

Effect of Seasonal Variation on the Nutrient Composition in Selected Fish Species in Lake Kainji-Nigeria.

Effiong, B.N. and Mohammed I.
Department of Fisheries Technology
Federal College of Freshwater Fisheries Technology, New Bussa –Nigeria

bartheffiong@yahoo.com

ABSTRACT: Samples of three (3) species of freshwater fishes *Citharinus citharus*, *Clarias anguillaris* and *Hemisyndontis membranaceus* from Lake Kainji, Nigeria were analyzed during the dry and wet seasons to study the variation in proximate composition of nutrients, mineral content and amino acid profile using standard procedures in wet weight basis. Result of the proximate composition of nutrients showed higher levels in the dry season samples than the wet season. This trend was observed also in the amino acid profile and the mineral content in all the fish samples. However, statistical analysis showed no significant difference in the samples at 0.05 level of significance. [Nature and Science. 2008;6(2):1-5]. ISSN: 1545-0740.

Keywords: Dry season, wet season, tropical fish, freshwater, mineral, amino acid.

INTRODUCTION

The developing countries, Nigeria inclusive are characterized by low food intake and poor nutritional status especially in the area of protein and energy. In Nigeria, starchy foods from root crops and cereals form majority of staple foods depending on the area of the country involved.

In recent years, research into increase production of fish as a cheap and available source of animal protein has been on with the assistant of government in various areas. Research findings have also rated fish nutrients quality very high thus making it an ideal source of vital nutrients both for nourishment and medicinal purposes.

Given that there are considerable evidences in the use of fish and fish products for solving health problems (Mumba, 2005; Onasanya, 2002; Hetzel, 1994), the need therefore arise for investigation into the nutritional composition of freshwater fishes in respect to seasonal variations.

It does appear that seasonal changes with its resultant effect on the activities of fishes may cause variations in their nutrient quality. This experiment was therefore conducted to ascertain such possibility.

MATERIALS AND METHOD

Replicate samples of three freshwater fish species, *Citharinus citharus*, *Clarias anguillaris* and *Hemisyndontis membranaceus* were bought from Monnai and Cover Dam fishing settlements in the Lake Kainji area, Nigeria. They were gutted, thoroughly washed and weighed for analysis in their fresh state in both dry and wet season samples. The study was conducted covering the period of wet and dry seasons from June 2005 to May 2006 in Lake Kainji, Nigeria.

Proximate composition of the following nutrients was determined using standard procedures of AOAC (2000): moisture, crude protein, lipid, crude fiber and Nitrogen free extract (NFE).

Amino acid profile of the fish samples was determined using the method of Abdullahi (2001). The minerals in the ash were brought into solution by wet digestion using concentrated HNO₃ (63%), per chloric acid (60%) and Sulphuric acid (98%) in the ratio of 4: 1: 1. Potassium and calcium was determined using flame photometer. Phosphorous was determined using spectronic 20 E, other mineral by Perkins Elmer Atomic Absorption Spectrophotometer model 2900 (U.S), (AOAC, 2000).

RESULTS AND DISCUSSION

The proximate composition of nutrients in the experimental fish for dry and wet seasons is presented in Tables 1 and 2. All the species had high moisture content in the range of (76.70% - 84.95%). High moisture contents have been similarly reported in other freshwater species (Abdullahi, 2001; Abdullahi *et al.*, 1999; Effiong, 2005). Differentiation in moisture and lipid content between dorsal and ventral portions of three farmed fish species has also been reported by Silvia *et al.*, (2006).

The values of crude protein (18.50% - 22.87%) in dry and wet season samples of the three species indicate that they are rich source of concentrated protein to consumers. This finding is similar to that

reported by Mumba and Jose (2005). The values were higher than those reported in beef, pork, lamb, mackerel and oyster (Eyo, 2001; 1998). Eyo (1992) also reported similar result from clupeids.

Abdullahi (2001) reported that the protein content in fish might vary with species due to certain factors such as the season of the year, effect of spawning and migration, food available etc.

The ash content of dry and wet samples of *Citharinus citharus*, *Clarias Anguillar* and *Hemisynodontis membranaceus* were generally low (0.40% - 1.35%); the crude fat also ranged from (2.45% - 6.85%). Abdullahi (2001) reported higher values (30.0 – 31.3/100g) from *Chrysichthys nigrodigitatus*, *Bagrus filamentosus* and *Auchenoglanis occidentialis*. The lower values recorded in this experiment may be attributed to the fish species. Nuray and Ozkan (2007) reported significant differences between moisture and ash contents in *Dicentrarchus labrax* and *Sparus aurata* respectively. There were no significant differences in the proximate composition of nutrients in both species.

In the dry season samples the crude fiber and nitrogen free extract were all negligible. For the wet season sample, crude fiber had a range of 0.68% - 0.90% while nitrogen free extract was negligible. Negligible amounts of these nutrients have been reported by other authors (Oladele et al., 2005; Effiong, 2005).

The result of the amino acid analysis from the experimental fish for both dry and wet seasons is shown in Table 3. The findings are similar to those reported in other freshwater species (Eyo, 2001; Borressen, 1992; Abdullahi et al., 1999). The values were close to or above the FAO (1993) reference value implying that the species contain protein of high quality and good source of dietary essential amino acid. The amino acids of the three species were on the average higher in the dry season than in the wet season.

