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Comparison of Nutrient Values of Wild and Cultured *Heterobranchus bidorsalis* and *Clarias gariepinus*

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ABSTRACT

Proximate body composition of wild and cultured Heterobranchus bidorsalis and Clarias gariepinus were analyzed. The crude protein content of wild and cultured H. bidorsalis and C. gariepinus were 55.03± 6.21%, 54.00±4.90%, 50.20±0.38%, and 48.90± 2.70% respectively which showed significant difference (p≤0.05). There were also significant differences (p≤0.05) in lipid values in wild and cultured H. bidorsalis and C. gariepinus (7.00±2.20%, 8.00±4.30%, 5.08±0.14% and 5.63 ± 0.91%). The ash values showed significant difference (p<0.05) (2.90±0.30%, 3.11± 2.26%, 2.3±0.69% and 2.09±0.08%) respectively. There was no significant difference (p≥0.05) in the moisture content between wild and cultured C. gariepinus (77.10±4.20% and 77.10±3.20%) but high significant difference (p≤0.05) in that of H. bidorsalis (69.4±15.6% and 78.10±5.50%). There were no significant difference (p≥0.05) in dry matter content in wild and cultured C. gariepinus (22.8±3.23% and 22.8±33%) but high significant differences (p≤0.05) were observed in H. bidorsalis (26.56±11.7% and 21.9±5.5%). The NFE and crude fibre showed significant differences (p≤0.05) in wild and cultured H. bidorsalis and C. gariepinus (17.24±3.28% and 17.90±1.90%), 2.35±0.60% and 3.28±0.90%; 16.66±2.00% and 17.70 ± 2.82%, 2.06±0.70% and 2.48±0.76%). The regression coefficient of the length-weight showed significant difference (p≤0.05) in the wild and cultured samples. Both species showed negative allometric growth.

Keywords: Nutrients composition, Wild, Cultured, *Heterobranchus*, *Clarias* species

INTRODUCTION

Fish is one of the most important foods and is valued for its nutritional qualities. Fish protein is a good source of high quality protein containing essential amino acids in the amount and proportion required for good nutrition. It also provides a good source of vitamins and minerals. Today in Sub-Saharan Africa, one out of every two live on less than one dollar ($1) a day (World Bank, 2004). More than one third of the sub-Sahara African population is under-nourished (FAO, 2003). The report estimated that fish provides 22% of protein intake and exceeds 50% in the poorest countries where animal is expensive and scarce. Eyo (2001) pointed that in the coastal countries of West Africa the proportion of dietary protein from fish is extremely high (47% in Senegal, 67% in Gambia and 63% in Sierra Leone and Ghana). The importance of fish in the diets of infants, young children and pregnant women cannot be over-emphasized. The crude protein content of fish can be of immense nutritional value to pregnant women for

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proper development of the foetus and prevention of abortion. It will also enhance the proper mental and immunity development against disease among growing children (NAFDAC, 2003). In low-income countries, staple foods such as rice, wheat, maize, and cassava make up the bulk of the food consumed by people and they supply majority of energy. However, some essential nutrients (essential amino acids and micronutrients) are not found in these staples. These important nutrients can be supplied by fish because they contain very light connective tissue (Eyo, 2001).

Fish is a key ingredient on the global menu, vital factor in the global environmental balance, and an important basis for livelihood worldwide (UNICEF, 2006). Fish has no cultural or religious restrictions which makes it more advantageous than pork, beef and mutton (NIFFR, 1999) Fish is an indispensable source of micronutrients, such as iron, iodine, zinc, vitamin A and B (Haruna, 2003; World Fish Centre, 2005). Present knowledge of the chemical proximate composition of fish species from Nigerian waters is scanty. The measurement of some nitrogen free extract and crude fibre is often necessary to ensure that they meet the dietary requirements and commercial specification (Onyia *et al.,* 2010). Some authors had worked on the comparative proximate composition of wild and cultured *C. gariepinus* (Edward 2006; Olapade *et al*. (2011)*, Clarias anguillaris* (Onyia and Danwesh, 2008), and none on *H. bidorsalis* and *C. gariepinus.* This study aims at comparing the proximate composition of wild and cultured *C. gariepinus and H. bidorsalis* with the view to explore their nutritional value.

MATERIALS AND METHODS

Eight (8) fish samples were collected from the Department of Fisheries, teaching and research fish farm (*H. bidorsalis* and *C. gariepinus* cultured) and eight each of *H. bidorsalis* and *C. gariepinus* were collected from the landing site of Lake Geriyo. The standard length of each fish was taken using metre rule. The weights of the sampled fish were measured with weighing scale (Ohaus® Analytical weighing balance, China).

