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 Chrysichthys 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, 18.50 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\textsubscript{2}SO\textsubscript{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\textsubscript{2}SO\textsubscript{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\textsubscript{2}SO\textsubscript{4} acid 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:

\[
\% \text{ Nitrogen} = \frac{\text{Titré value} (A-B) \times \text{Normality of acid} \times \text{Vol.} \times \text{N} \times 100}{\text{Sample weight (mg) \times volume of digest (aliquot)}}
\]

\[
\% \text{ Crude protein} = \frac{\text{Titre value}}{0.01 \times 100} \times 14.01 \times 100
\]

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. walker* ranged from 1.37 - 1.38% and for *C. nigrodigitatus* the values varied between 1.37% 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 expression 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*.

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

**Significant at P<0.05

### References


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