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Nutrient Composition of Fresh Water and Marine Water Fish Species in Mokwa Metropolis, Niger State, Nigeria

Abdullahi, U. U.
Agriculture Technology Department,
Niger State College of Agriculture, Mokwa

Gana, D. A.; Danjumar & Mairo A.
Home and Rural Economic Department,
Niger State College of Agriculture, Mokwa

Abstract

The study determined the nutrient composition of fresh water and marine fish species in Mokwa Central Market. The fishes were de-gutted, washed and cleaned and were oven dried at 150^0C for 24 hours. Dried samples were pack in neat nylon bag and transported to research laboratory for proximate and mineral analysis. The results show that there were significant difference ($p<0.05$) in the nutritional composition and mineral profile of the fresh water and marine fishes. Results of this study also show that *Oreochromisniloticus* and *Heterotisniloticus* have more nutrients among fresh water fishes than even cat-fish that dominate aquaculture industry. The study thereforerecommend that these fresh water fish species should be introduce in Nigeria aquaculture industry because there were good source of nutrients of public health significant and have the potential to improve nutritional status of individual households.

Keywords: Nutrient, Composition, Proximate Analysis, Fish, Water

Introduction

Fish constitutes very important component of human diet for many people and often provides much needed nutrients for a healthy living. It serves as a principal source of dietary protein which is less expensive in relation to other protein foods (Fawole*et al*., 2007). The fish muscle contains four basic nutrients in varying proportions; water 70-80%, protein 16-25%, lipids 1-5% and vitamins (Clucas, 1982) which makes it less tough and more digestible compared to beef, chicken and mutton. Fish has higher levels of essential sulphur-containing

amino-acids such as cysteine, methionine and lysine which are limiting in some legumes and most cereal diets The characteristics of fish as a cheap source of animal proteinmakes it an excellent component of human diet and this quality makes fish protein to be practically indispensable to developing countries, such as Nigeria, for diet supplementation, where the staple diet or food consist primarily of starchy foods (Idris*et al*., 2010).

Fish offer a good potential to meet human protein requirement due to it cheapest source of animal protein and one of the widely distributed organisms in the aquatic environment (Rashed 2001). The importance of fish product as a valuable source of animal protein in human diets cannot be over emphasized, because it play an important role in determined residents diet (Ahmed *et. al*, 2009). Fish protein is relatively cheaper and richer in lysine and other sulphur amino acids than all livestock protein, and it complementing high carbon hydrate diets (Abdullahi*et al.,* 2001) cited by Adeyemi*et al*., (2010). In providing essential nutrients of high bioavailability which are found in limiting amounts in carbon hydrate diets. It is also important for livelihoods, income and as food for the rural poor who suffer disproportional from under nutrition, including micronutrient deficiencies

In Nigeria, the growing demand for fish has increased domestic fishing efforts and has also resulted in rising fish imports and prices (Delgado *et al*., 2003). Unlike in many other countries, however, artisanal fishermen dominate the fishing industry in Nigeria (Olubanjo*et al*., 2005). With coastline of 960km, a continental shelf of 14 to 45 km and an estimated inland of about 12.5 million hectares capable of producing over 512,000 metric tonnes of fish annually (Mabawonku, 1989), Nigeria has great potential for achieving self –reliance in the production of fish and it's by –products. That is, enough potential for the production of aquatic resources so as to ensure adequate and reliable supplies of dietary protein to her rising human population. The marine and fresh water fisheries' resources including the extensive coastline, brackish water, lagoons and creeks, lakes and rivers are quite substantial. Enough supplies of fish and other marine products can thus be obtained from them.

Nigeria has about 1.7 million population and annual demand for fish is about 2.6 million tonnes, out of which 700,000 tonnes is produced locally and the balance is imported to complement local production (Lawal*et al*. 2014). Only 5% of this 0.7 million metric tonnes produced locally is from aquaculture. The remaining 95% is

from the capture fisheries, which are dominated by the artisanal fishermen. These capture fisheries are been over exploited, due to habitat destruction, Aquaculture is been encouraged to reduce the volume of fish imported to Nigeria and to increase dietary protein intake.

