

Comparative Study on the Proximate Composition of *Chrysichthys nigrodigitatus* and *Chrysichthys walkeri* (Family Claroteidae) from Oyan Lake

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Abstract
A study was conducted to determine and compare the proximate composition of C*hrysichthys nigrodigitatus* and *Chrysichthys walkeri* from Oyan Lake, Ogun State, Nigeria. Fish samples were collected during the months of February, March and April, 2013 from Oyan Lake and conveyed to the laboratory for analysis. The proximate composition of protein, fat, moisture, ash and crude fiber were measured. Results revealed a moisture monthly variation between 69.68 ±2.44 – 77.28 ±1.56 for *Chrysichthys walkeri* and 68.52±2.94 – 72.47±3.65 for *Chrysichthys nigrodigitatus.* The protein content ranged between 19.47±0.33 – 20.14±0.43 for *Chrysichthys walkeri* and for *Chrysichthys nigrodigitatus* the protein content ranged from18.62±1.2 in March to 20.54±1.03 in February. The fat content of *Chrysichthys walkeri* ranged from 1.24% in February to 1.63 % in April, while for *Chrysichthys nigrodigitatus* the values ranged from 9.00% - 9.53%. The mean monthly ash content of *Chrysichthys walkeri* ranged from 1.37 - 1.38% and for *Chrysichthys nigrodigitatus* the values varied between1.37% and 1.57%. Further results reveal a significant difference in the protein content and fat content of *Chrysichthys walkeri* in February and in the month of April while the protein content of *Chrysichthys nigrodigitatus* differed significantly in the month of February from the month of March. In all the months *Chrysichthys walkeri* had the lowest protein content of 19.47%; it also had the lowest fat, ash and crude fibre content of 1.24%, 1.21% and 3.68% respectively.
Keywords: *Chrysichthys walkeri, Chrysichthys nigrodigitatus,* proximate composition, Oyan Lake

Introduction

All over the world, people are becoming more aware of food quality and its implication on their health. Fish contributes to food security in many regions of the world, providing a valuable supplement for diversified and nutritious diets. The image of fishery products fit quite well in the healthy food trend. Fish is easy to digest, low in calories, high in protein and good source of fats and other elements for health. However, the quality of fish species determines the nutrient values and nutrient content varies with fish species. Proximate composition is used as an indicator of fish quality. Chemical body composition of fish could illustrate its physiological condition and health (Saliu *et al*., 2007).

Proximate composition generally comprises the estimation of moisture, protein, fat and ash contents of the fresh fish body. They can differ in nature and quantity according to their function and availability (Love, 1980; Huss, 1988). The composition of a particular species often appears to vary from one fishing ground to another, and from season to season, but the basic causes of change in composition are usually variation in the amount and quality of food that the fish eats and the amount of movement it makes. Body composition can give idea about age classes of the same species or can compare nutritional differences between and among the species (Zafar and Ashraf, 2011). Determination of some proximate profiles such as protein content, lipid, ash and other nutrients is often necessary to ensure that they are within the range of dietary requirement and commercial specifications (Watchman, 2000).

Chrysichthys is a genus of claroteid catfishes native to Africa. There are currently 42 recognized species in this genus (Froese and Daniel*,* 2011), in Nigeria inland waters only five species have been identified, *C. nigrodigitatus*, *C. walkeri*, *C. auratus*, *C. furcatus* and *C. filamentosus*. Both *Chrysichthys nigrodigitatus and Chrysichthys walkeri* fishes have important commercial value; more abundant, desirable for consumption and fetch medium to high prices in the markets in Nigeria. *Chrysichthys* is sought after for its flavour and chemical composition (Akinsanya *et al*., 2007; Saliu 2008 and Olarinmoye *et al*., 2009). As fish is a critical source of dietary protein and micronutrients for people living around Oyan Lake and in Nigeria, there is need to investigate the commonly consumed fish species and convey an appropriate information to the consumer about the nutritional quality of these fishes. This study was conducted to determine and compare nutrient status of *Chrysichthys nigrodigitatus and Chrysichthys walkeri* from Oyan Lake. The primary objective was to determine which of the two is more nutritious for human consumption.

