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Proximate, Mineral and Heavy Metal Analysis of Some Fish Speciescaught from Shagari Earth Dam

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Abstract: *Threefish species (Oreochromisniloticus,Bagrusbayad (mac) and Clariasgariepinuscaught from Shagari earth dam were analysed for their proximate, minerals and heavy metal content.Proximate analysis of the fish samples was done by official (AOAC) method. Minerals and Heavy metals in the fish powder were determined by atomic absorption spectroscopy (AAS). Theresult of proximate composition revealed that the fishes have protein content within the range of 13.96 - 16.56% and moderate level of ash content (1.90 - 7.25%). Available carbohydrate fall within 1.20 – 5.25% while crude lipid appears between (1.36 – 1.64%). Nitrogen free exracts (DW) falls within0.38 – 1.93%. Na (74.44±6.42mg/100g) and Zn (0.09 ± 0.02 mg/100g) were found higher in C. gariepinus, while O. niloticus dominatedin K (168.50 ± 12.50mg/100g), Mg (0.69 ± 0.06 mg/100g) and Pb (0.17 ± 0.05 mg/100g). B. bayad(mac) has higher content (3.94 ± 0.19mg/100g) for P, (0.04± 0.20) for Cr and 0.06± 0.30mg/100g for Cd. The fisheshave low level of trace elements and heavy metals. Potassium and Sodium are the predominant macro-elements in the fish samples. Their consumption could reduce macro-nutrient and potassium malnutrition in both poor and rich family groups.*

Keywords;*Proximate Analysis, Fish Species,* ***Minerals,*** *Heavy Metals.*

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I. Introduction

Food is no doubt, the only supplement that compliments human ecosystem and satisfies basic necessities for its effective functions (Umar *et al.,* 2013). Allen and co-workers (2006) outlined that common nutrient deficiencies are connected to poor dietaryintakes. Food consumption is a means of not only fighting hunger, but providing the body with the nutritional diet, necessary for effective body maintenance of growth.

Abbey *et al.* (2016) reported that a high level of most minerals is found in fish bones. Fish is consumed, not only by the people living in riverineareas, but to most families especially those living in the coastal areas due to its availability, nutritional composition and vitality,cost of providing substitutes to it.Apart from supplying the body with required nutrients, food (fish) consumption may be a cheap medium of exposure to certain ailments.

According to Dougherty and co-workers (2000), fish consumption is a major route of chemical exposure to man. Although fish is a good source of protein in diet, provides a means of livelihood tobillions of people who rely on fishingas source of employmentand food.

Effective utilization of fish and fish products is seen to be helpful in the economy of many coastal areas such as recreational fishing. Fish consumption, according to Merciaiand co-workers (2014), could reduce the risk of cardiovascular diseases, certain types of cancers and increases to some extent, the intelligence quotient(IQ) in growing children. Fish serves as an important source of energy (Sutharshiny and Sivashanthina, 2011) and its consumption has been recommended by many nutritionists; fish oil and meat has been discovered to contain polyunsaturated fatty acids (PUFAs) that are valuable in decreasing a number of coronary heart diseases like arthrosclerosis etc (Sutharshiny and Sivashanthina, 2011). In addition, WHO (2011) outlined that more than 2 billion people are affected by micronutrient deficiency, a condition referred to as ‘hidden hunger’ which according to Abbey et al. (2016) and Merceai et al. (2014) could be reduced by fish consumption.

Virtually all heavy metals (including the essential heavy metals);Iron, Copper, Chromium etc are toxic to living organismsif safe limits are exceeded. According to Nnaji *et al*. (2006) one of the cheap methods of their contact to the human body is through diet.Ikemand co-workers (2003) pointed out that the contamination, persistence, toxicity and bioaccumulation of heavy metals in soil sediment and water source is a major concern especially in developing countries like Nigeria.

More over the degree of pollution in the water determines the concentration of heavy metals in it. Fishspecies cannottherefore escape the detrimental effects of pollution(Clarkson,1998;Oleifa *et al*., 2004).

