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COMPARATIVE STUDY OF PROXIMATE COMPOSITION OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*) (LINNAEUS, 1758) FROM FRESH WATER AND BRACKISH WATER IN NIGER DELTA REGION, NIGERIA

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Abstract:*The aim of this study was to determine and compare proximate composition and mineral content of Oreochromisniloticus from fresh water and brackish water. Fish samples were collected from Bayalsa State (fresh water samples) an Rivers State (Brackish samples) and analyzed for their nutrient compositions. The results of proximate composition of the O. niloticus from fresh water and brackish water showed that the moisture content was of 73.92% in brackish water species and 72.07% in freshwater,respectively, crude protein was of 17.90 % in brackish samples and 22.23% in the fresh water ones. Ash content had a percentage composition of 3.82 % in the brackish water and2.50% in the fresh water species.The level of lipid content of O. niloticus in fresh water (1.17±0.37) was found significantly (P<0.05) higher than that in brackish water (0.39±0.04) samples. Further results showed that the levels of zinc in both fish samples were found to be very close to each other (P<0.05) while the level of potassium content of O. niloticus in fresh water was found significantly (P <0.05) higher than that of samples from brackish water with the value of 2.38±0.30mg/100g and 0.33±0.07mg/100g respectively. The results show that O.niloticus from the two sources of water has a good supply of fish nutrients and minerals.*

Keywords:*Orechromis niloticus, Fresh water, Brackish water, Proximate composition*

1. Introduction

Fish distribution and abundance in different habitats is associated with availability and abundance of food and substrate types in a particular habitat [1]. Habitat selection by fishes is not extremely rigid as most species of fish exhibit some degree of plasticity and therefore spread to various habitat types [2]. Niger Delta region of Nigeria is blessed with fresh and brackish water bodies that are rich in fin fish and shellfish. Faced with an array of aquatic habitat, a fish species can choose which habitats to use. This is because a single habitat seldom provides all necessary resources for long termsurvival and reproduction and couple with the rate of oil pollution in the Niger Delta.

The cichlid family, with a total of 1330 species, is the second largest family in the perciformes order [3]. Nile Tilapia (*Oreochromis niloticus*) is one cichlids widely distributed in the inland water bodies in Nigeria. Although, they are mainly fresh water fish *O. niloticus* has been described as euryhaline and can disperse along brackish coastalines between rivers [3].The species is esteemed as food; affordable and supporting both small scale subsistence and commercial fisheries in Nigeria. It grows to a

maximum length of 62 cm, weighing 3.65 kg (at an estimated 9 years of age). The average size (total length) of *O. niloticus* is 20 cm [5]. Demand for fish and fishery products are on the increase because of the excellent nutritional quality and the beneficial effects on health.Nutritional quality of a fish is the detailed analysis of nutrients contained in it. Fish meat consists of several components that all contribute to its overall chemical composition and is used as an indicator of nutritional value. Fish muscle is rich in protein, unsaturated fatty acids and mineral elements [6, 7].
Consumers have often wanted to know if there are nutritional differences in various fish species from different sources [8] particularly same fish species from difference habitats. It is against
this background this study was designed to determine and compare the proximate composition and mineral contents of fresh *Oreochromis niloticus* from the fresh water and brackish water.

2. Materials and Methods

Fish Samples

The brackish water fish samples (*O.niloticus*) used for this study were purchased from landing site of Oba river, Rivers State (4° 45′N 6° 50′ E)while the fresh water fish samples (*O.niloticus*) were purchased from landing site of Swali market, Bayelsa State (4° 45′ N, 6° 5′ E). The average weight and length of sampled fish ranged between 190.7 - 198.9g 185.34±9.66 and 18.68 -19.57±2.13cm, respectively were collected in polyethylene bags (cold stored) and transported early in the morning to the National Agency for Food and Drug Administration Control (NAFDAC) in Port Harcourt, Rivers State .The fish were then gutted and thoroughly washed with clean tape water and ready for chemical analysis. Fish samples were homogenized separated by taking only meat portion (fillet) used in human consumption to determine crudeprotein, total lipid, moisture, carbohydrate and ash content. Crude protein was determined by Kjeldahl method (%Nx6.25), which involves digestion of sample and then distillation for N determination while crude fibre moisture and lipid content were determined according to the method described in AOAC[9] . Ash was estimated by burning in a muffle furnace at 500ºC for 24 hours, and the incinerated sample was cooled in desiccator and weighed for ash determination. The mineral content of the fishes were determined from the solution obtained after dissolving the ash in distilled water containing a few drops of concentrated HCL.
Carbohydrate content was obtained by difference from the combined percent of moisture, protein, ash and fat from 100. The assessment of proximate composition and mineral contents of each sample was performed in triplicate.

