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Research Article

Proximate composition of nutrients in fresh adult catfishes: Chrysichthys nigrodigitatus, Heterobranchus bidorsalis and Clarias gariepinus in Yenagoa, Nigeria

Keremah R. I.* and Amakiri G.

Department of Fisheries and Livestock Production Technology, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

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***Corresponding Author**
Keremah R. I.
E-mail: *Kreginald6@gmail.com*
Phone: *+2348055311660*

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ABSTRACT

The evaluation of nutrient composition in adult *Chrysichthys nigrodigitatus* (CN), *Clarias gariepinus* (CG) and *Heterobranchus bidorsalis* (HB) was determined on wet basis. A total of 60 samples (weight: 500g – 1kg fish) comprising 20 of each species were gutted, washed, ground and analyzed for moisture, protein, fat, ash and carbohydrate, using standard methods. Results showed the mean values for moisture, protein and fat as 72.53± 0.23 (CG) – 80.73± 0.23% (HB), 18.20± 0.13(HB) – 21.37± 0.13% (CN) and 2.13± 0.10 (CN) – 7.25 ± 0.10% (CG). The carbohydrate and ash values ranged 1.33± 0.19 (HB) – 2.55± 0.19% (CG) and 1.63± 0.09 (HB) – 3.30± 0.09% (CN). The caloric values for protein was 13.27± 0.14 (CN) – 17.22± 0.14 Kcal/100g (CG), fat showed 27.26± 0.19 (CN) – 57.31± 0.19 Kcal/100g (CG) and carbohydrate 1.17± 0.34 (HB) – 1.35± 0.34 Kcal/100g (CN). The nutrients showed significant differences at p< 0.001 between the fishes examined. These catfishes were observed to contain adequate quality animal protein, fat and ash that would provide appreciable amounts of essential nutrients such as amino acids, fatty acids, minerals and energy to support human health.

INTRODUCTION

Fish is one of the most important animal protein sources that are widely consumed by all races and classes of people (Abolude and abdullahi, 2005). It compares favorably with milk, meat, pork and poultry (James, 1984). Fish and fishery products are highly nutritious and are excellent sources of other dietary essentials like vitamins and minerals. Fish fat contains a high proportion of polyunsaturated fatty acids which may help to decrease the incidence of atherosclerosis and heart related diseases (Akande, 2011). Fish also provide an important complement to the predominantly carbohydrate based diet of many people in Nigeria (Akande, 2011). Fish in a fresh state has minimal changes in texture, taste and appearance. Processing methods usually change these properties so that the characteristics of the fish also alter according to the process used (Edun, 2012).

Catfishes are very important commercial and highly valued fishes (Olokor et al., 2011). They enjoy consumers preference (Holden and Reed, 1972; Francis, 1977), are adaptable to adverse environmental conditions, resistant to disease, accept cheap feed to thrive and have fast growth rate (Olufeagba, 1996). *Chrysichthys nigrodigitatus*, a Bagrid species which is greyish-blue in colour, is restricted to the bottom of deep water, omnivorous; consume bivalves, detritus, chironomid, crustaceans and vegetable matter (Bankole et al., 2011). This fish can be raised in both fresh and brackish water environments. *Clarias gariepinus* belongs to the family Clariidae, has a big long head and the body is 3.1 – 3.88 times the head with 52-62 rays. It is an omnivorous fish, has a high commercial value in the market especially at the commencement of dry season (Ime – Ibanga and Fakunle, 2007). *Heterobranchus bidorsalis* is of the Clariidae family. It is an elongated fish with a broad, flat, strong, granulated and depressed head. This mudfish is omnivorous with predatory tendency (Marioghae, 1991). These catfishes have smooth and scaleless body, are highly valued by consumers and keep well in both fresh and dried states. The economic importance of catfishes such as *Clarias* and *Heterobranchus* also encourage intergeneric hybridization of the species (Ezenwa, 1985).

Most of the works done on the nutritional value of *C. nigrodigitatus, C. gariepinus* and *H. bidorsalis* were centred on the smoked products. With improved handling practices and processing to extend the shelf life of fish products, it is of paramount importance that every consumer of fishery products harvested and marketed should obtain good quality protein from the fish consumed. This experiment was therefore undertaken to evaluate the nutrient compositions in the adult of these catfishes in the fresh state.

MATERIALS AND METHODS

Fish Sample Collection and Preparation

A total of 60 samples of fresh adult fishes comprising 20 each of *Chrysichthys nigrodigitatus* (CN), *Clarias gariepinus* (CG) and *Heterobranchus bidorsalis* (HB) with size range, 500g – 1kg were purchased from fish mongers in Yenagoa, Bayelsa State. They were identified using Keys by Holden and Reed (1972) and Fischer et al. (1981) and preserved in domestic deep freezers for later use. The fishes were prepared by removing the gills, guts, fins and viscera organs and washed thoroughly with clean water. The edible portion of each of the different fish species were blended and homogenized using mortar and pestle and a blender. Each sample was packed separately in different bottles and labeled according to the type of fish in readiness for analysis.

Proximate Analysis

Each fish sample in its fresh state was subjected to chemical analysis in triplicate using the procedures of the Association of Official Analytical Chemists (AOAC), 1990. The analysis of the samples was carried out in the Laboratory of Department of Chemistry, Niger Delta University, Wilberforce Island in Bayelsa State, Nigeria. Parameters determined were protein, lipid, ash and moisture contents. The total amount of carbohydrate was obtained by difference 100% - (%moisture +%protein+%lipid/fat +%ash). The gross energy or calories was calculated for each species using factors of 5.5, 4.1 and 9.5Kcal/g for protein, carbohydrate and fat respectively (Winberg, 1971; Olatunde, 1980). This experiment was carried between March and April, 2011.

