Vol. 4, Issue 1:
Issues in Science & Agricultural Technology
ISSN: 2714-3643; September, 2025

RUGIPO Research & Technical Journal
https://elearning.rugipo.edu.ng/Rugipo_Tetfund_Journal_Research_Portal/
TETFund/DESS/POLY/OWO/ARJ/04

COMPARATIVE STUDIES ON PROXIMATE COMPOSITION OF DIFFERENT PARTS OF AFRICAN CATFISH *(Clarias gariepinus)*

*ULAKA George. A and BASHAR Taibat. A.
Department of Fisheries Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria
*Corresponding E-mail: georgeayo00@gmail.com

Abstract:
The study on proximate composition of different parts of fresh adult catfish (*Clarias gariepinus)* was carried out using standard procedures. Five adult live catfishes of 2kg each was procured from Owo, Ondo State, Nigeria. The fish muscle, eggs, intestine and gills were compared based on proximate compositions. 50g each of the selected parts for evaluation were extracted fresh surgically. The dry matter, ash content, crude fat, crude protein and carbohydrates were examined. The statistical relationship between the proximate contents of all the catfish parts examined showed no significant variation (P > 0.05). The highest protein content was discovered in fish muscle (57.71% CP) with (56.98% CP), (49.99% CP) and (42.24% CP) for eggs, gills and intestine, respectively. The dry matter was higher in the fish muscle (12.38% DM) than in other parts, as the eggs had the least dry matter (4.21% DM). The intestine and the gills have the highest crude fat (33.31% CF) and (30.99% CF) respectively, while the muscle (9.89% CF) and eggs (3.89% CF) were lower in comparison. The carbohydrate content of eggs (27.5% CHO) and muscle (25.41% CHO) was significantly higher than those discovered for the intestine (11.20% CHO) and gills (3.85% CHO), while the ash content range between (3.64% Ash) and (7.59% Ash). The results were subjected to one way analysis of variance (ANOVA). Catfish intestine and gills contain more crude fat (lipid) while flesh and eggs have a very increase crude protein, which may be favourable for improved diet formulation for both animal and man.

Keywords: *proximate analysis, comparison, nutrition.*

How to Cite: Ulaka, G. A. and Bashar, T. A. (2025). Comparative Studies on Proximate Composition of Different Parts of African Catfish *(Clarias gariepinus)*. *RUGIPO Research and Technical Journal in Science and Agricultural Technology*, 4(1):68–74.
https://elearning.rugipo.edu.ng/Rugipo_Tetfund_Journal_Research_Portal/

1.0 Introduction

African catfish, *Clarias gariepinus*, is one of the most widely consumed freshwater fish in Nigeria and some African countries due to its large acceptability (Eyo, 2001). The nutritional composition of cultivated fish is mainly dependent on the type of food administered. Other factors may include feeding habits, feed conversion ratio, water quality, species, cultured medium, and period (Fagbenro *et al.,* 2005). Visual assessment of fish using size, freshness, and other physical appearances may not give accurate nutritional information about the fish; therefore, the need for laboratory analysis of fish for in-depth information on the nutritional quality is necessary (Fawole and Olagunju, 2007).

The knowledge of fish nutritional composition is essential for its maximum utilisation. Fish of various species do not provide the same nutrient profile to their consumer, and the nutritional value of a fish varies with season and diet (Varljen *et al*., 2003). Moisture, dry matter, protein, lipids, vitamins and minerals are the most important components that act as sources of nutritive value of fish meal (Waterman, 2000).

Determination of some proximate profiles, such as protein content, ash, lipid, and other nutrients, is often necessary to ensure that they are within the range of dietary requirements and commercial specifications (Waterman, 2000). Several studies on the proximate composition of fish have been from different parts of the world so far. Proximate composition of various freshwater fishes, especially African catfish (*Clarias gariepinus*), was estimated by Kamel *et al.* (2007); however, this study is designed to determine the proximate composition of different parts of catfish and to compare the nutritional values of different parts of catfish in order to contribute to the existing knowledge of nutritional composition of catfish parts.

