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Proximate composition of *Clarias gariepinus* (Burchell, 1822) from cultured and wild environment

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Abstract
Effect of sex and sizes on the nutrients composition of the fish samples was analyzed following the procedure of (AOAC 1998). ANOVA and T-test was used to analyzed the differences. Male fish has higher per cent of crude protein than female fish (59.46± 0.39 and 70.37±0.40) from cultured and wild environment respectively. The lipid content of Female fish is significantly higher ($p>0.05$) than male (6.94±0.29 and 5.42±0.08) in cultured source. Increase in size of the fish sample, decrease the amount of lipid in cultured environment (8.03±0.24, 5.33±0.06 and 6.69±0.13) respectively. Crude protein content shows no significant differences across the sizes in the wild ($p<0.05$). The considerable high level of crude protein and lipid content observed from wild is an indication that fish is a good source of high quality protein and lipid content.

Keywords: Cultured, wild, proximate composition, sex, sizes, *Clarias gariepinus*

1. Introduction
The protein content of fish averages 15-20%, and it contains significant amounts of all essential amino acids. Fish is an excellent source of lysine and/or the sulphur-containing amino acids, which are lacking in cereal grains, and is a good source of A, B and D vitamins, calcium, phosphorous, iron, copper and selenium (1). The nutritional contributions of fish are multiple and go beyond simply providing a source of calories and protein. Fish are valuable source of fatty acids, including (PUFA) Omega-3 polyunsaturated fatty acid (2). Consumptions of fish in a diet correlate with a 36% reduction in heart diseases (3 and 4). The A variation of the nutrients compositions of fish occurs according to several factors such as seasonality, habitats, tropical level and diets (5). Fish are important source of food and contributes to about 50% of total animal protein in the diets of many African countries (6). In addition, 5% of the populations in Africa depend wholly or partially on the fisheries sector, mostly artisanal fisheries, for their livelihood (7). Therefore, aquaculture production remains the best option to bridge the wide gap between demand and supply of fish in most countries of the world especially the sub-Saharan Africa (8). Fish is one of the cheapest sources of protein for millions of people in Africa (9). Consumption of fish in diet also enhances the proper mental and immunity development against diseases among young children (10). FAO estimates are that about 60% of people in developing countries depend on fish for over 30% of their animal protein. The objective of this paper to determines the proximate composition of *Clarias gariepinus* from Cultured and Wild sources.

2. Materials and methods
2.1 Study area
River Galma is one of the main tributaries of River Kaduna. It has its headwaters near the north western edge of the Jos Plateau and falls near the Magami village into Kaduna plains. The main tributaries of Galma River are Shika River in the middle course and the Rivers Kinkiba and Likarbu in its lower course. The Galma reservoir which is popularly called Zaria dam was constructed across the Galma River in 1975. It is located at latitude $11^{0}06`40.61``$N and longitude $7^{0}43`21.27``$

2.2 Sex identification
Male and female are easily distinguished from one another under field examination after they

are about 10cm long. Female Genital Papilla (FGP) which is short while Male genital papilla (MGP) which is pointed (11). The genital papillae are present on the ventral side of the fish. In males the genital papilla has only one opening (the urinary pore of the ureter) through which both milt and urine pass. In females the eggs exit through a separate oviduct and only urine passes through the urinary pore.

2.3 Sample preparation
Wild fish was obtained from the fisher folks in River Galma, Zaria while cultured fish was purchased at Synergy Fish Farm, Wuchichiri, Zaria. The sample was transported to Fisheries laboratory, Department of Biology, Ahmadu Bello University, Zaria. Length and weight was measured using a measuring board and sensitive weighing scale respectively. The fish was beheaded, gutted and wash with running water. An electric oven was used to dry the sample at about 90^0C. Dried fish sample was ground, packaged in container and label prior to the analysis.

2.4 Experimental design
The experiment was divided in to five batches (Male, Female, Small, Medium and Larger fish) from both cultured and wild sources. A total of fifty fish was used for this research. This comprises five individual fish for each batch. Mean value was taken from the duplicate of each analysis.