Material and Methods

Specimens of the two native species *C. nigrodigitatus and C. walkeri* of all fish were collected from fishermen fishing in the Oyan Lake during the months of February, March and April, 2013. Fish total length to the nearest 0.1 cm and fish total weight to the nearest 0.1 g were recorded. Thirty (30) samples each of *C. nigrodigitatus* and *C. walkeri* were bought from Oyan Lake and thoroughly washed and weighed for analysis in their fresh state. The weight and length of *C. walkeri* and *C. nigrodigitatus* used for the nutritional evaluation studies were 333.33g±44.09, 118.50 cm ±1.32 and 343.33g ±34.8, 118.00cm±1.32 respectively. Samples were transported in iced containers to the Biotech Laboratory of the Federal University of Agriculture, Abeokuta. Values of the crude protein, crude fibre, fat content, ash content and moisture content were determined using the standard procedures of AOAC (2000).

Crude protein was determined by first digesting one gram of each fish species sample into a 50ml digestion flask and the Kjeldahl mixture which acts as a digestion catalyst was added with 5ml concentrated tetraoxosulphate VI acid (H_2SO_4). Some pumice stones (anti-bumping granules) were also added. The flask containing the sample mixture was heated gently at an inclined angle in a Kjeldahl digestion rack until frothing subsided. It was then boiled until the solution became colourless. Heating of the mixture released the nitrogen in the various samples which was then converted to ammonia with the concentrated H_2SO_4. It was cooled and transferred into a 100ml volumetric flask and diluted with distilled water to the mark and mixed thoroughly. A blank containing only H_2SO_4acid and catalyst was also heated. A 10ml aliquot was transferred to the distillation apparatus and then introduced to the sample chamber. 10ml of 40% sodium hydroxide was released into the sample chamber slowly from the sample addition funnel. The ammonia was entrapped in a receiving solution containing 10ml of 2% boric acid solution in which 4 drops of bromocresol green/2 drops of methyl red indicator had been added. Distillation continued until the pink colour turned greenish. This was then titrated with standard HCl acid (0.01N) and the percentage of crude protein was determined using the following calculation:

% Nitrogen = Titre value (A-B) × Normality of acid × Vol. of N× 100
Sample of weight (mg) × volume of digest (aliquot) = Titre value × 0.01 × 100 × 14.01 × 100
Sample weight (mg) × 10
% Crude protein = % N_2 × 6.25

Fat content of the moisture free sample was determined by extracting the fat by using a suitable solvent by soxhlet method A.O.A.C (2000). The specimens were then digested and filtered, the filtrate was then dried at 105°C for 12 hours, cooled and weighed to get the residue. The residue (crude fibre and ash) was incinerated in weighed crucibles at 600°C for 12 hours. This was then cooled in a desiccator and weighed to obtain the weight of the ash (A.O.A.C., 2000). The crude fibre content was then estimated by trichloroacetic acid method as describe by the A.O.A.C. (2000).

The moisture content was determined using the following equation:
% Moisture = W1 – W2 × 100
Where, W1 = Weight of known amount of sample (fresh) + crucible
W2 = Weight of oven dried sample (A.O.A.C, 2000).

Statistical Analysis

Data analysis was performed using excel (2007) and SPSS (11.5). Means of wet, crude protein, fat, ash and crude fiber of fish muscle were compared between *C. walkeri* and *C. nigrodigitatus*, by t-student test ($p < 0.05$).

Results

The result of proximate analysis of *C. walkeri* and *C. nigrodigitatus* is shown in Tables 1 and 2 respectively. The result indicates that moisture content is the major component of the proximate composition. Results revealed a moisture monthly variation between 69.68 ±2.44 – 77.28 ±1.56 for *C. walkeri* and 68.52±2.94 - 72.47 ±3.65 for *C. nigrodigitatus.* The protein content ranged between 19.47±0.33 - 20.14±0.43 for *C. walkeri* and for *C. nigrodigitatus* the protein content ranged from18.62±1.2 in March to 20.54 ±1.03 in February. The fat content of *C. walkeri* ranged from 1.24% in February to 1.63 % in April, while for *C. nigrodigitatus* the values ranged from 9.00% - 9.53%. The mean monthly ash content of *C. walkeri* ranged from 1.37 - 1.38% and for *C. nigrodigitatus* the values varied between1.37% and 1.57%. The crude fibre content of *C. walkeri* ranged from 3.76% - 4.89% and for *C. nigrodigitatus* the values varied between 5.83% and 9.87%. *C. walkeri* had the lowest protein, fat, ash and crude fibre content of 19.47%, 1.24%, 1.21% and 3.68% respectively, while *C. nigrodigitatus* had the lowest moisture content (68.52%).

