Amino Acid and Proximate Compositions of Cultured and Wild Oreochromis niloticus (Linnaeus 1758) from Makurdi-Nigeria

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Abstract: This study was aimed at identifying the fish habitat that harbors *O. niloticus* with higher nutrients and availing these findings for nutritional guidance. Amino acid and proximate compositions of *O. niloticus* from Lower Benue River and UAM fish farm were determined monthly for a 3month period, using methods of Benitez (1989) and AOAC (2006) respectively. The mean of Glutamic acid (12.51±0.64 and 11.85±0.67) and Alanine (5.40±0.23 and 4.50±0.41) varied significantly ($p<0.05$) between the wild and cultured while other amino acids were not. In October, ash (4.62±0.02 and 3.69±0.02), fat (4.71±0.06 and 3.61±0.02), protein (14.62±0.07 and 9.98±0.02) and moisture (75.67±0.07 and 79.65±0.15) varied significantly between the wild and cultured *O. niloticus*. Crude protein (20.46±0.01 and 18.75±0.04) and moisture (69.32±0.02 and 73.35±0.20) significantly varied in November between the samples respectively. Only crude protein (18.89±0.04 and 20.31±0.06) varied statistically in December between wild and cultured. The mean of crude protein (17.99±1.22 and 16.34±1.86) and the mean moisture (72.53±1.16 and 74.94±1.52) differed significantly between the wild and cultured. From these results. *O. niloticus* wild expressed superiority over the cultured, however, both River Benue at Makurdi and the UAM fish farm harbor nutritious *O. niloticus* which is good for human consumption based on our daily amino acid and protein needs.

1 INTRODUCTION

More recently, fish has become a favorite foodstuff for many people due to several health reasons (Ali and Kiumars, 2010). However, considering the maximum utilization and the knowledge of fish composition, conducting studies on fish flesh vital in the fishery industry.

According to Silva and Chamul (2000), the nutritional composition of fish varies greatly from one species and individual to another depending on numerous factors such as age, feed intake, sex, the environment and season. Puwastien et al., (1999) stated that fish proximate composition serves as a good indicator of fish quality, and it varies with parameters like genetic strain, diet, feed rate and age.

In order to flourish and maintain bodily functions, fish similarly to other animals require different nutrients in sufficient quantities (Ashraf et al., 2011). It also has the ability to synthesize some but not all nutrients. Hence, some of these nutrients must be obtained from outside sources. Apart from the natural productivity of ponds, cultured fish is provided with nutrient-rich feed, while captured fish on the other hand, solely depends on natural food in the aquatic environment for its survival and sustenance. These variations have been reported to directly related to the growth, health and body composition of fish. Therefore, fish composition is a good index of fish food availability and feeding habits (Ashraf et al., 2011).

For the nature of the raw material in fish to be known before chilling, freezing, smoking orcanning can be correctly applied. Fish processors are directly interested in the proximate composition of fish (FAO, 2004).

Bakir et al., (1993) mentioned that *Oreochromis niloticus*, *Tilapia zilli*, *Sarotherodon galilaeus*, as well as *Clarias gariepinus*, *Clarias angullaris* and *Heterobranchus longifilis* from the Cichlidae and Clariidae families form part of the freshwater fish species mostly cultured in the developing nations. Hence, the need for using cultured and wild O. niloticus for this study.

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2 MATERIALS AND METHODS

2.1 Sample Collection

Twelve (12) samples of O. niloticus were collected for this study, comprising of six (6) samples each from Lower Benue River at Wadata/Tse-Adee landing site Makurdi (with average weight of 70.13g) and the University of Agriculture Makurdi (U.A.M) fish farm (with average weight of 67.42g). The samples were then taken to the Hydrobiology and Fisheries Research laboratory, University of Jos, Plateau State, Nigeria where the laboratory analyses were conducted.

2.2 Study Duration

The duration for this study was three (3) months, and the laboratory analysis of fish carcass was carried out in a monthly basis from October to December, 2014.

2.3 Amino Acid Profile Determination

The Amino acid profile in the known sample was determined using methods described by Benitez (1989) in Technicon sequential Multi-Sample Amino Acid Analyzer (TSM).

2.4 Determination of Proximate Composition

Proximate composition of moisture, crude protein, fat, and ash was determined based on the method described by the Association of Official Analytical Chemists (AOAC, 2006). All values of proximate parameters were converted and presented on wet weight basis after each calculation.