Nutrient composition of individual fish species depend on their feeding habits, sex, species, seasonal variation and other factors (Effiong and Mohammed, 2008). Therefore the measurement of proximate analysis and minerals profile is often necessary to ensure that they meet the requirement of food regulation and commercials specification (Waterrmann, 2000). Besides being used as food, fish is also increasing demanded as feed ingredient in livestock industry; however information concerning the chemical composition and mineral profile is valuable to nutritionists concerned and food scientist who are interesting in developing them to high-protein foods, however, Lack of health benefit of consuming fish nutrient and healthy food choice is major challenge in the study area and also insufficient information on nutritional content of commonly consumed fish species.

Objective of the study

The broad objective was to determine the nutrient composition of commonly consumed fish species in Mokwa metropolis

Specifically the study;

1. Determined the proximate composition of the fresh water and marine fish species.
2. Measured the mineral profile of the fresh water and marine fish species.

Materials and method

The study area: the area Mokwa central market located in Mokwa metropolis, which is the Headquarter of Mokwa local government area of Niger state, located in the middle belt of northern and southern part of the savannah of Nigeria. The fish production in Mokwa metropolis is on the increase due to enhanced awareness of it profitability.

Sample collection and preparation: The fish samples were collection from fish dealer's and fish mongers in Mokwa central market located in Mokwa metropolis. The fish samples collected are *Oreochromisniloticus, Clariasgarirpinus,* parachamisobscura, *Clupeaharengus*, scomberscombrus, and *Heterotisniloticus*. The sample fishes were de-gutted, wash and clean with tap water. The fish samples were than oven dried at 150^0C for 24 hours. The dried fishes were de-boned and packed in clean nylon bag and transported to National Institute for Fresh Water Fisheries Research Laboratory, New Bussa for proximate analysis and mineral profile.

***Proximate analysis and mineral profile of the fish samples*:** There were carried out according to the official methods of analysis described by the Association of Official Analytical Chemist (A. O. A. C) by 2010.

Data analysis: All data were express as mean and one-way ANOVA at 0.05 level of significance. Analysis of variance (ANOVA) was used to determine the nutrients composition and minerals profile of fresh water and marine fishes in the study area.The level of significant difference between the means were tested using LSD at (P<0.05) using 16.0 version of SPSS 26 statistical package for window 7.

Results of the study

Proximate composition of the fish samples: The proximate composition of the marine and fresh water fishes are shown in the Table 1. The moisture content was significant (p< 0.05) among the fishes in which *Scomberscumbrus* which is marine fishes was highest with 16.17± 0.82 followed by *Clupeaharengusa, Parachamis obscura, Clariasgariepinus, Hetrotisniloticus, and Oreochromicniloticus*, with 16.17±0.82, 10.69±1.50, 9.33±0.97, 6.92±1.70, 6.10±0.22, 3.87±0.99 and 2.75±0.32.

The crude protein was significant (p< 0.05) among the fishes and higher in *Heterotisniloticus*which show no significant (p> 0.05) with *Oreochromicniloticus* which are fresh water fishes with 72.59±1.95 and 67.45±2.67. *Clupeaharengus* has Crude protein of 63.04±3.04 follow by *Clariasgariepinus* and *Parachamisobscura* with 54.31±2.08 and 50.35±5.98 respectively.

The fat content of *Clupeaharengus, Scomberscumbrus* and *Parachamisobscura* show no significant (P>0.05) between but were significant (P<0.05) with *Clariasgariepinus*, *Oreochromisniloticus* and *Heterotisniloticus*. The fibre content of*clupeaharengus* was higher with 3.07±2.34 which were significant difference (p<0.05) with others fishes which show no significant (p>0.05) in between.

Ash content of the fishes were significant (p<0.05), higher in fresh water fishes than marine fishes while *Oreochromisniloticus* has the highest followed by *Hetrotisnilotucus*,and *Paranchamisobscura*.Ash content in marine fishes were lower and was significant between *Clupeaharengus*and *Scomberscumbrus*. Nitrogen free Extract (NFE) were significant (p<0.05) among the marine and fresh water fishers.