Results reveal a significant difference ($P<0.05$) in the protein content and fat content of *C. walkeri* in February and in the month of April. The moisture content of *C. walkeri* differed significantly ($P<0.05$) between February and March; and also between February and April. These results reveal a correlation in the values of protein, fat and moisture variables in the months of February and April (Table 3). Table 3, it can be deduced that the protein content of *C. nigrodigitatus* differed significantly in the month of February from the month of March.

Also results reveal that the February crude fibre value of *C. nigrodigitatus* was significantly different (P<0.05) from the value obtained in April.

Discussion

The nutritional compositions of fish include crude protein, crude fibre, amino acid, fatty acid and trace elements, whose types and contents are the embodiment of fish nutritional value. In this study, the moisture, crude protein and ash contents of *C. nigrodigitatus* muscle were similar to those of *C. walkeri*. This is in agreement with the observations of Marais and Erasmus (1977) in their study of several freshwater fish species. The crude protein content for the two catfishes in this study was consistent with values obtained by Eyo (2001) recorded on some selected freshwater fish in Nigeria. The crude protein content in fish flesh varies between 17% and 21%, depending on the species, the nutritional and production cycle, as well as the body part (Chaijan *et al*., 2010). The moisture content recorded in this study was within the range of those previously reported for other fishes by Gallagher *et al*. (1991). The mean monthly ash content of *C. walkeri* ranged from 1.37 - 1.38% and for *C. nigrodigitatus* the values varied between1.37% and 1.57%. Chukwa and Shaba (2009) found higher amounts of ash content in *C. gariepinus* (3.06%) than the two catfish species in this study. The fibre content values recorded for *C. walkeri* (3.76% - 4.89%) is similar to the report of Lovell (1988) that carnivores do not need as much fibre, they require less than 4% but values recorded on *C. nigrodigitatus* was found to be greater than 4%. The values of fat content were also outside the range stated by Eyo (2001) of some selected inland water fish species. The fat content of *C. nigrodigitatus* was higher than that of *C. walkeri.* This could be attributed to the different abilities of fat absorption and different expressional levels of the fatty acid synthase gene of the two species. Lipids include a wide heterogeneous group of compounds and the fat content of fish can be as low as 0.5% and as high as 16-18%.The quantity and quality of fat content in fishes are affected by feed quality, water quality, spawning season, fish migration, fish size and starvation (Hardy and King, 1989). The reason for this variation is not clear at the moment, because the fish species belong to the same genus and have similar feeding behaviour. The month wise profile of proximate composition of the two species revealed significant difference in protein, fat and moisture. Weatherly and gill (1987) noted that the values of body composition in fishes vary considerably within and between species, with fish size, sexual condition, feeding, time of the year and activity, these could be the reason for the differences.

Conclusion and Recommendation

It could be concluded that the two fish species are good source of protein and other nutrients even though each species has its own nutritional value parameters. However, the result shows that proximate composition in *C. nigrodigitatus* was higher than *C. walkeri*. *C. nigrodigitatus* is thereby recommended for human consumption because they have more nutritional value than *C. walkeri* particularly in terms of fats and protein and are also rich in all the other nutrients.

Table 1: Monthly mean of the Proximate Composition of *Chrysichthys walkeri*

Month	Protein	Fat	Moisture	Ash	Crude Fibre
February	19.47±0.33	1.24 ±0.07	69.68 ±2.44	1.38 ±0.27	4.89±0.16
March	19.64 ±0.65	1.48 ±0.187	77.28 ±1.56	1.21±0.04	3.68±078
April	20.14 ±0.43	1.63 ±0.12	76.02 ±2.44	1.37 ±0.13	3.76±0.77

Table 2: Monthly mean of the Proximate Composition of *Chrysichthys nigrodigitatus*

Month	Protein	Fat	Moisture	Ash	Crude Fibre
February	20.54 ±1.03	9.53 ±0.59	72.47 ±3.65	1.57±0.03	5.83±0.933
March	18.62±1.2	8.80 ±0.91	72.15±5.53	1.60 ±0.15	7.00±1.94
April	19.70± 0.46	9.00 ±0.15	68.52±2.94	1.37±0.18	9.87±1.97

Table 3: T- test of Proximate Composition of *C. nigrodigitatus* and *C. walkeri*.