Data analysis

Date analysis was done using Analysis of variance (ANOVA) according to the statistical analysis system (Steel and Torie, 1987). Differences among sample means were tested for significance with Duncan's multiple range test (Duncan, 1955) at a level of 0.05.

RESULTS

The proximate composition of the fish samples are shown in Table 1. The protein content ranged from 18.20$\pm$ 0.13% (HB) – 21.32$\pm$ 0.13% (CN). The fat (lipid) content is highest for *Clarias gariepinus* (CG) and ranged from 2.31$\pm$ 0.10% – 7.25$\pm$ 0.10%. The ash content was between 1.63$\pm$ 0.09% (HB) and 3.30$\pm$ 0.09% (CN) while the moisture content ranged from 72.53$\pm$ 0.23% (CG) – 80.73$\pm$ 0.23% (HB). The carbohydrate was highest for CG, 2.55$\pm$ 0.19% and lowest for HB, 1.33$\pm$ 0.19%. Statistical analysis on protein, fat, ash, moisture and carbohydrate showed significant differences ($p<0.001$) in the fish samples. The gross calorific values also showed significant differences

($p < 0.001$) for protein, fat and carbohydrate (Table 2). The total caloric values were 42.14± 0.67 Kcal/100g (CN), 53.55± 0.67Kcal/100g (HB) and 75.75± 0.67Kcal/100g for CG.

DISCUSSION

The proximate composition of nutrients in all fish samples showed variation among the individual species. Afolabi (1984) reported that the variation could be due to geographical location, season of the year, feed intake, metabolic efficiency, energy expelled by the fish, sex, species of fish and size. However, the crude protein (CP) content for the 3 catfishes in this study compared favorably with values obtained by Alfred – Ockiya and Ndiomu (1998) but slightly higher than that of Nisa et al., (1995). Effiong and Tofa (2006) reported 18.60% CP for *Clarias gariepinus* which was close to the 19.67% obtained in this study. The fat content of fishes obtained in this study was lower than that reported by Olomu et al. (1981). Fat content in an animal's body is highly variable and this could affect the levels of other constituents especially water. This was evident in the observed crude fat levels by Effiong and Tofa (2006) for *C. gariepinus* (1.85%) and 9.70% for *H. longifilis* while 7.25± 0.10% and 3.43± 0.10% were obtained for similar species in this study. The percentage of fat in an animal's body normally increases with the level of food intake (Maynard et al., (1984). This reason could be responsible for the differences in fat values obtained in this study compared to the results of other workers. Murray and Burt (1977) however attributed low lipid content in fishes to migration and span due to low feeding ability in fishes at such periods.

Carbohydrates occur in very small amounts in an animal's body in the form of glycogen (Maynard et al., 1984). Hence the low values obtained in this study could be attributed to this reason. Values of carbohydrate in this experiment were found to be lower than those of Olatunde (1980). The moisture values for *C. nigrodigitatus*, *C. gariepinus* and *H. bidorsalis* obtained were similar to those reported for finfishes by Clement and Lovell (1994). The 72.53-80.73% moisture content for the catfishes in this study were similar to the 75.80-80.83% reported by Effiong and Tofa (2006) for *C. gariepinus*, *H. longifilis* and their hybrid, 'Heteroclarias'. Food intake and amount of fat in the body of an animal are said to influence moisture level (Maynard et al., 1984). The calorific values could be attributed to high fat content observed for the test fishes in this study. These values were lower than those of Alfred-Ockiya and Ndiomu (1998).

Table 1: Proximate nutrient composition (%) of *C. nigrodigitatus*, *C. gariepinus* and *H. bidorsalis* (on wet basis)

Species	Component (%)				
	Moisture	Protein	Fat	Carbohydrate	Ash
C. nigrodigitatus	79.53±0.23^{a}	21.37±0.13^{a}	2.13±0.10^{c}	2.21±0.19^{a}	3.30±0.09^{a}
C. gariepinus	80.73±0.23^{a}	18.20±0.13^{c}	3.43±0.10^{b}	1.33±0.19^{b}	1.63±0.09^{c}
H. bidorsalis	72.53±0.23^{b}	19.67±0.13^{b}	7.25±0.10^{a}	2.55±0.19^{a}	2.50±0.09^{b}

Means with same superscript for a given parameter in the same vertical row are not significantly different (P> 0.001).

Table 2: Gross calorific values (Kcal/100g) of fresh adult *C.nigrodigitatus*, *C.gariepinus* and *H.bidorsalis* (on wet basis).

Species	Component (Kcal/100g)			
	Protein	Fat	Carbohydrate	Total
C. nigrodigitatus	13.27±0.14^{c}	27.52±0.19^{c}	1.35±0.34^{b}	42.14±0.67^{c}
C. gariepinus	17.22±0.14^{a}	57.31±0.19^{a}	1.22±0.34^{b}	75.75±0.67^{a}
H. bidorsalis	15.85±0.14^{b}	36.31±0.19^{b}	1.17±0.34^{b}	53.55±0.67^{b}

Means with same superscripts for a given parameter in the same vertical row are not significantly different (P> 0.001).

CONCLUSION

This study revealed the importance of *C. nigrodigitatus*, *C.gariepinus* and *H.bidorsalis* (catfishes) as good sources of protein and other nutrients. They have high calorific values and are rich in fat, hence are excellent reservoir of fat soluble vitamins. The percentage ash content in these fishes is an indication that they are good sources of mineral when consumed in our diet. The nutritional information so obtained in this study would probably enable consumers to know the benefits derivable from these catfishes.

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