2.0 Materials and Methods

The study was carried out in the Teaching and Research Farm Laboratory, Department of Fisheries Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria. Five (5) pieces of 2kg each fresh catfishes were sourced from Owo area of Ondo State and used for the experiment. With the aid of dissecting tools/Surgical tools and other laboratory tools such as mortar and pestle for homogenising, an electric Laboratory Oven (Model TT9033A) for drying the samples, with the support of foil paper and petri dishes. 50g of various fish parts (Eggs, Intestine, Gills and Muscle) were carefully extracted surgically and kept separately in each labelled Petri-dish and air-dried for about 20 minutes.

Preparation of Samples; Each of the extracted sample in the petri-dishes were transferred to a clean foil paper and moved immediately to the electric laboratory oven model (TT9033A) for continuous drying at 160 ℃ for 72 hours and allowed to cool in a desiccator for 1 hour. The samples were removed and each sample was ground with the aid of a Laboratory pestle and mortar to obtain a fine surface area. These dried samples were labelled in sample bottles before further laboratory analysis. The proximate composition was determined using AOAC (2005) methods of analysis.

Figure 1: Various Catfish Parts Extracted

Laboratory Determination of Proximate Analysis: Each proximate composition was determined in the Laboratory using each specific method as duly specified using AOAC (2005) methods of proximate analysis;

Dry Matter (DM): The weight of initial samples was taken after extraction and was recorded as w_1, while the weight of dried samples was recorded as w_2 in each case as obtained via the use of an electric sensitive scale. These were used to determine the dry matter (DM) of each sample using the formula below;

$$\text{Dry Matter (DM)} = \frac{w_1 - w_2}{w_1} \times 100\%$$

Dry Matter =100-Moiture content

Ash Content (AC): 5 grams of each sample was weighed and placed in a crucible before ashing in a furnace, recorded as w_1. These samples were heated at 450^0C for 16 hours and allowed to cool in a desiccator for 1hour. The weight was taken and recorded as w_2. The formula below was used to obtain the Ash content

$$\text{Ash content (A.C)} = \frac{w_1}{w_2} \times 100\%$$

Crude Fat (CF): 10 grams of sample was weighed into a bag made of muslin cloth and placed in a Soxhlet extraction unit, which was connected to a round-bottom flask containing $^2/_3$ full of petroleum ether (boiling point of 80 – 90^0C). The petroleum ether was allowed to boil for 5 hrs. The ether evaporated into the fume hood, and the flask was allowed to cool at room temperature. The fat content was calculated with the formula below:

$$\text{Crude Fat (C.F)} = \frac{w_1 - w_2}{w_2} \times 100\%$$

Where; CF = Crude Fat; w_1 = Weight of round bottom flask with samples, w_2 = Weight of clean empty round bottom flask

Crude Protein (C.P.): Kjeldahl method of digestion, distillation and titration was used to determine crude protein content. The percentage of crude protein was determined using the calculation for the standard HCl titrant

$$\text{Nitrogen} = \frac{(A - B) \times N \times 1{,}4007}{w}$$

1. Where: A = NHCl required for the sample
   B = NHCl required for the blank
   N = Normality of titrant
   W = Weight of sample (g)

Note the C.P content (%) = % Nitrogen x 6.25

Carbohydrate Content (CHO); The carbohydrate content of the samples was determined using the differential method recommended by AOAC (2001), following the formula

%CHO = 100 – Ash% + Fibre% + Protein% + Fat%

Statistical Analysis: The results of proximate composition of various catfish (*Clarias gariepinus*) parts obtained from the study were subjected to statistical analysis of variance (one-way ANOVA) to compare the differences in proximate composition of various catfish parts. The significant means were separated by correlation at all 5% confidence level.

3.0 Results

Table 1: Proximate Composition of Various Catfish (*Clarias gariepinus*) Parts

Catfish Part (*Clarias gariepinus*)	**Dry Matter**	**Ash Content**	**Crude Fat**	**Crude Protein**	**CHO**	**SEM**
Catfish Eggs	4.21	7.42	3.89	56.98	27.50	5.08
Catfish Intestines	7.81	5.44	33.31	42.24	11.20	6.62
Catfish Muscle	12.38	3.64	9.86	57.71	25.41	1.50
Catfish Gills	7.58	7.59	30.99	49.99	3.85	0.83

The proximate analysis of various fish parts is shown in Table 1. The moisture content recorded in eggs was low (4.21%), while the highest Dry matter was found in fish muscle (12.38%). The highest crude protein was found in eggs (56.98% CP) compared to fish intestine, muscle and gills, 42.24%, 48.71% and 49.99% CP, respectively. The fish eggs also have the highest carbohydrate, 27.50% while fish gills recorded the lowest percentage of CHO (3.85%). The highest fat content was found in the fish intestine, 33.31% followed by the gill, 30.99%, fish muscle, 9.86% and fish eggs, 3.89%. The ash content ranges from 3.64% for fish muscle to 5.44% for fish intestine, 7.42% for fish eggs and 7.59% for fish gills.