Variables	*Chrysichthys nigrodigitatus*		*Chrysichthys walkeri*	
	T-Statistics	Sig-Value	T- Statistics	Sig-Value
Protein				
February – March	6.190	0.025**	-0.422	0.701
February – April	0.537	0.025**	-6.228	0.025**
March – April	-0.913	0.458	-1.732	0.225
Fat				
February – March	0.534	0.647	-1.640	0.243
February – April	0.748	0.532	-2.988	0.096**
March – April	-0.218	0.848	-1.153	0.368
Moisture				
February – March	0.040	0.972	-4.174	0.053**
February – April	-0.189	0.205	-14.675	0.005**
March – April	0.609	0.605	0.814	0.501
Ash				
February – March	-0.189	0.868	0.663	0.575
February – April	1.322	0.317	0.009	0.994
March – April	0.782	0.516	-1.000	0.423
Crude Fibre				
February – March	-0.407	0.723	1.391	0.299
February – April	-2.978	0.097**	1.585	0.254
March – April	-0.796	0.510	-0.056	0.960

**Significant at $P<0.05$

References

Akinsanya, B., O.A. Otubanjo and C.A. Ibidapo. (2007). Helminth bio load of *Chrysichthys nigrodigitatus* (Lacepede 1802) from Lekki Lagoon, Lagos Nigeria. Turk. J. Fish. Aquat. Sci. 7: 83-87.

AOAC (2000). “Official Methods of Analysis” 17th Ed; Association of Official Analytical Chemists Washington, D.C.

Chaijan, M., A. Jongjareonrak, S. Phatcharat, S. Benjakul and S. Rawdkuen (2010). Chemical compositions and characteristics of farm raised giant catfish (*Pangasianodon gigas*) muscle. LWT - Food Science and Technology 43(3): 452-457.

Eyo, A.A. (2001) *Fish Processing Technology in the Tropics*. University of Ilorin Press, Ilorin, Nigeria, ISBN-13: 9789781770456, Pages: 403

Froese, R. and Daniel, P., eds. (2011). Species of *Chrysichthys* in FishBase. December 2011 version.

Gallagher, M.L., Harrel M.L. and Rulifson R.A. (1991) Variation in lipid and fatty acid contents of Atlantic Croaker, Stiped Mullet and Summer Flounder. *Transactions of the American Fisheries Society* 120: 614 – 619.

Hardy, R. and King, L (1989). Variation in n-3 fatty acid content of fresh and frozen salmon. Omega 3 News, 4:1-4.

Huss, H.H. (1988). Chemical composition. In: *Fresh fish: quality and quality changes*. Pp. 15-25. Rome: Food and Agriculture Organization of the United Nations Danish International Development Agency

Love, R.M. (1980). *The chemical biology of fishes.* Pp. 387. London: Academic press.

Lovell, T., 1988. Nutrition and Feeding of Fish. Van Nostrand Reinhold, New York, pp: 260.

Marais, J.F.K. and T. Erasmus. (1977). Body composition of *Mugil cephalus, Liza dumerile*, *L. richardsoni* and *L. tricuspidus* (Teleostei: Mugilidae) caught in the Swartkops Estuary. *Aqua,* 10: 75-86

Olarinmoye, O., V. Taiwo, E. Clarke, C. Kumolu-Johnson, O. Aderinola and F. Adekunbi. (2009). Hepatic pathologies in the brackish water catfish (*Chrysichthys nigrodigitatus*) from contaminated locations of Lagos Lagoon complex. *Appl. Ecol. Environ. Res*. 7: 277-286.

Saliu, J. K., Joy, O. and Catherine, O. (2007). Condition factor, fat and protein content of five fish species in Lekki Lagoon, Nigeria. *Life Science J*. 4: 54-57.

Saliu, J.K. 2008. Effect of smoking and frozen storage on the nutrient composition of some African fish. *Adv. Nat. Appl. Sci*. 2: 16-20.

Watchman, I.I (2000). Composition and Quality of fish, Edinburgh, Tory Research Station. Weatherly, A.H. and Gill, H.S. (1987): The biology of fish growth, London, academic Press. 433-443

Zafar, A. and M. Ashraf, (2011). Comparative studies on the seasonal variations in the nutritional values of three carnivorous fish species. *Int. J. Agric. Biol*., 13: 701–706

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