Generally, the nutrients content of the three species analyzed were not significantly different between the dry and wet season samples. The slight variation observed could be due to increase activity in fish species especially reproduction during the wet season. Various authors have reported the seasonal variation of protein and amino acid in fishes. Most of the authors reported higher values during dry season than the wet season. Although in most cases, there were no significant differences when analyzed statistically (Abdullahi, 2001).

Otitologbon (1997) reported that there was no significant difference in his investigation of the amino acid composition of the whole body tissues of three tropical fish species. Variations in nutrient composition have been reported in other fish species, *Sardinops sagax* (Gamex-meza et al., 1999); Pike perch, Rainbow trout and Eel (Mustafa et al., 2001).

The result of the amino acid profile showed that glutamic acid was the highest for both seasons in all the experimental fish samples. This result is in agreement with the work of other authors as shown earlier in this discussion. It does appear that glutamic acid is highest in the amino acid profile of fishes.

The mineral content of all the three experimental fish samples showed calcium as the highest present in both the dry and wet season samples (Table 4). Saadettin et al., (1999) reported that the most abundant microelements in fish were Zn and Fe followed by Cu with the remaining elements present in amounts below toxic levels. The variation in moisture and ash content in the fish species were within a narrow range according to the same authors.

However, the overall result indicated that mineral content was higher in the wet season samples than the dry season. Kriton (2007) reported differences in trace mineral content in sea bream (*Sparus aurata*) and sea brass (*Dicentrarchus labrax*), two of the most important Mediterranean fish species. He also observed higher ash content in sea brass but lower muscle fat and higher muscle moisture content in sea bream.

Eyo (2001) reported that the mineral content of fish makes fish unavoidable in the diet, as it is a source of different minerals that contribute greatly to good health.

Although there was no significant difference in the nutrient composition of the fish samples between dry and wet season samples, observed variations could be attributed to changes in activities in the fish species when related to variation in seasons. These activities include spawning and migration. The findings of other authors in relation to this study followed the same trend.

Table 1: Proximate Analysis of nutrients in Dry Season Samples

Fish species	Moisture content	Ash content	Crude protein	Crude fat	Crude fiber	N.F.E
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<i>Citharinus citharus</i>	76.70%	0.40%	22.87%	2.45%	Neg.	Neg.
<i>Clarias anguillaris</i>	80.95%	0.50%	18.52%	2.65%	Neg.	Neg.
<i>Hemisynodontis Membranaceus</i>	79.75%	0.60%	21.00%	4.05%	Neg.	Neg.
STD	2.19	0.1	2.18	0.82		

All data are not significantly different ($p>0.05$)

Table 2: Proximate Analysis of nutrients in Wet season samples

Fish samples	Moisture content	Ash content	Crude fat	Crude protein	Crude fiber	N F E
<i>Citharinus citharus</i>	84.70%	1.35%	4.50%	21.625	0.75%	Neg.
<i>Clarias anguillaris</i>	80.85%	0.90%	6.85%	19.22%	0.60%	Neg.
<i>Hemisynodontis membranaceus</i>	84.20%	0.75%	5.00%	21.52%	0.90%	Neg.
STD	2.09	0.31	1.24	1.36	0.13	

All data are not significantly different ($p>0.05$)

Table 3: Amino acid values of experimental fish samples

Amino acid	<i>Citharinus citharinus</i>		<i>Clarias anguillaris</i>		<i>Hemisynodontis membranaceus</i>	
	Dry season	Wet season	Dry season	Wet season	Dry	Wet season
Alanine	4.18	4.06	6.36	6.05	6.50	6.61
Arginine	4.05	3.89	6.81	6.74	5.86	5.88
Aspartic acid	9.19	10.0	11.40	9.89	12.43	12.84
Glutamic acid	15.26	15.6	15.42	15.68	15.59	15.76
Glycine	2.84	2.52	9.19	9.98	5.87	6.25
Histidine	3.26	3.07	3.18	3.49	2.52	3.24
Isoleucine	2.58	2.49	2.68	3.01	4.24	4.65
Leucine	-	-	7.29	7.68	8.52	8.10
Lysine	8.15	8.39	6.34	6.33	10.52	10.62
Methionine	3.06	3.04	2.42	2.31	-	-
Phenylalanine	2.70	2.54	4.39	4.68	3.88	4.87
Proline	2.91	2.76	6.46	5.39	4.43	3.87
Serine	2.63	2.57	5.28	5.18	4.41	4.56
Threonine	4.12	4.08	5.10	5.01	5.23	4.89
Tyrosine	3.14	3.27	3.33	2.96	3.46	2.98
Valine	4.67	4.18	4.24	4.36	5.17	5.18

Table 4: Mineral Composition of dry and wet season samples

Minerals	<i>Citharinus citharus</i>		<i>Clarias anguillaris</i>		<i>Hemisyndontis membranaceus</i>	
	Dry	Wet	Dry	Wet	Dry	Wet
Calcium	2.55	2.77	2.85	2.91	2.86	2.89
Potassium	0.63	0.76	0.71	0.78	0.64	0.71
Magnesium	0.21	0.35	0.28	0.32	0.23	0.29
Phosphorus	0.023	0.036	0.021	0.029	0.02	0.027

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