II. Materials and Methods

Sample Collection and Treatment

The three fish species (*B. bayad, O. niloticus and C. gariepinus*) were caught from Shagari Earth Dam. The samples were identified at the fisheries laboratry, washed, dried, powdered and conveyed to the lab for further analyses. The method given by AOAC (1999) was adopted for the sample digestion. The Proximate analysis was carried out using the method of AOAC (1999) while heavy metals were determined by AOAC (2005). Tests were run in triplicates and recorded as mean values.

III. Results and Discussion

Table 1 presents the result of the proximate analysis of the 3 fish species

Table 1: Proximate Content of the fish species

Parameter	*B. bayad*	*O. niloticus*	*C. gariepinus*
Moisture(% w/w)	78.32	72.02	75.80
Ash(% DW)	1.90	7.25	2.00
Crude Lipid (% DW)	1.64	1.36	1.45
Crude Protein % DW)	16.56	15.68	13.96
N.F.E (% DW)	0.38	1.93	1.54
Available CHO (%DW)	1.20	1.76	5.25

N.F.E = Nitrogen-free extracts; Values are mean ± SD from 3 replicates.

Table 2: Mean Concentration of Macro Elements in the 3 Fish Species

Macro Element (mg/100g)	Fish Specie		
	O. niloticus	*B. bayad*	*C. gariepinus*
Na	70.65± 5.32	74.15±9.29	74.44±6.42
K	168.50 ±12.50	164.95±8.18	165.13±8.86
P	3.84± 0.27	3.94±0.19	3.52±0.28
Ca	0.93±0.12	0.23±0.43	0.38±0.02
Mg	0.69 ±0.06	0.09±0.06	0.23±0.05

Table 3: Heavy Metal Contents in the 3 Fish Species

Heavy Metal (mg/100g)	Fish Specie		
	O. niloticus	*B. bayad*	*C. gariepinus*
Cr	0.04±0.00	0.04±0.02	0.04±0.07
Cu	0.03±0.02	0.04±0.20	0.03±0.01
Zn	0.08±0.06	0.07±0.03	0.09±0.02
Cd	0.02 ±0.01	0.06 ±0.30	0.05±0.01
Pb	0.17±0.05	0.08±0.06	0.06±0.02

IV. Discussion

The result of proximate composition of *B. bayad.C. gariepinus* and *O. niloticus* is shown in Table 1. *B.bayad*had the highest (78.3%) followed by *C. gariepinus* (75.80%), while *O. niloticus* had the least (72.20%) moisture content. The values fall within the range (66-81%) reported for moisture content of Sri Lankan fishes by Sutharshiny and Sivashanthina (2011). The ash content of *O. niloticus* (7.25%) overshadowed the 1.90 and 2.00% obtained for *B. bayad* and *C. gariepinus* respectively. These values are lower than 44.11±0.03g/100g and 42.99± 0.05g/100g reported by Abbey *et al*. (2016) for tuna frames and tuna gills respectively.However, *B. bayad* has the highest protein content (16.56%) and the least available carbohydrate (1.20%) while O. niloticus overshadowed in Nitrogen-Free extracts (1.93%) as compared to 1.54% and 0.38% for *C. gariepinus* and *B. bayad* respectively. The values for protein content in *B. bayad* (16.56%), *O. niloticus* (15.68%) and *C. gariepinus* (13.96%) are within the protein range (16-21%) reported in Sri Lankan fishes by Suthershiny and Sivashanthina(2011). The highest lipid content (1.64%) was obtained for *B. bayad*followed by *C. gariepinus* (1.45%) while *O. niloticus*had only (1.36%). These values are higher than 1.33± 0.14, 0.75±0.15 and 1.12± 0.11% reported for *Arbutus pavarii, Nitraria retusa* and *Ficus palmate* respectively by Hegazy *et al.* (2013). In addition, Suthershiny and Sivashanthina(2011) outlined that fish specieshave lipid content within the range 0.2-5 %.The values obtained for proteinin fishes content fall within 16-21%, a range reported bySuthershiny and Sivashanthina(2011). Ackman (1989), Outlined four categories of fish according to their lipid content: Lean fish (<2%), low (2-4%), medium (4-8%) and high fat (>8%). The fish species examined can therefore be considered to fall under lean fish category since their lipid content is within 1.36 – 1.64%.