3. Data Analysis

Data collected for the proximate analysis in triplicate are expressed in means (±SD) and compared by student's t- test ($P < 0.005$) of SAS[10].

4. Results and Discussion

Proximate Composition

Table 1 presents the proximate composition of the *O. niloticus* from fresh water and brackish water . Moisture content was 73.92% in the brackish water samples and 72.07% in the fresh water, crude protein was 17.90 % in the brackish *O. niloticus* and 22.23% in the fresh water *O. niloticus*. The percentage composition ofash content was 3.82 % in the brackish water samples and 2.50% in the fresh

water species. The proximate composition of carbohydrate in the brackish (1.59%) was slightly lower than in the fresh water species (1.84%) and also the lipids content in brackish water species (0.39%) was lower than in the *O. niloticus* in fresh water (1.17%). The fibre content in the fresh water was 0.11% and in the brackish water specieswas 0.04%.

Table 1

Proximate Composition of *O. niloticus* From Brackish Water and Fresh water

Proximate composition (%)	Brackish water samples			Fresh water samples		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Ash	0.25	7.14	3.82±2.14	0.55	4.94	2.5±1.33
Moisture	49.43	74.21	73.92±9.26	48.48	74.50	72.07±6.34
Protein	11.15	20.25	17.90±2.83	19.54	24.87	22.23±2.19
Carbohydrate	0.24	2.10	1.59±8.88	1.47	2.90	1.84±6..20
Lipid	0.21	0.64	0.39±0.13	0.12	3.11	1.17±1.10
Fibre	0.02	0.05	0.04±0.01	0.02	0.30	0.11±0.10

The mineral composition of *O.niloticus* from the two sources are presented in Tables 2 and 3. Large amount of potassium was found in the fresh water (2.38 mg/100g) and the brackish species recorded low value of potassium 0.33 mg/100g. Obtained results demonstrate that the value of zinc in the fresh water species was 0.14 mg/100g and in the brackish species was 0.33 mg/100g. The value of copper in brackish species (0.36mg/100g) was lower than in the fresh water species (0.77 mg/100g).

Table 2

Mineral Composition of *O. niloticus*fromFresh and Brackish Water

Mineral composition (mg/100g)	BrackishWater			Fresh Water		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Copper	0.04	1.01	0.36±0.32	0.24	1.82	0.77±0.05
Zinc	0.11	0.64	0.30±0.21	0.04	0.28	0.14±0.08
Potassium	0.08	0.60	0.33±021	1.15	4.05	2.38±0.09

Table 3 presents the comparative of proximate composition of *O. niloticus* from brackish and fresh water .In the table significant differences were observed only for fibre and lipid contents. The level of lipid content of *O. niloticus* in fresh water (1.17±0.37) was found significantly ($P<0.05$) higher than of brackish water (0.39±0.04) samples.

The level of fibre in *O.niloticus* in fresh water was found to be statistically higher than that of brackish water samples with mean value of 0.11±0.03% and 0.30±0.07%, respectively ($P<0.05$) in the

presen tstudy. The levels of zinc in both fish samples were found to be very close to each other (*P<0.05*) while the level of potassium content of *O. niloticus* in freshwater was found significantly (*P* <0.05) higher than that of samples from brackish water with the value of 2.38±0.30mg/100g and 0.33±0.07mg/100 g, respectively.

Table 3
Comparative Result of the Proximate Composition and Mineral Contents of*O. niloticus* from Brackish and Fresh Water

Proximate composition	Brackish water Mean±SD	Fresh Water Mean±SD
Ash	3.82±0.71	2.50±0.44
Moisture	73.92±3.09	72.07±2.11
Protein	17.90±0.94	22.23±8.05
Carbohydrate	1.59±2.96	1.84±2.07
Lipid	0.39±0.04 [b]	1.17±0.37 [a]
Fibre	0.04±0.00 [b]	0.11±0.03 [a]
Copper	0.36±0.11	0.77±0.17
Zinc	0.30±0.07 [a]	0.14±0.03[b]
Potassium	0.33±0.07[b]	2.38±0.30 [a]

Means ± SD within the same row that have different letter is significantly different (*P*<0.05).