Table 2: Analysis of Variance for Proximate Composition of Various Catfish (*Clarias gariepinus*) Parts

Treatment	Dry Matter	Ash Content	Crude Fat	Crude Protein	CHO	SEM
Fish Eggs	4.21b	7.42a	3.89c	56.98a	27.5a	5.68
Fish Gills	7.58ab	7.59a	30.99a	49.99c	3.85c	0.93
Fish Intestines	7.82ab	5.44ab	33.31a	42.24b	11.2b	7.41
Fish Muscle	12.38a	3.64b	9.89b	57.71a	25.41a	11.3

The analysis of variance for the proximate composition of various fish parts is presented in Table 2. The results show that the dry matter of gills and intestine are significantly similar (7.58% and 7.82%). The ash content for eggs, 7.42% and the ash content for gills, 7.59% were also significantly related. More so, the crude fat composition for gills and intestine, 30.99% and 33.31% were also significantly related. Generally, these results showed that the crude protein for all the fish parts investigated was high (eggs 56.98% CP, gills 49.99% CP, intestine 42.24% CP and muscle 57.71% CP).

Table 3: Descriptive Statistics for Proximate Composition of Various Catfish (*Clarias gariepinus*) Parts

Variable	Mean	SE Mean	St. Dev	Minimum	Maximum
Dry matter (Muscle)	8.00	1.68	3.35	4.21	12.38
Ash content (Gills)	6.023	0.932	1.864	3.640	7.590
Crude fat (Intestine)	19.52	7.41	14.82	3.39	33.31
Crude protein (Muscle)	42.0	11.3	22.6	10.0	58.7
CHO (Eggs)	16.99	5.68	11.37	3.85	27.50

The descriptive statistic for the proximate composition of various catfish parts is presented in Table 3. The result showed that the fish muscle has the highest dry matter with a mean of 8.00 and a maximum of 12.38, indicating that it has the highest moisture content among the fish parts. The muscle has the lowest ash content, with a mean of 6.023 and a minimum of 3.640, suggesting that it has the least mineral content compared to other fish parts. The fish intestine has the highest crude fat content, with a mean of 19.52 and a maximum of 33.31, also indicating that it has the highest fat among the fish parts. The fish muscle has the highest crude protein with a mean of 42.0 and a maximum of 58.7, showing that it has the highest crude protein content among the parts. Fish eggs also have the highest carbohydrates with a mean of 16.99 and a maximum of 27.50, indicating that the fish eggs have the highest carbohydrate.