Mean concentration values of Macro-elements in the fish species were presented in Table 2. *C. gariepinus*has the highest concentration of Na (74.44±6.42 mg/100g) while *O. niloticus* overshadowed in the concentrations of K (168.5±12.5 mg/100g) and Ca (0.93±0.12mg/100g). *B. bayad* overshadowed in Mg (0.093±0.06), which is higher than (0.30±0.06 mg/100g) reported for *Sida cordifolia* by Rajeev*et al.,* 2010.The concentration of Na in *B. bayad*(74.15 ±9.29mg/100g); *C. gariepinus*(74.44±6.42mg/100g) and*O. niloticus* (70.65mg/100g) are similar to 70.06±0.14mg/100g reported for *Decalapis hamiltonii* by Ranjeev *et al*. (2010).Potassium was observed to be the predominant element in all the 3 fish species with 168.5±12.5mg/100g in *O. niloticus, C. gaeipinus* (165.13±8.86mg/100g) and (164.95±8.18mg/100g) for *B. bayad*. Hegazy and co-workers (2013), reported relatively higher quantities of K 349.33±6.66, 263.33±6.11 and 208.67±7.09 for *Arbutus pavarii*, *Nitraria retusa* and *Ficus palmate* respectively.

However, least values were obtained for Ca(0.23±0.43) in *B. bayad* and Mg (0.23±0.049mg/100g) in *C. gariepinus.* Concentration of P was higher in *B. bayad* (3.94±0.28mg/100g) and least in *C. gariepinus*(3.52±0.28). These values fall below (16.50±1.00mg/100g) found for *Vitex doniana* by Vunchi *et al.*(2011). Level of Mg (130.2±0.10mg/100g) found for *Decalapis hamiltonii* by Ranjeev *et al.* (2010) and (20.10±0.10mg/100g)for *Vitex doniana* by Vunchi *et al.* (2011) were higher than 0.69±0.056mg/100mg/100g and 0.093±0.06mg/100g found for *O. niloticus* and *B. bayad* respectively.

Heavy Metal contentin the threefish species was presented in Table 3. The concentration of Pb in *O. niloticus* (0.17±0.05mg/100g) happens to be the highest compared to Zn (0.08±0.06mg/100g), Cd (0.015±0.10mg/100g), Cr (0.04±0.10mg/100g) and Cu (0.03±0.20mg/100g. Lead concentration in soil samples of Yargalma Northern Nigeria was discovered to be much higher (29.66mg/kg) as reported by Tsafe *et al*. (2012). Least concentrations were observed for Cd (0.015±0.10mg/100g) in *O. niloticus*, Cu (0.04±0.20mg/100g) in *B. bayad* (mac) and Cu (0.03±0.10mg/100g) in *C.gariepinus.* Highest level of Zn (0.09±0.02mg/100g) was observed in *C. gariepinus*; which is much lower than 68.91 mg/kg (Zn) reported by Tsafe *et al* ; 2012 for soil samples.*B. bayad*(mac) has the highest concentration of Cr (0.043±0.02) but lower than 44.72 reported by Wu Yao-guo *et al.* (2010) for polluted soil in a mining region.Due to their toxicity, persistence and bioaccumulation problems, they constitute a serious source of environmental pollution (Mgbemena *et al*., 2017; Tam and Wong, 2000).

V. Conclusion

The heavy metal and mean concentration of macro elements in the 3 fish species (*O. niloticus, B. bayad and C. gariepinus*) revealed that the fish species were good sources of macro elemenets especially K and N. However, the least concentrations of heavy metals indicate its recommendation for daily diet.

According to Umar *et al.* (2007), genetic variation exerts considerable influence on the elemental composition of diet; therefore, values obtained in this finding may vary from subsequent analysis in same or different environment elsewhere.

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