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COMPARATIVE STUDY ON PROXIMATE AND MINERAL COMPOSITIONS OF AFRICAN CATFISH, *Clarias gariepinus* FROM DIFFERENT CULTURE ENCLOSURES

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Abstract
This study was carried out to determine and compare the proximate and mineral compositions of African catfish,Clarias gariepinus from different culture enclosures (plastic, sandcrete tanks and earthen ponds), at the Teaching and Research Farm of The Department of Fisheries and Aquaculture Technology, the Federal University of Technology, Akure, Ondo State, Nigeria. Proximate composition parameters analysed were moisture, ash, crude lipid, crude protein and NFE from the fish flesh. Protein content (%) showed a significantly higher value in earthen pond (56.4) than sandcrete (50.8) and plastic tanks (50.3). The moisture contents of the fish ranged between 5.02 and 5.71%, ash contents between 10.1 and 12.8%, lipid contents ranged from 16.8 to 20.9%. The mineral compositions (ppm) analysed were magnesium (Mg), calcium (Ca), phosphorus (P), potassium (K) and sodium (Na). There was no significant difference ($p>0.05$) in sodium from the three culture enclosures. Calcium and magnesium were significantly different ($p<0.05$) in the three culture enclosures. The result of phosphorus and potassium ranged between (5.94 and 6.02, 8.87 and 9.12) respectively. The increase in percentage crude proteinmay be attributed to the fact that fish samples are good sources of protein. However this study considered Clarias gariepinus in earthen pond culture enclosure with the highest value of crude protein contents as the best. The mineral composition of C. gariepinus in the three culture enclosures in this study contained appreciable concentration of magnesium, calcium, phosphorus, potassium and sodium.

Keywords: *Clariasgariepinus, plastic, sandcrete and earthen.*

Introduction

Fish, a major product of aquaculture is an important source of protein for the teeming population in developing nations (FAO, 2014). Fish and fishery products play a critical role in global food security and the nutritional needs of humans' health (FAO, 2014).Nigeria, like many other developing countries of the world is faced with the task of meeting the protein demands of it's ever-increasing human population. Fish has been acknowledged as an important source of animal protein, contributing significantly to the survival and well-being of a large number of the people in the country (Oladimeji *et al*., 2017). Fish is a cheap source of animal protein and has no religious taboo or any known cultural limitation affecting it's consumption, therefore increasing the aquaculture production in Nigeria is clearly needed, especially as the capture fisheries resources are declining, due to over fishing, habitat destruction and pollution (Olaoye *et al*., 2014). Fish farming is an enterprise, thereby proper management techniques and economics must be put in place. Fish farming/culture is the growing of fish in a controlled environment(concrete or earthen ponds), vats (wooden or fibreglass) and plastics (Osawe, 2007; Nwokoye *et al*., 2007).

The African catfish, *Clarias gariepinus*, (Family Clariidae) is an economically important food fish; the most cultured fish species in Nigeria, because of its fast growth rate, tolerance to poor water quality and ability to withstand high stock ingdensities (Saad *et al.,* 2009).It lives in freshwater and can tolerate extreme environmental conditions with pH range between 6.5-8.0 and depth of 0.8m as well as man-made oxidation ponds or even urban sewer system (Skelton, 1993).The major constituents of fish are; water, protein, lipid and carbohydrate (Waterman, 1980). It has been reported that, proximate composition of fish varies greatly and the variation could be due to age, feed intake, sex and sexual changes connected with spawning, the environment and season (Silva, and Chamul, 2000). Proximate composition has been reported to be a good pointer of physiology needed for routine analysis in fisheries and aquaculture (Cui and Wootton, 2011). A number of investigators have attempted to relate changes in body composition to seasonal variables (Dawson and Grimm, 1980; Jarboe, and Grant, 1996). The knowledge of fish composition is essential for its maximum utilization in aquaculture. The specific aim of this study was to determine the proximate and mineral compositions of *Clarias gariepinus from different* culture enclosures (plastic, sandcrete tanks and earthen ponds).

Materials and Methods

African catfish *Clarias gariepinus* used for this study was obtained *from different* culture enclosures (plastic, sandcrete tanks and earthen ponds), at the Teaching and Research Farm of The Department of Fisheries and Aquaculture Technology, the Federal University of Technology, Akure, Ondo State. Three fish samples of average weight 800±11.3g from each enclosure were selected and analysed for proximate and mineral compositions using standard procedure of (AOAC, 1990).

The data collected were analysed by one way analysis of Variance (ANOVA) at 95% confidence level using SPSS (version 22) as described by Steel and Torrie (1980).Comparisons among means were separated using Duncan Multiple Range Test (DMRT) at $p<0.05$.

Results

Proximate composition of *C. gariepinus* in the three enclosures were significantly different ($p<0.05$) as shown in Table 1.Moisture contents ranged between 5.02 and 5.71%, ash content ranged between 10.1 and 12.8%, lipid contents ranged from 16.8 to 20.9%, the crude protein contents ranged from 50.3 to 56.4%, with earthen pond enclosure having the highest crude protein content of 56.4% while that of plastic and sandcrete had 50.3 and 50.8%, respectively. However, there was no significant different ($p>0.05$) in crude protein of *C. gariepinus* from plastic and sandcrete culture enclosures.