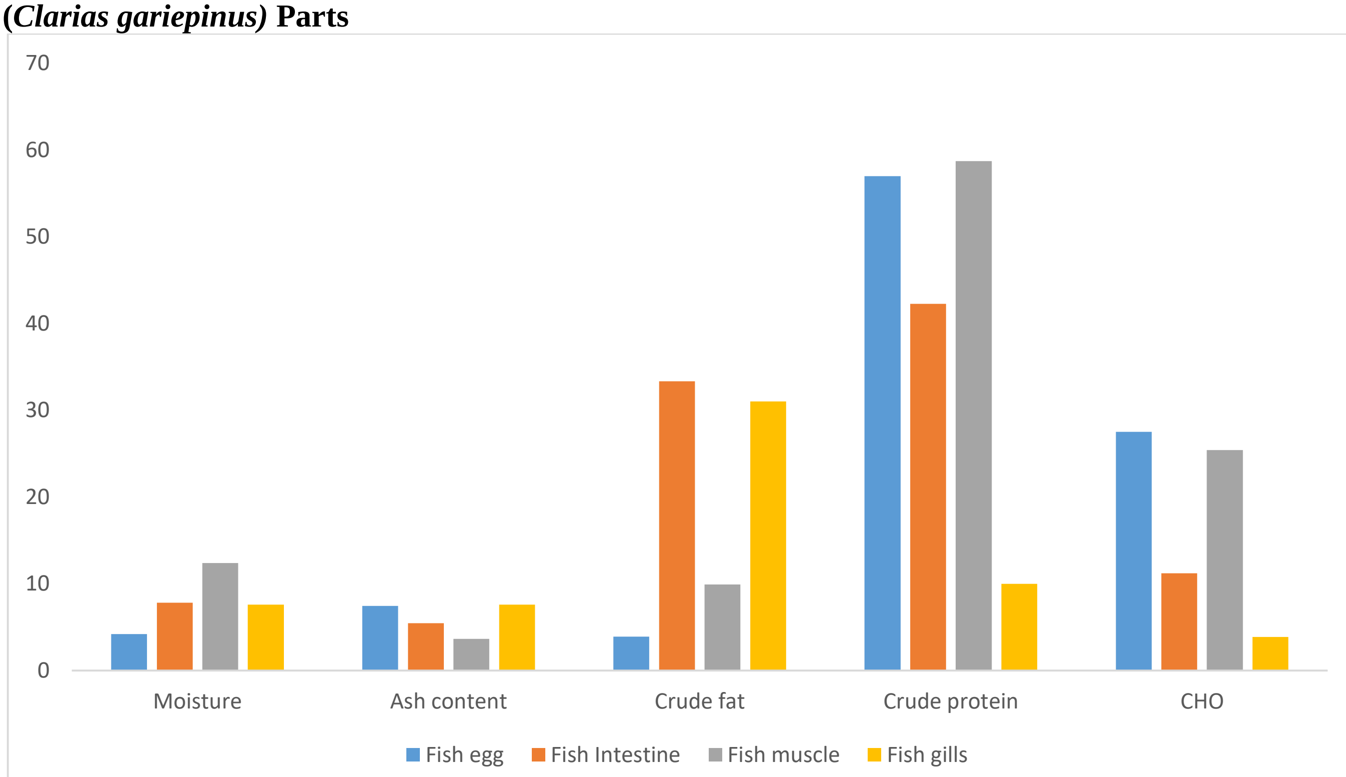
Table 4 : Correlation: Moisture, Ash content, Crude fat, Crude protein, CHO

Dry Matter	Ash content	Crude fat	Crude protein
Ash content	-0.868		
P-Value	0.132		
Crude fat	0.065	0.133	
P-Value	0.935	0.867	
Crude protein	0.131	-0.548	-0.756
P-Value	0.869	0.452	0.244
CHO	0.032	-0.356	-0.942
P-Value	0.968	0.644	0.058

Cell Contents: Pearson correlation P-Value

The statistical relationship between proximate results is presented in Table 4. The result of the statistical relationship showed that there is no significant variation ($p > 0.05$) between the proximate content of all fish parts evaluated.

Figure 2: Bar Chart Showing Comparison between Proximate Composition of Various Catfish (*Clarias gariepinus)* Parts



4.0 Discussion

The results of this experiment showed that all the nutritional elements evaluated in various fish parts showed variable values and are higher than those reported by Ogbe and Omada (2020) for fish head, flesh, bone and fins in protein, fat, moisture and ash contents. The highest protein was observed in the catfish muscle (flesh), 57.71% C.P., while the least protein content was in the catfish intestine, with 42.24% C.P. These protein values agreed with those reported by Effiong and Fakunle (2011), which range between 21.62 – 60.57%, but are higher than those reported in mackerel and oyster (Eyo, 2001).

The protein content in fish range with species due to certain factors such as the season of the year, the effect of spawning and migration, including food quality and availability (Abdullahi, 2001).

The ash content reported in this study ranged between (3.64% - 7.59%) and was higher than that reported by Effiong and Muhammed (2008), with the highest value (5.88 and 5.50) respectively in *Late niloticus* and *Bagius bayad.*

The moisture content recorded in this study was comparably lower than those reported by Ogbe and Omada (2020) for fish flesh, head, bone and fins.

The crude fat concentration in this present study is higher in fish intestine (33.31%) and gills (30.99%) than in muscle and eggs (9.86%) and (3.8%), respectively. This might be connected to the feed consumed by the fish in relation to the digestive region of the body. These results are higher than those reported by Ogbe and Omada (2020) for *Clarias gariepinus* parts, Adeyeye and Adamu (2005) for *Gymnarchus niloticus.* This might suggest that the fish species parts used in this study may be a very good source of fish oil required for food therapy in the human diet, according to the report of Oyebanmiji *et al.* (2008). The results of carbohydrate in this study were very high in fish eggs (27.5%) and fish muscle (25.41%), while the lowest value was found in fish gill (3.85%) and fish intestines (11.20%), these values were higher than those reported by Ogbe and Omada (2020) for *Clarias gariepinus* parts.