Proximate analysis

Proximate composition follows the standard procedures. Moisture content was determined by weighing the difference before and after oven drying (at 105ºC) for 16 hours. Ash content was determined by ashing procedure of incineration of 2g of each sample in a muffle furnace (Lenton Furnaces, England) at 600ºC for 2 hours. Protein content (N x 6.25) was determined by the Micro-Kjeldahl method described by Fagbenro *et al*., (2005). Crude lipid was extracted with n-hexane in a Soxhlet extractor, crude fibre by acid-base digestion using 1.25% H_2S0_4 (w/v) and 1.25% NaOH (w/v) solution, while available nitrogen free extract (NFE) was calculated by difference. The energy value (Kcal; 100g) of the sample was estimated by multiplying the percentage of crude protein, crude fibre and NFE by the factors of 16.70, 37.70 and 16.70 respectively (Vadivel and Janardhanan, 2004). All proximate components were analyzed in triplicate and reported as mean on % dry matter basis.

Length-weight relationship

Length-weight relationship was expressed by the equation $10 = aL^b$. The 'b' is an exponent with a value between 2.50 and 3.50 demonstrating normal growth dimensions and interpretation of relative well-being.

Statistical analysis

Analysis of variance (ANOVA) was used to compare means of the proximate composition data. Further analysis was carried out where there were significant difference ($p \leq 0.05$) using Least Significant Difference test.

RESULTS

Mean proximate body composition of wild and culture *H. bidorsalis* and *C. gariepinus* are shown in Table 1. Wild *H. bidorsalis* had significantly ($p \leq 0.05$) high crude protein followed closely by cultured *H. bidorsalis* (55.03±6.21 and 54.02±4.90) respectively.

Table 1: Proximate composition of wild and cultured *H. bidorsalis* and *C. gariepinus*.

Fish strains	CP	Ash	NFE	CF	DM	Moisture	Lipid
WHb	55.03±6.21^{a}	2.9±0.30^{c}	17.24±3.28^{c}	2.35±0.60^{d}	26.56±11.70^{a}	69.4±15.60^{c}	7.00±2.20^{b}
CHb	54.03±4.90^{b}	3.11±2.26^{a}	17.90±1.90^{a}	3.28±0.90^{b}	21.90±5.50^{c}	78.10±5.50^{a}	8.00±4.30^{a}
WCg	50.20±0.38^{c}	2.30±0.60^{b}	16.66±2.00^{d}	2.06±0.70^{c}	22.80±3.23^{b}	77.10±4.20^{b}	5.08±0.14^{c}
CCg	48.90±2.70^{d}	2.09±0.08^{d}	17.70±2.82^{b}	2.48±0.76^{a}	22.80±3.30^{b}	77.10±3.20^{b}	5.63±0.91^{c}

Means with the same superscript in the same column are not significantly different ($p \geq 0.05$). Key: W*Hb* = Wild *H. bidorsalis,* C*Hb* = Cultures *H. bidorsalis,* W*Cg* = Wild *C. gariepinus*, C*Cg* = Cultured *C. gariepinus*

There was significant ($p \leq 0.05$) difference in the Ash contents of the two strains. NFE, crude fibre and dry matter contents were significantly different. There were significant differences in the moisture and lipid contents of wild and cultured strains of *H. bidorsalis* 69.40±15.60 and 78.10±5.50, 7.00±2.20 and 8.00±4.3.

The nutrients composition of the two strains of *Clarias gariepinus* from wild and culture, showed significant difference ($p \leq 0.05$) in the crude protein content. *C. gariepinus* wild had 50.20±0.38 and cultured 48.90±2.70 crude protein. *C. gariepinus* wild had 2.30±0.69 and cultured 2.09±0.08 ash content, *C. gariepinus* wild had 2.35± 0.6 and cultured 3.28±0.9 NFE .There were significant differences ($p \leq 0.05$) in the Ash and NFE contents. The crude fibre and lipid contents showed significant differences ($p \leq 0.05$). However, the least significant difference revealed no variations in the dry matter and moisture contents between the two strains.

High correlations was observed (Table 2) between ash and crude protein (0.95), lipid and protein (0.84), lipid and ash (0.93) and moderate in lipid and NFE (0.67). Negative correlations were observed between crude fibre and crude protein, crude fibre and ash, dry matter and NFE, moisture crude protein, ash, as well as dry matter. Also, lipid and CF, moisture had negative correlation. However, there was low correlation between NFE and ash, CF and NFE, moisture and NFE.