2.5 Proximate analysis
The chemical composition of the samples was analyzed using the procedure of Association of Official Analytical Chemists (12) at Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.

2.5.1 Determination of Moisture Content

$$\text{Moisture content (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

Where:
W_1= Weight (g) of sample before drying
W_2= Weight (g) of sample after drying
%DM = 100 - %Moisture

2.5.2 Determination of Crude Protein

$$\%\text{Protein} = \frac{(A-B) \times N \times 14.007 \times 6.25}{W}$$

Where:
- A= Volume (ml) of 0.2 N HCL used sample titration
- B= Volume (ml) of 0.2 N HCL used in blank titration
- N= Normality of HCL
- W= Weight (g) of sample
- 14.007= Atomic weight of nitrogen
- 6.25= the protein-nitrogen conversation factor for fish and its by-product.

2.5.3 Determination of Fat Content

$$\text{Fat\%} = \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100$$

2.5.4 Determination of Ash Content

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

2.5.5 Determination of crude fiber

$$\%\text{Crude fiber} = \frac{\text{weight of crude fiber}}{\text{weight of original sample}} \times 100$$

2.5.6 Nitrogen free extract (NFE)
%NFE = 100 – (%MC + %CF + %CF + %ASH + %EE)

3. Data analysis
Data collected was subjected to analysis of variance test (ANOVA) using statistical package for social science (SPSS) version: 21.0. T-Test was used to compare the proximate composition between cultured and wild fish base on sizes and sexes at significant level (p<0.05)

4. Results
Table 1 shows the proximate composition of male and female *Clarias gariepinus* from cultured and wild source respectively. Moisture content (0.16% and 1.11%) and (1.46 and 3.15); Crude protein level (59.46% and 54.80%) and (70.80 and 64.41); Crude fiber (1.50% and 2.14%) and (1.38 and 1.12); Oil (5.42% and 6.94%) and (8.73 and 8.12); Ash content (8.74% and 10.77%) (11.83 and 7.27).

Table 1: Proximate composition of Cultured and Wild *Clarias gariepinus* base on sexes

Parameters							
Cultured	DM	MC	CP	CF	LIPID	ASH	NFE
Male	99.84±0.01	0.16±0.01	59.46±0.39	1.50±0.09	5.42±0.08	8.74±0.23	24.72±0.54
Female	99.89±0.01	0.11±0.01	54.80±0.55	2.14±0.14	6.94±0.29	10.77±0.35	25.24±0.53
P-Value	0.049	0.067	0.012	0.100	0.028	0.073	0.469
Wild							
Male	98.87±0.34	1.46±0.01	70.37±0.40	1.38±0.12	8.73±0.26	11.83±0.11	6.23±0.56
Female	97.52±0.01	3.15±0.67	64.41±0.43	1.12±0.11	8.12±0.12	7.27±0.24	16.60±0.83
P-value	0.056	0.130	0.003	0.137	0.186	0.004	0.001

The values are presented as mean ± standard error from the pooled sample in duplicate. P>0.05 are not significantly different
Key: DM= Dry matter; MC= Moisture content; CP= Crude protein; CF= Crude fiber; NFE= Nitrogen free extract

Table 2 shows the proximate composition of *Clarias gariepinus* from cultured environment and wild base on sizes. The moisture content was (0.86%, 0.47% and 0.13%) and (3.15%, 3.22% and 2.70%); Crude protein (61.34%, 62.23% and 53.32%) and (55.60%, 61.88% and 66.95%); crude fiber (0.69%, 1.11% and 2.44%) and (0.97%, 0.86% and 1.12%);

lipid (8.03%, 5.33% and 6.69%) and (6.96%, 7.90% and 8.23%); Ash content (13.08%, 8.47% and 10.83%) and (10.07%, 6.41% and 10.07%) for Small, medium and larger fish respectively.

