fawole *et al.* [12]. Fat content varies with specie, sex, size, age, feed intake (type of food) and season [15]. The result also agreed with a report that fat content varies from 0.2% to 25% [12]. The carbohydrate contents of the fish were varied with eel having the highest value of 7.36% followed by channa 6.84%, cat 0.49 and Tilapia having the lowest value of 0.36%. The low contents may be due to increase in the other constituents of the different fish species since carbohydrate was determined by difference. Among the fish studied, Channa fish is highly recommended for eating because of its high protein and lipid contents. The fat in fish is mostly omega 3 fatty acids. This is followed by eel. These two species of fish should be mostly recommended to people living with HIV virus because of their high protein content.

Table 1: Percentage Proximate Composition of four fish species from Oguta lake

Fish specie	Moisture content	Protein content	Ash content	Lipid content	Carbohydrate content
Tilapia(*Orienchromis niloticus*)	75.95±0.005	18.88±0.00	1.25±0.005	3.56±0.0065	0.36±0.005
Eel (*Auguilla rostratra)*	36.60±0.005	44.28±0.0057	4.0±0.005	7.80±0.0057	7.36±0.005
Cat fish (*Clarias gariepinus)*	74.90±0.0059	20.20±0.006	1.28±0.0059	3.13±0.0058	0.49±0.0057
Channa (*Channa argus*)	35.20±0.0057	46.25±0.005	3.46±0.0068	8.25±0.006	6.84±0.006

Heavy metal concentration in surface water from Oguta lake

Table 2 shows the level of heavy metals in Oguta lake surface water with the standard limits of three Regulatory Bodies viz (World Health Organization) WHO, NAFDAC and SON. There were no trace of arsenic and chromium recorded in the surface water of Oguta lake. The levels of heavy metals like copper and cadmium were below the levels of the Regulatory Bodies and therefore pose no threats to the life of the organisms living in or using the water. The level of lead was recorded as 0.83. This value was far higher than the values stated as permissible values by the three regulatory bodies. Oguta Lake is used for recreational activities and for transporting people and vehicles from one village to the other across the town and this may be the cause of the high lead content. Exhaust fumes from gasoline have been identified as one of the sources of lead in the environment [16]. The lead concentration reported in this work is in agreement with the studies by Mgbemena [17] who reported high concentration of 0.63 in Aba River. The level of mercury recorded in Oguta Lake was far too outrageous compared to the level of the Regulatory Bodies though no death has been confirmed of mercury poisoning in Oguta. The high level of mercury in Oguta may probably be as a result of industries sited in Oguta and its environs that discharge their effluents into the Lake.

Table 2: Heavy metal concentration in surface water from Oguta Lake compared with the regulatory bodies (mg/dm^3)

Heavy metals	Oguta lake	WHO	NAFDAC	SON
Arsenic	-	0.01	0.01	0.01
Chromium	-	0.05	0.05	0.05
Copper	0.036±0.002	0.5-2.0	1.0	1.0
Cadmium	0.002±0.002	0.003	0.003	0.003
Lead	0.83±0.006	0.01	0.01	0.01
Mercury	0.60±015	0.001	0.001	0.001

CONCLUSION

Since the nutrients in fish vary with species, it is necessary that the specie which will provide better nutrients be sought and eaten and thus be recommended. The high levels of lead and mercury in the surface water from Oguta lake portends health risks to users of such water for domestic purposes.

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