Table 2: Correlation of the nutrient values of wild and cultured *H. bidorsalis* and *C. gariepinus*

	%crude protein	%Ash	NFE	CF	Dry matter	% moisture	Lipid (%fat)
Crude protein (%)	1						
Ash (%)	0.95	1					
NFE (%)	0.19	0.35	1				
CF (%)	-0.74	-0.51	0.37	1			
Dry matter (%)	0.51	0.21	-0.28	-0.89	1		
% moisture	-0.59	-0.31	0.22	0.92	-0.99	1	
Lipid (%)	0.84	0.93	0.67	-0.27	0.08	-0.18	1

Table 3 shows regression and condition factor of wild and cultured *H. bidorsalis* and *C. gariepinus*. The b, r^2 and K values showed allometric growth difference between strains. Condition factor of wild and cultured *C. gariepinus* were closely related. Cultured *H. bidorsalis* had higher condition factor (1.40). There was no significant difference in r2 while the K-factor showed that the fish species are in healthy condition.

Table 3: Regression values and condition factor of the species

Parameters	Wild *C. gariepinus*	*Culture C. gariepinus*	Wild *H. bidorsalis*	Culture *H. bidorsalis*
Weight(g)	258.63	325.88	402.55	194.00
Length(cm)	28.63	30.40	42.38	24.75
B	1.518	1.299	1.663	1.694
r^2	0.975	0.904	0.833	0.966
K	1.06	1.18	0.53	1.40

DISCUSSION

Fish is widely accepted because of its high palatability, low cholesterol and tender flesh (Onyia *et al*., 2010). However, less number of consumers eats fish because of its nutritional value. It is therefore necessary to make information available to consumers and fishery workers on the nutritional contribution of some fish species in their diets (Adewoye *et al*., 2005).

The proximate composition of *H. bidorsalis* from the wild and culture revealed considerable crude protein contents of 55.033% and 54.00% respectively (Table 1) compared to 20.54±0.34 obtained in *Heterbranchus longifilis* (Udo, 2012). The considerable high protein content value is an indication that fish is a good source of quality protein (FAO, 2003). The variation in crude protein could be due to essential nutrients in the local environment in which the fish lived (Adewoye and Omotosho, 1997).

Variation in crude fibre values in wild and cultured *H. bidorsalis* could be based on nutritional and environmental factors. The result of moisture content in *H. bidorsalis* wild (69.40%) and culture (78.10%) fell within the accepted range of 30 – 90 moisture content for most fish species (Eyo, 2001). This indicated significant difference ($p \leq 0.05$), it could be as a result of age, diet and environmental factors (Gupta *et al.*, 2007).

There was a variation in lipid content of the two strains. The mean lipid content in *H. bidorsalis* wild was less than cultured. This variation could be influenced by nutritional values of the fish.

More so, proximate composition of *C. gariepinus* from the wild and cultured strains revealed that there was significant difference in their crude protein content. This could be attributed to fish´s consumption, absorption ability and conversion potentials of essential nutrients in their local environment into biochemical attributed needs of the body (Adewoye and Omotosho, 1997). It was observed from this study that crude protein and dry matter contents were higher in wild *C. gariepinus* than cultured *C. gariepinus*. The same observation was made in the crude protein contents of wild and cultured *H. bidorsalis*. This result agreed with Olapade *et al*. (2011) that worked on wild and cultured *C. gariepinus* who reported the proximate

composition values were higher in wild *C. gariepinus*. The moisture content for both wild and cultured strains of *H. bidorsalis* and *C. gariepinus* were within the accepted range 30 – 90% (FAO, 1999). There were variations in the proximate compositions of wild and cultured *H. bidorsalis* and *C. gariepinus* in this study. The variation in the mean proximate composition, particularly lipid, among individuals of the same species is a common phenomenon in fish (Ssali, 1998; Zenebe *et al*., 1998). However, these variations were attributed to factors such as geographical area in which they were caught, age, sex and size (Adewoye *et al*., 2005; Edward, 2006).

Length-weight relationship

H. bidorsalis both from the wild and cultured exhibited a negative allometric growth. The values of 'b' were found to be 0.83 and 0.97, respectively. The results from wild and cultured *C. gariepinus* both from strains equally exhibited negative allometric growth, with values of 'b' found to be 0.98 and 0.90 respectively.

The results agreed with the findings of Konan *et al*. (2007) who reported that *Brcianns imberri* strains had negative allomtric growth. Samat *et al.* (2008) reported that *H. longifilis* exhibited negative allometric 'b' values which are in agreement with the results obtained in this research. The same author reported that 'b' values can be affected by increase in weight values due to water intake, food or gonads, season of the year and the time of the day when the fish was caught.

The correlation regression analysis (r^2) between lengths and weights of *H. bidorsalis* (wild and cultured) and *C. gariepinus* (wild and cultured) were significantly high because they were close to 1. This means that the relationship between length and weight is high, which agreed with Ecoutin *et al.,* (2005) and (Konan *et al*., 2007).

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