Table 2: Proximate composition of Cultured and Wild *Clarias gariepinus* base on sizes

Parameters							
Cultured	DM	MC	CP	CF	LIPID	ASH	NFE
Small	99.14± 0.01	0.86± 0.01	61.34± 1.61	0.69± 0.20	8.03± 0.24	13.08± 0.28	15.99± 2.24
Medium	99.83± 0.01	0.47± 0.01	62.23± 3.83	1.11± 0.25	5.33± 0.06	8.47± 0.18	22.39± 3.65
Large	99.87± 0.01	0.13± 0.01	53.32± 0.56	2.44± 0.35	6.69± 0.13	10.83± 0.26	26.60± 0.78
P-Value	0.000	0.000	0.075	0.010	0.000	0.000	0.064
Wild	97.53±	3.15±	55.60±	0.97±	6.96±	10.07±	23.93±
Small	0.01	0.67	0.43	0.05	0.12	0.26	0.40
Medium	96.78±	3.22±	61.88±	0.86±	7.90±	6.41±	19.74±
Large	0.01	0.01	0.66	0.06	0.17	0.20	0.66
	97.20±0.12	2.70±0.06	66.95±1.08	1.12±0.06	8.23±0.20	10.07±0.13	10.03±1.16
P-value	0.001	0.616	0.000	0.044	0.004	0.000	0.000

The values are presented as mean ± standard error from the pooled sample in duplicate. P>0.05 are not significantly different
Key: DM= Dry matter; MC= Moisture content; CP= Crude protein; CF= Crude fiber; NFE= Nitrogen free extract

5. Discussion

The proximate composition of African catfish *Clarias gariepinus* from cultured and wild environment in respect to sex showed high nutritional value (Table 1). The proximate composition of wild *Clarias gariepinus* and cultured *Clarias gariepinus*from both male and female varies. Protein content of Male *Clarias gariepinus* from both cultured and captured was significantly higher than female *Clarias gariepinus* which was (59.46±0.39 and 70.37±0.40) for male while (54.80±0.55 and 64.41±0.43) for female respectively. The lipid content of female *Clarias gariepinus* (6.94±0.29) was significantly higher (p<0.05) than male *Clarias gariepinus* (5.42±0.08) from cultured source. These findings supported the findings of (7 and 13). The variation in crude protein could be due to essential nutrients available in the local environment in which the fish lived (14). My current finding does not agree with the finding of (15) who reported that, the proximate composition of fish does not undergo any significant change between both sexes.

However, the percentage crude fat content was significantly higher (p<0.05) in captured *Clarias gariepinus* from both sex than cultured source. This could be due to the movement restriction in the confined environment where the fish lived. (16) also found that lipids in fish vary greatly and this variation is related to feed, migratory swimming or sexual changes in connection with spawning.

There were no significance differences (p>0.05) between the proximate composition of captured and cultured *Clarias gariepinus* from both male and female particularly in Dry matter, Moisture content, crude fiber, and ash content. There was significance differences (p<0.05) between the crude protein content of *Clarias gariepinus* from wild and cultured sources base on sizes. In cultured environment, increases in sizes from smaller to medium decreases the amount of crude protein (from 61.34±1.61 to 62.23±3.83) and ash content (from 13.08±0.28 to 8.47±0.18) while the oil content was slightly increases with increases of sizes (Table 2). This finding is supported by the finding of (15) who reported that juvenile fish contains more protein than adult fish. While in wild source, increase in sizes increases the amount of crude protein and oil content (55.60±0.43, 61.88±0.66and 66.95±1.08) and (6.96±0.12, 7.90±0.17 and 8.23±0.20) small, medium and large fish respectively.

The slight variation observed in percentage crude protein with habitats may be attributed to fish's consumption, absorption capability and conversion potentials of essential nutrients from their diets or their local environment in such biochemical attributes needed by the organism's body (14).

6.0 Conclusions

Base on the results of the study, it was found that the protein and lipid content of male and female *Clarias gariepinus* from cultured and wild environment varies. Male has higher percentage of protein than female from both sources. While, female has higher per cent of lipid than male in cultured environment. However, there was no significant difference in the lipid content between the male and female fish in the wild. Larger fish has lower per cent of crude protein and lipid content in cultured environment. While in the wild, the amount of crude protein and lipid increases with increase in sizes from total length of (23, 40 and 60cm) respectively.

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