2.5 Statistical analysis

Student t-test and descriptive statistics (mean and standard error of the means) were used to analyze the data obtained from this work.

3 RESULTS

A comparison between the amino acid profiles of *O. niloticus* from Lower Benue River and that of U.A.M fish farm indicated a significant difference ($p<0.05$) between Glutamic acid (12.51±0.64 from the river and 11.85±0.67 from the pond) and also, Alanine (5.40±0.23 from the wild and 4.50±0.41 from the cultured) while the rest amino acids remained insignificantly different ($p<0.05$) as shown in Table 1.

Table 1: Amino acid profiles of *O. niloticus* from Lower River Benue and U.A.M fish farm

Amino Acid (g/100g protein)	Source		P-Value
	Lower River Benue	UAM Farm	
Lysine	6.84±0.28	6.78±0.28	0.681
Histidine	2.07±0.13	2.03±0.08	0.267
Arginine	5.97±0.21	5.29±0.21	0.681
Aspartic acid	8.96±0.19	8.47±0.31	0.732
Threonine	2.52±0.22	2.31±0.15	0.851
Serine	4.08±0.15	3.52±0.25	0.623
Glutamic acid	12.51±0.64	11.85±0.67	0.047*
Proline	4.21±0.24	3.81±0.34	0.241
Glycine	6.59±0.22	5.47±0.37	0.369
Alanine	5.40±0.23	4.50±0.41	0.047*
Cystine	0.79±0.07	0.73±0.06	0.091
Valine	4.12±0.29	3.53±0.27	0.235
Methionine	2.26±0.09	2.19±0.06	0.414
Isoleucine	3.44±0.16	3.15±0.09	0.364
Leucine	6.87±0.15	6.51±0.22	0.259
Tyrosine	2.89±0.15	3.00±0.09	0.871
Phenylalanine	3.81±0.13	3.65±0.21	0.681

*indicates statistical difference ($p<0.05$). Source: Laboratory work.

Table 2 shows the results of monthly proximate compositions of *O. niloticus* from Lower Benue River and that of U.A.M fish farm. It reveals that all proximate parameters varied significantly ($p<0.05$) during the month of October with fat (4.71±0.06 and 3.61±0.02), ash (4.62±0.02 and 3.69±0.02), crude protein (14.62±0.07 and 9.98±0.02) and moisture (75.67±0.07 and 79.65±0.15) for *O. niloticus* from Lower Benue River and that of U.A.M fish farm respectively.

During the month of November, fat and ash did not vary significantly while crude protein and moisture varied significantly at $p<0.05$ with the following values; 20.46±0.01 and 18.75±0.04 crude protein and moisture content of 69.32±0.02 and 73.35±0.25 of *O. niloticus* from the river and fish farm respectively as shown in Table 2. In December, the results showed that only crude protein (18.89±0.04 and 20.31±0.06) varied significantly between wild and cultured *O. niloticus* while the other parameters were not statistically different ($p<0.05$) as equally showed in Table 2.

Variations in all the proximate parameters for the entire study period (Oct. to Dec.) shows that the mean of crude protein (17.99±1.22 and 16.34±1.86) and the mean of moisture (72.53±1.16 and

74.94±1.52) differed significantly ($p<0.05$) while fat and ash were not significantly different through the period between *O. niloticus* from Lower Benue River and U.A.M fish farm as shown in Figure 1.

Table 2: Monthly Variation of Proximate compositions of *O. niloticus* from Lower Benue River and U.A.M fish farm

		Fraction			
Month	**Source**	**Fat**	**Ash**	**Protein**	**Moisture**
October	Lower River Benue	4.71±0.06	4.62±0.02	14.62±0.07	75.67±0.07
	UAM Farm	3.61±0.02	3.69±0.02	9.98±0.02	79.65±0.15
	P-value	*0.039**	*0.035**	*0.013**	*0.039**
November	Lower River Benue	2.88±0.02	1.62±0.02	20.46±0.01	69.32±0.02
	UAM Farm	3.12±0.07	2.07±0.06	18.75±0.04	73.35±0.25
	P-value	*0.056*	*0.058*	*0.037**	*0.030**
December	Lower River Benue	2.89±0.08	4.65±0.04	18.89±0.04	72.59±0.25
	UAM Farm	3.39±0.04	4.16±0.04	20.31±0.06	71.83±0.01
	P-value	*0.068*	*0.079*	*0.041**	*0.160*

Source: Laboratory work.