The results from this study showed that every part of the fish evaluated in this study is a good source of protein, fat, minerals and carbohydrate. This observation concurred with the reports of AOAC (1994), who reported that protein, lipids and moisture contents are the major constituents when evaluating the nutritional value of fish.

5.0 Conclusion

This study has elucidated that all catfish parts are a good source of nutrients to the consumers and within the limits required by the body for healthy growth and development. More so, the study further revealed that catfish intestine and gills supply more lipids while the flesh and eggs have relatively increased protein and carbohydrate levels. Hence, infants' and patients' diet could be influenced with the proper and adequate combination of various fish parts into their diets.

6.0 Recommendation

From the study above, catfish is an essential ingredient when any safe, medicinal and nutrient-enriched diet is to be considered. Therefore, it is recommended that further studies be carried out to examine and determine the proper quantity required for incorporation of fish parts like intestine and gills to drugs and diets whenever nutrient-enriched drugs or diet supplements are to be prepared. Household infant raisers should be encouraged and trained to include catfish in their diets to improve the protein level of their growing ones.

References

Abdullahi, S. A. (2001). Investigation of Nutritional Status of *Chrysichthys nigridigitaus, Bayrus filamentous* and Auchenoglanis occidentals' family Barigdae. *Journal of Aid Zone Fisheries* 1:39-50

Adeyeye, E. I., Adamu, A. S. (2005). Chemical Composition and Food Properties of *Gymnarchus niloticus* (trunk fish). *Biosci. Biotech. Res.* Asia 3(2):265-272

AOAC (1994) Official Methods of Analysis of the Association of Official Chemist. 14th Edn., AOAC, Arlington, USA.

AOAC (2001) Official Methods of Analysis of the Association of Official Chemist. 14th Edn., AOAC, Arlington, USA.

AOAC (2005) Official Methods of Analysis of the Association of Official Chemist. 18th Edn., AOAC International, Maryland USA.

Effiong, B. N. and Mohammed, I. (2008). Effect of Seasonal Variation on the Nutrient Composition in Selected Fish Species in Lake Kainji Nigeria. *Nature and Science* 6(2): 1-5.

Effiong, B. N. and Fakunle, J. O. (2011). Proximate and Mineral Composition of Some Commercially Important Fish in Lake Kainji, Nigeria. *Journal of Basic and Applied Scientific Research* 2497-2500.

Eyo, A. A. (2001) Chemical composition and amino acid content of the commonly available feedstuff in Nigeria. in fish nutrition and fish feed technology. *Proceedings of First National Symposium on Fish Nutrition and Fish Feed Technology Held at Niomar* Lagos: 15-26.

Fagbenro, O. A., Akinbulumo, M. O., Adeparusi, O. E., and Raji, A. A. (2005) Flesh yield, proximate and mineral composition of four commercial West African freshwater food fishes. J Anim Vet Adv 4: 848-851.

Fawole A. C, Olagunju T. E (2007). Proximate mineral composition in some selected freshwater fishes in Nigeria. J Food Saf 9: 52-54.

Kamel, S. (2007) Nanotechnology and its application in lignocelluloses composites, a mini review. *Express Polym Lett 1:* 546-575.

Ogbe, K. U. and Omada, O. I. (2020). Comparative Studies on the Proximate Composition on the Various Body parts of *Clarias gariepinus* and *Scombers scomrus. Journal of Applied Science and Environmental Management.* Volume 24(4), 615-618.

Oyebanmiji, O. F., Fagbohun, T. R. and Olubanjo, O. O. (2008). Fungal Infestation and Nutrient Quality of Traditionally Smoke-Dried Freshwater Fish. *Turkish Journal of Fisheries and Aquatic Sciences,* 8:7-13.

Varljen J, Brmalj S, Baticic L, Obersnel V, Kapovic M (2003) Lipid classes and fatty acid composition of diplodus vulgaris and conger originating from the adriatic sea. *Food Technol. Biotechnol.* 41:149-156.

Waterman J J (2000) Composition and quality of fish. Torry research station. Edinburg.