THE NUTRITIONAL VALUE OF *Heterotisniloticus* 'ECOMOG FISH' UNDER FRESH, SMOKED AND SUN-DRIED CONDITIONS IN CALABAR, CROSS RIVER STATE, NIGERIA

ABSTRACT

The nutritional value (ash, moisture, fibre, protein, fat and carbohydrate) of three preservative states: fresh, smoked and sun-dried of *Heterotisniloticus* (Ecomog fish) in Cross River State, Nigeria was investigated, using the standard A. O. A. C (2005) methods. Total of nine matured size (3 – 4kg body weight) fishes were obtained from artisan fishermen in Idundu (Great Kwa River). The fishes were divided into three groups; each group represented a treatment (preservative state). Samples were treated and laboratory studies carried out separately, before achieving proximate composition for each replicate. The results showed that, fresh *Heterotisniloticus*gave the highest mean protein content (9.58±0.02%), mean moisture content (84.83±0.01g) and mean ash content (10.74±0.19%); smoked *Heterotisniloticus*gave the highest mean fat content (17.53±0.04%) and mean fibre content (0.15±0.02%), while the sun-dried showed the highest value in mean carbohydrate contents (76.60±0.01%). Although fresh *Heterotisniloticus*is highly recommended for human consumption, in respect to our results; we may therefore conclude that these local sources of proteins are important not only in aiding to reduce high incidence of Protein Energy Malnutrition (PEM) among the lower socio-economic populace, but also in alleviating anaemia, and as energy food source.

Keywords: Nutritional values, *Heterotisniloticus*, fresh, smoked, and sun-dried.

INTRODUCTION

Nutritional is defined as the study of the relationship between people (mankind) and the food they eat (Mba, 1980). The knowledge of the chemistry composition of food substances is very vital to human health and other living things, such that scientists have continuously developed interest in the study.

However, like meat, milk and eggs, fish is an excellent source of nutrients with sufficient amount of substances that facilitates body repairs, rapid growth and good health to mankind; these substances includes the build-up of protein (amino acids), fat, carbohydrates, fibre, moisture, vitamins and minerals as diet when digested and assimilated (Bassir*et. al.* 1973).

The nutritional biochemist are constantly being disturbed about what people consumes in the food and the effects on their health via the qualitative and quantitative values that are embedded; as this goes a long way to access the "status quo" of the entire people and their way of life and reasoning. Thus, paints the image of the group either as clans or tribes with their unique features (Mba, 1980).

Heterotisniloticus belongs to the family – Arapaidae, order – osteoglossidae, generally called bony tongues, with a maximum size of 100cm in its standard length (SL) and a maximum weight of 10.2kg. This fish is a pelagic fresh water dweller which serves a purpose in aquaculture and for commercial seed also, as it is normally found in the tropics of 25-30 and 18 - 22 in the Nile (Olagbemide, 2015).

Heterotisniloticus has been considered as a mud- feeder, as it is best known as a native in all the basins of the Sahel Sudanese region, Senegal, Gambia, Corubal, Volta, Oneine, Niger, Eneoue, Chad, Nile basin, and Lake Turkana; as a successful introductions in the storage

reservoir of Cote d'voire, Sanaga, Nyong, Cross River basin, Ibeno, and Ogowe rivers, together with the lower and middle Congo basin , includingUbamil, Kasai and Madagascar (Curvier, 1829).

A knowledge of local communities indicates that, species is widely consumed in a smoked conditions while some (minute) is consumed as fresh, but the sun-dried state is extremely low or not at-all, especially in the Calabar municipality and Akwa Ibom State as a whole. Therefore, this research work will be of significance to the educationists, students, researchers, nutritionists and basely, the socio economic fish dealers in Cross River State, Akwa Ibom State and the entire Nigerians.