*indicates statistical difference ($p<0.05$).

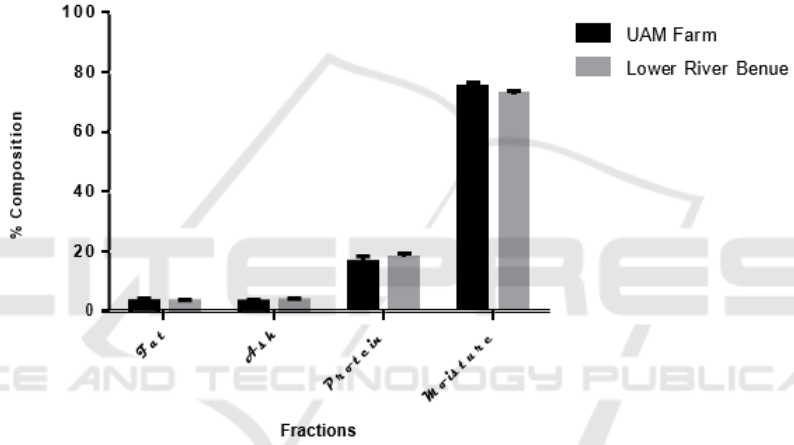

Figure 1: Mean proximate compositions of *O. niloticus* from Lower Benue River and U.A.M fish farm

4 DISCUSSION

The mean ash values for *O. niloticus* from Lower Benue River (3.63±0.59) and U.A.M (3.31±0.48) did not fall in same range with the results obtained by Osibona et al., (2009) from *Tilapia zilli* (1.2±0.2% ash). This difference may be due to environmental factors and variation in the ages of fish samples used. Crude protein result of *O. niloticus* from Lower Benue River (17.99±1.22) was higher than the crude protein value of *O. niloticus* from the wild (14.328 Cp) studied by Ayeloja et al., (2013) but lower than that of wild Tilapia zilli (19.0±1.9) obtained by Osibona et al., (2009). When the crude protein of *O. niloticus* from Lower Benue River (17.99±1.22) and U.A.M (16.34±1.86) are compared, there was a variation of 1.65%. However, all the values of mean crude protein from this study lie within the range obtained from the findings of Eyo (2001) which was between 15-20% crude proteins in fresh fish tissues. This indicates that fish, irrespective of their species and source of capture, have a certain range for their crude protein content.

When the mean moisture value of *O. niloticus* from Lower Benue River is compared with that of U.A.M, it indicated a significant variation ($p<0.05$) which clearly justifies the fact that fish from same species obtained from different environments could vary in term of their nutrient contents. The mean of moisture contents of *O. niloticus* from Lower Benue River and U.A.M were all notably less than the moisture content of *O. niloticus* obtained by Eyo. This could be due to difference in geographical location. *Oreochromis niloticus* obtained from Lower Benue River had moisture content of 72.53±1.16. When compared with the 78.325%

moisture obtained from wild *O. niloticus* by Ayeloja et al., (2013), there was a difference of 5.80%. This difference could probably be due to differences in fish age, feed intake, location, and even sexes as reported by Silva and Chamul (2000) and Eyo (2001).

In terms of fat, the results of Ramlah et al. (2016) from Indonesian wild and cultured *O. niloticus* (0.10 and 0.18 respectively) were far lower than fat contents of this study (3.49±0.387 and 3.37±0.092 respectively).

The crude protein of wild *O. niloticus* (18.46±1.22) from this study was higher compared to that of wild

O. niloticus from Indonesia which was 12.94 as reported by Ramlah et al (2016). However, the cultured O. niloticus from this study which had 15.87±1.86 is 0.92% less than the 16.79 obtained from cultured Indonesian *O. niloticus* by Ramlah et al. (2016).

The variations in amino acid content and proximate compositions in this study were possibly due to differences in capture environments, months of the year, the food availability, sexes, age and sizes of the sample fishes used.

5 CONCLUSIONS

This research clearly reveals the superiority in nutritional composition of wild *O. niloticus* obtained from Lower Benue River at Makurdi against its counterpart from the ponds of University of Agriculture Makurdi fish farm. However, both the wild and cultured *O. niloticus* from Makurdi are good for human consumption since they are all high in protein and amino acid contents, and their nutritional values fall within ranges established by other authors.

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