TABLE 1: Proximate Composition of *Clarias gariepinus* reared in three enclosure systems.

	Enclosures		
Parameter (%)	**Plastic**	**Sandcrete**	**Earthen**
Moisture	5.02 ± 0.00^a	5.29 ± 0.00^b	5.71 ± 0.00^c
Crude ash	12.8 ± 0.03^c	10.1 ± 0.10^a	10.7 ± 0.00^b
Crude lipid	18.5 ± 0.07^a	20.9 ± 0.00^c	16.8 ± 0.00^b
Crude protein	50.3 ± 0.00^a	50.8 ± 0.03^a	56.4 ± 0.27^b
NFE	13.38 ± 0.09^c	12.91 ± 0.13^b	10.39 ± 0.27^a

Means in the same row with different superscript, are significantly different at ($p<0.05$)

Table 2 shows the resultsof mineral composition (phosphorus, calcium, potassium, magnesium and sodium) of *Clariasgariepinus* reared inthree enclosure systems. There was no significant difference ($p>0.05$) in sodium from the three culture system. However there were significant differences ($p<0.05$) in calcium, magnesium of *C. gariepinus* from the culture systems. The result also shows that phosphorus and potassium of *C. gariepinus* reared in earthen pond and sandcrete tank were not significantly different ($p>0.05$).

TABLE 2: Mineral Composition of *Clariasgariepinus*reared in three enclosure systems.

	Enclosure		
Parameter (ppm)	**Plastic**	**Sandcrete**	**Earthen**
P	6.22 ± 0.23^b	6.02 ± 0.05^a	5.95 ± 0.02^a
K	9.12 ± 0.03^a	10.4 ± 0.12^b	8.87 ± 0.04^a
Na	3.81 ± 0.04^a	3.85 ± 0.67^a	3.83 ± 0.02^a
Ca	7.26 ± 0.03^c	6.70 ± 0.04^b	4.96 ± 0.07^a
Mg	2.92 ± 0.02^c	2.26 ± 0.03^b	2.01 ± 0.07^a

Means in the same row with different superscripts are significantly different at ($p<0.05$)

Discussion

The proximate composition values obtained in the present study, showed variations in *C. gariepinus* reared in the three enclosure system. The range of the values recorded for crude protein content (50.3 – 56.4) and moisture content (5.02 – 5.71) in the present study agreed with the value range recorded by Osibona*et al.,* 2006, Murray and Burt 1977 and Onyia*et. al.,* 2007) on proximate compositions and catfish *Clarias gariepinus* and *Clarias anguillaris*.

The moderately high percentage crude protein may be attributed to the fact that fishes are good sources of pure protein, but the differences observed in values obtained could also be as a result of fish consumption or absorption capability. Fish have the ability of converting nutrients form diets or environment into potential biochemical components (Adewoye and Omotosho, 1997).

However, the value of crude lipid and ash contents in this study deviates from that of Adebowale*et. al.,* (2008) and Adetuyi*et. al.,* (2012),range of 16.8 - 20.9 for crude lipid and 10.1 – 12.8 ash contents were obtained in the present study as against (1.58 – 6.09 and 4.61 – 5.13) recorded by Adebowale *et. al.,* (2008) and (1.35 – 5.68 and 1.47 – 2.23) recorded by Adetuyi *et. al.,* (2012), for fat and ash contents respectively. The significant differences ($p<0.05$) in the lipid contents of *C. gariepinus* reared in the three different enclosure systems could be due to the metabolic and physical activities of the fish (Adetuyi *et. al.,* 2012).

Mineral compositions of *Clarias gariepinus* reared in the three enclosure systems contained appreciable concentrations of magnesium (Mg), calcium (Ca), phosphorus (P), potassium (K) and sodium (Na). This suggests that the three enclosure systems can be used to rear *C. gariepinus* for optimum source of minerals.

According to Lagler *et. al.,* (1977), fish species derive minerals from food and their environment. Calcium is important for growth and the maintenance of bones, teeth and muscles (Turan *et. al.,* 2003). Okaka and Okaka (2011) also suggested that calcium is necessary for blood coagulation and integrity of intracellular diseases in man; hence, it's useful in the treatment of diabetes and hypertension (Usip *et al.,* 2017). Mineral compositions of *C. gariepinus* reared in earthen pond were lower in comparison with plastic and sandcrete tanks. This could be as a result of the rate in which these components are available in the water body,(Yeannes and Almandos, 2003).Furthermore, the ability of fish to absorb and convert essential nutrients from feed or water bodies is reduced in the natural environment (Ricardo *et al*., 2002; Adewoye *et al*., 2003; Fawole *et al*., 2007). The above findings suggest that mineral composition of fish is affected by the enclosure system. The changes observed in the chemical parameters assessed in this study might be due to the differences in rearing conditions that they were subjected to.

Conclusion

This present study has elucidated that, *C. gariepinus* reared in earthen ponds have more crude protein but less lipid contents than the ones reared in sandcrete or plastic tanks. The observed range of protein and ash contents of the fish indicated that the species is a good source of protein and minerals such as magnesium (Mg), calcium (Ca), phosphorus (P), potassium (K) and sodium (Na).

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