However the recent studies has shown that in helping to maintain optimal health and prevention of some chronic diseases may depend on the type of fish and nature of fish that people consume; as the high occurrences of Protein Energy Malnutrition (PEM) in Nigeria, is attributed to insufficient factors, which includes: unavailability and lack of knowledge of the common sources of protein, together with the unaffordable process of fish and meats, which the lowest socioeconomic group that forms a large section of the populace cannot afford.

The objectives of the study was to determine the protein content, moisture content, fibre content, ash content, carbohydrate content, and fat content of *Heterotisniloticus*under fresh, smoked and sun dried preservative state.It also aimed at arousing interest in the study of sea animals; as sources of essential nutrients, thus encouraged the rate of consumption of the species.

MATERIALS AND METHOD

This research was carried out in the field and laboratory; as sampled fishes were collected in the field, while the treatment and proximate analysis of the nutrient content was carried out (analyzed) in the laboratory.

Description of the study area

These fish samples were obtained from the fishermen in Idundu (Great Kwa River) Akpabuyo Local Government Area in Cross River State, Nigeria, with a co-ordinates of latitude $5^{o}\ 00^{1}$ and longitude $6^{o}\ 25^{1}$. Idundu is located in the North-East of Cross River State and South East region of Nigeria.The climate condition in Idundu (Great Kwa River) is generally characterized by a wet season in some part of the year and dry season in the other part of the year, thereby creating flooding and low tide respectively in the zone (Akpan, 2003) as it introduces a high bio-diversity, supporting a wide range of variety of species in the environments.

Collection and treatment of samples

Five (5) samples were collected from the fishermen, for each of the preservatives states; making it a total of fifteen (15) samples in all.

The fresh samples were washed with distilled water and 2g were used for moisture content determinations; as the ones for the dry weight analysis were dried in an air-circulating oven at 56^{o}C. The dried samples were crushed, through the use of a laboratory mutter and pistol; thus, the grinded samples were placed in an air tight container labeled correctly and kept in a cold dry place, as most of the chemicals used were of analytical graded, and distilled water was also used throughout the experiment where it was applicable.

Measurement of fish lengths and weights

All the sample collected in the site were measured approximately, ranging from 20 to 30cm in their body lengths and about 3 - 4kg in their body weight; as these body length was

measured in terms of their standard length (SL). Thus, the condition factor (CF) was calculated based on their minimal values as;

$CF = 100 * W/L^b$
$CF = 100 * 6000kg/ (20)^3cm=6000\ 00kg/ 8000cm$
$CF = 75kg/cm.$

Laboratory studies

The fresh fish, sun-dried fish and smoked fish were obtained from the fishermen in the same form which it is been supplied to the public, and was filleted as a quantitative flesh of the samples were been collected grinded and oven-dried, for the determination of proteins, carbohydrates, fats, fibres, moisture and ash contents were been obtained in the Biochemistry laboratory, University of Calabar, Calabar.

Treatment of samples

These powdered samples from the fresh, sun-dried and smoked preservative states were measured and analyzed in different fish samples, as the standard deviation in their preservative compositions were been carried out. The determination formulae for each nutrient analyzed was beckoned from AOAC (2005).

DETERMINATION OF MOISTURE CONTENTS

Procedures:

a. 2g of the wet samples in the fresh, sun-dried and smoked specimens were collected, weighed into a porcelain dish and covered with a dish.
b. The dish and its content were placed in a vacuum oven at 70^oC for 24 hours.
c. The dish and its content were cooled in a desiccators containing conc. H_2SO_4 as a drying agent and then weighed.
d. The procedures obtained above, were separated until a constant weight was achieved for each preservative samples.