The values obtained for proximate composition on the *O.niloticus* from both sources during the study agreed with the findings of Suzuki [11] who reported that the main constituents of fresh fish are water (65-80%), protein (15-24%), fat (0.1-22%), carbohydrate (1-3%) and inorganic substances (0.8-2%) [12] also observed that the chemical composition of fish varied from 16-21% proteins, 0.1-25% lipids, 0.4-1.5% ash and moisture 60-81% with extremes of 96%. [13] described fish meat, in general, as having a proximate composition of 77.2% water, 19% meat protein, 2.5% lipid and 1.3% ash. The ranges of values of the proximate composition of the *O.niloticus* from the brackish water were slightly different from freshwater samples. Variation of biochemical composition of fish flesh may also occur within same species depending upon the fishing ground, fishing season, age and sex of the individual and reproductive status.The habitat and food intake of these species are equally diverse. These widely different environmental conditions of temperature, salinity, pressure, availability of food etc. have profound influence on the biochemical composition. Factors that play a role in the meat composition can be both endogenous (genetic) and exogenous (related to diet and the environment)[14].

Fish meat is very nutritious food source, because of its high content of protein and essential amino acids [15, 16].The protein content of the fish samples ranged from17.90 % in the brackish species to 22.23% in the fresh water species. This indicates that fresh water fishes are better sources of protein in the body when consumed. These values were in agreement with those reported earlier [17].The relatively high to moderate percentage crude protein may be attributed to the fact that fishes are good source of pure protein, but the differences observed in values obtained could also be as a result of fish consumption or absorption capability and conversion potentials of essential nutrients from their diets or their local environment into such biochemical attributes needed by the organisms body[18].

The results in table1 followed the general rule of proximate composition of fish which states that there is an inverse relationship between the water, protein and fat contents of fish flesh. When the fat content is low, the moisture level and protein content are higher.*O.niloticus* in the two water bodies is generally low in

lipid. Brackish water samples had a significantly lower ($p< 0.05$) lipid content (0.39 ±0.04%) than fresh water (1.17± 0.37%).[19] attributed low lipid content in fishes to migration and span due to low feeding ability in fishes at such periods. Ash content had a percentage composition of 3.82 % in the brackish water and 2.50 % in the fresh water species.

The observed range of ash content from the two water bodies indicates that the species is a good source of minerals.

The variations in ash content could be attributed to the water body as fresh water fish are lower in sodium than salt water fish. The carbohydrate content in the brackish water species (1.59%) was slightly lower than in the fresh water species (1.84%). Fish flesh contains negligible quantities of carbohydrates because glycogen presents in living fishisrapidlyconverted to lactic acid after death. The relatively low values of carbohydrate could be due to higher values of moisture and a relatively high value of protein content. The proportion of water in the fish varies widely, though in a majority of cases the variation is always between 70-80%. In the present study, moisture content was 73.92% in the brackish water species and 72.07% in the fresh water. The fishes had moisture ranging from 65.0 to 75.8 % indicating that the percentage moisture in fish muscles was within the acceptable level.

The variations in the proximate composition in *O.niloticus* from fresh water and brackish water could be attributed to widely different environmental conditions of temperature, salinity, pressure, availability of food etc. have profound influence on the biochemical composition.

Many studies have shown that the concentration in minerals is greatly affected by different environmental factors (food availability, salinity, temperature) and intrinsic such as species, age, sex and physiological factors [20].The level of potassium in the *O.niloticus* from fresh water (2.38±0.30) was found to be higher than that of brackish water samples (0.33±0.07) which is far below FAO range of 19-502mg/100g. The amount of Cu and Zn in flesh of *O.niloticus* in this study differed from each other. The value of zinc in the fresh water species was 0.14 mg/100g and in the brackish species was 0.33 mg/100g. These results are in agreement with the FAO ranges of 0.23 - 2.1 mg/100 g recommandation. According to [21], the recommended daily requirement of copper in human nutrition ranges between 1.5 - 2.5 mg. The value of copper in this study ranged from 0.36 mg/100g in brackish species to 0.77 mg/100g in the fresh water species. The amounts of copper in fish flesh range from 0.04 to 0.6mg 100g with an average 0.25mg [22]. This is much lower than the recommended daily intake, assuming a single serving of 100g fish per day.

In conclusion, the results clearly indicate nutritional potential of *O.niloticus* from the two study sites for human consumption. However, in terms of protein, lipid and fiber contents fresh water species has higher nutritional value than brackish water species. Similarly the amounts copper and potassium in fresh water *O.niloticus* are higher than the brackish water species.

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