Table 1: Proximate Composition of Fresh Water and Marine Water Fishes

	Sample	Moisture	Protein	Fat	Fibre	Ash	NFE
Marin	I	10.69±1.50^{b}	63.04±3.04^{b}	19.99±1.36^{a}	3.07±2.34^{a}	4.71±0.68^{c}	1.09±1.64^{c}
fishes	II	16.17±0.82^{a}	39.13±1.67^{e}	20.97±2.06^{a}	0.33±0.07^{t}	3.87±1.08^{d}	19.53±3.62^{a}
Fresh	III	2.75±0.32^{d}	67.45±2.67^{a}	13.44±2.53^{c}	0.77±0.10^{t}	12.14±1.77^{a}	3.45±0.34^{c}
water	IV	6.92±1.70^{c}	54.31±2.08^{d}	16.79±3.02^{b}	0.99±0.07^{t}	7.50±2.50^{b}	13.47±1.68^{b}
fishes	V	9.33±0.97^{b}	50.35±5.98^{d}	18.97±2.52^{a}	0.83±0.08^{t}	7.45±1.70^{b}	13.08±5.84^{b}
	VI	3.87±0.99^{d}	72.59±1.95^{a}	10.82±0.68^{d}	0.76±0.02^{t}	7.86±1.29^{b}	4.08±1.67^{c}

Values are means± standard deviation. Mean values in the same column with different superscript differ significantly ($p<0.05$) I-*Clupeaharengusa*, II- *Scomberscumbrus* III-*Oreochromisniloticus* IV-*Clariesgariepinus*, V-*Parachamisobscura*, VI- *Heterotisniloticus*

***Minerals profile of the samples fishes*:** The mineral profile is shown in the table 2. The potassium content were significant ($p<0.05$), among the fishes and higher in *Oreochromisniloticus*and *Hetrotisniloticus* which are fresh water fishes which show no significant ($p>0.05$), with 831.07±0.01 and 830.50±0.50 but were significant (P>0.05) with marine fishes.The manganese content were significant ($p<0.05$) between fresh water and marine water fishes and was also significant within. Theiodine content were also significant ($p<0.05$), among the fish samplesin which*Clariesgaripinus* has the highest followed by*Hetrotisniloticus*and *Oreochromisniloticus* which are fresh water fishes with 111.01±0.01, 109.05±0.01, and 108.91±0.001, while *Clupeaharengusa*and *Scomberscumbrus*are marine fishes with 108.09±0.01 and 106.26±0.01, this showed that fresh water fishes has the highest iodine content than marine water fishes. The calcium content were highest in marine water fishes than fresher water which show significant ($p<0.05$) among the groups, *Clupeaharengusa* has the highest followed by *Scomberscumbrus*, *Parachamisobscura,Oreochromisniloticus,C lariesgaripinus,Hetrotisniloticus* and with 368.51±0.01, 367.88±0.01, 367.50±0.06, 367.02±0.01,367.50±0.01 and 363.60±0.06. *Clupeaharengus* recorded the highest iron content with 13.24±0.01 and show significant with others marine and fresh water fishes. While zinc content were higher in marine fishes and were significant ($p<0.05$) with fresh water fishes, but also show significant difference ($p<0.05$)in between fresh water fishes.

Table 2: Mineral Composition of the Smoke Fishes

	Sample	K	Mn	I	Ca	Fe	Zn
Marine	I	824.53±0.18^{c}	3.82±0.00^{cd}	108.09±0.01^{e}	368.51±0.01^{a}	13.24±0.01^{a}	8.16±0.01^{a}
Fishes	II	824.53±0.01^{d}	3.75±0.01^{de}	106.26±0.01^{g}	367.88±0.01^{b}	12.90±0.01^{f}	8.11±0.01^{a}
Fresh	III	831.07±0.01^{a}	3.79±0.01^{cd}	108.91±0.01^{d}	367.02±0.01^{d}	13.17±0.01^{c}	7.95±0.01^{c}
water	IV	823.86±0.02^{c}	3.84±0.01^{bc}	111.01±0.01^{a}	364.91±0.01^{e}	12.80±0.01^{g}	8.00±0.01^{c}
Fishes	V	827.37±0.58^{b}	3.70±0.01^{e}	107.75±0.01^{f}	367.50±0.06^{c}	13.21±0.00^{b}	8.02±0.01^{bc}
	VI	830.50±0.58^{a}	3.90±0.06^{b}	109.05±0.01^{c}	363.84±0.01^{f}	13.10±0.01^{d}	8.09±0.01^{ab}

Values are means± standard deviation. Mean values in the same column with different superscript differ significantly ($p<0.05$)

I-.*Clupeaharengusa*, II- Scomberscumbrus III-*Oreochromisniloticus* IV-*Clriesgariepinus*, V-*Parachamisobscura*, VI *Heterotisniloticus*

K- potassium Mn- Maganase, I- Iodine Ca-Calcium, Fe- Iron, Zn- Zinc express as mg/100g

Discussion of Results

In this study, the moisture content were higher in marine fishes than fresh water fishes, and the high level of moisture in fish flesh accounts for it perishability, while according to Eyo (2001), moisture content is used to determine the degree dehydration of fish and fish products.

The crude protein was significant ($p< 0.05$) higherin fresh water fishes such as *Oreochromicniloticus* and *Heterotisniloticus* than marine fishes and other fresh water fishes in this study and crude protein content of the fish are used to raise consumers' confidence in the product.Where about three quarters of fish protein forms the structural components of the muscle and the remaining is referred as soluble proteins in term of enzymes.The significant difference recorded in fresh water fishes and marine fishes and also between fresh water fishes,could be attributed to the fish species, season, sex and feed availability. Effiong and Mohammed (2008) reported that these factors are responsible for such variation. This study show that age of the fish also showed variation in nutrient composition, the difference observed in the obtained values could be as a result of absorption capability and conversion potentials of essential nutrients from their diets or their local environment into such biochemical attributes needed by the organism body, (Adewoye and Omotosho, 1997). There were correlation between moisture content and crude protein content of the fishes in this study because the high the crude protein the lower the moisture content visa-versa.

The fat contents were significant lower in fresh water fishes than marine water fishes in this study, while Fat content are very important in fish

preservation.The variation in fat content among proximate components of fish, usually reflects differences in the way it is being stored in a particular species, but may also be affected by season/life cycle variations and the diets/food availability of the species at the time of sampling, Ababouch, (2005) cited by Bogard, *et al*., (2015). According to FAO, (2010) there is also considerable seasonal variation in the fat content of fatty fish, and alsothe composition of a particular species varies from one fishing ground to another, and from season to season, and basically in the quality of food they eats and the movement they made. (Bogard, *et al*., 2015).

Nitrogen free extract(NFE) is minor component of fish flesh making up about 1%, while glycogen is the major componentof it which is breakdown during rigor. Rigor mortis which is very important characteristic that determine the shelf-life and quality of fresh fish and fish product.In this study marine fishes such*Scomberscumbrus* is higher in NFE followed by C*lariasgaripinus* and *Parachamisobscura* which are fresh water fishes while *Clupeaharengusa*(marine fish) and *Heterotisniloticus* fresh water fish record low NFE

Fresh water fishes recorded higher ash content than marine fish in this study, while the variation in ash content are related to inclusion of bones as edible parts in their diet. Ash content correlated to the minerals contents, while the minerals compositions were shown in Table 2. Eyo (2001) reported that the mineral content of fish makes fish indispensable in the human diet and contribute greatly to good health.

Potassium helps to regulate body fluids and mineral balance in and out of the cells. The fresh water fishes has higher potassium content than marine fishes and 82 to 83.1 mg/100grecorded in this study is higher than 57 -58 mg /100g reported by Bogard*et al*., (2015).

Calcium content ranged from 36.3 to 36.8 mg/100g and was significant ($p<0.05$) among fresh water and marine water fishes. These results are within range reported by FAO, (2013) and Bogard*et al*., (2015). Calcium protect cardiovascular diseases by lowering blood pressure.

The iodine content were significant higher in fresh water fishes than marine fishes among the fishes and the ranges recorded in these are10.6 to 11.1 mg/100g. The iodine content of foods tends to be largely dependent on environment conditions. According to Eyo (2001) Iodine are needed for the development of strong teeth and the prevention of goiter and this are needed for human development

Iron content of the fresh water and marine water fishes ranges from1.32 to 1.23 mg/100g and is lower than 2.6 mg/100g reported by Bogard*et al*.,

(2015) and FAO (2013). Zinc concentration varied considerably from 0.82 to 0.8 mg/100g and this shows that zinc in animal-source (fish) is highly bioavailable.

Conclusion

The results obtained from this study show that *Oreochromisniloticus*and *Heterotisniloticus*which are fresh water fishes have more nutrients profile than marine known as ice fish (imported fishes) that dominate Nigeria fish markets and others fresh water fishes. Therefore the Nutrients composition of fresh water is more superior in term of proximate analysis and mineral profile than marine fishes and Introducing these fish species in aquaculture industry would give more fish varieties there by creating more job for the teeming youth.

Recommendations

It is than recommendthat *Oreochromisniloticus* and *Heterotisniloticus* should be more consume among the fresh water fishes and culture of these fish species through aquaculture practicesshould be encourage.

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