Calculation

Moisture (%) wet weight $= \frac{\text{Loss in weight on drying}}{\text{Initial weight of sample}} \times 100$

DETERMINATION OF ASH CONTENTS

Procedures:

a. The crucible was weighed, empty weight and ignited at 55^oC for three (3) hours, then cooled in a desiccators and weighed; as the sample powder of 2g was placed in the crucible, the lid was also placed and weighed.
b. This practice was been repeated, until a constant weight was obtained; as the percentage ash content calculated as;

% ash content $= \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$

DETERMINATION OF PROTEIN CONTENTS

Procedures:

a. 2.0g sample was weighed and put into a 500ml standard kjeldahl flask containing onekjeldahl catalyst tablet, some anti-burningchips and some of concentrated H_2O_4.
b. The digestion flask was placed into the digestion rack and heated gently for onehour; to prevent vigorous charring and frothing.
c. The flask and its contents were then subjected to vigorous heating for 8-10 hours until a clear bluish solution was obtained.
d. After digestion, the solution was cooled, and quantitatively transferred into the 100ml standard flask and made up to mark with distilled water.
e. 10ml portion of this digestion was pipetted into a semi-micro kjeldahlmarkham distillation apparatus and treated with 30ml, 40% NaOH solution.
f. The ammonia evolved was steam, distilled as described by Markham (1942) into a 100ml conical flasks containing 10ml solution of a saturated boric acid into two drops of the double indicator was been added.
g. The tip of the condenser was immersed into the boric acid double indicator solutions as the distillation continued until about three (3) times the original volume was obtained.
h. The tipped of the condenser was raisedwith a few millimeters of distilled water.
i. The remains of 10ml digest were discarded and they flasks rinsed three (3) with a distill water before the next determination.
j. The distillate was then titrated with the standard hydrochloric acid solution until a purple-pink end point was reached. Distillation was carried out in triplicate for each digest, and the percentage nitrogen content was obtained by appropriate calculations.
k. A blank determination was also carried out in a similar manner as described above except for the omission of the samples in the digestion flask.

Calculation

% N2 in the sample= $\frac{\text{ml of HCl (sample) - ml HCl X normality of HCl X 100g X 100.14}}{\text{Weight of sample (g) x 1000 x ml of digest.}}$

The crude protein was obtained by multiplying the percentage nitrogen by the factor (weight) of individual samples containing protein.

DETERMINATION OF CRUDE FIBRE CONTENTS

Procedures:

a. In order to assess and determine the acid digestion, the pat free materials (4g) was being and quantitatively transferred into a 400ml beakers which was leveled in 200ml.
About 50ml of 1.25% sulphuric acid was added to the mixture and then made up to the 200ml mark with a distilled water and was filtered through a Buchner Funnel with the help of a suction pump; the residues was being washed with hot water until it was free from acid contents.
b. In determining the base digestion, the residue was been transferred into a 400ml beaker, 50ml of 1.25% (w/v) NaOH was added in-order to make up to the 200ml mark with distilled water and was been heated for 30 minutes with a constant stirring; thus, filtered through the Buchner funnel and washed with hot water until it was free from base.
c. Finally, the residues was being washed twice with a 95% methanol and was transferred into a porcelain crucible and was been dried at 100^oC. The crude fibre content was being determined from the loss in weight of crucible and its content after ignition.

% Crude fibre= Loss in weight of crucible/its content X 100
Initial weight of sample

DETERMINATION OF FAT CONTENTS

Procedures:

a. About 5.0g of ground material weighed accurately into a fat extractor thimble.
b. 250ml of petroleum ether was poured into a previously weighed 500ml flask containing anti-bumbing clips.
c. The soxhlet extractor into which the thimble with its contents had been introduced was been fitted into the round button flask and the extraction apparatus was set up with the flask fitting on the heating.
d. The content of the flask were heated; as the ether evaporated it, condensed and dropped into the thimble where it extracted the ether soluble constituents into the round bottom flask.
e. The extraction process lasted for about 8 hours.
f. The thimble was then removed and dried in an oven at 50^{o}C
g. A small amount of petroleum ether contained in the round bottom flask was distilled off using a water bath at 50^{o}C, the lipid extract was left in the flask.
h. The round bottom flask and the lipid extract were finally dried in an oven at 100^{o}C and weighed.
i. The amount of lipid extracted was obtained from the differences between the weight of the flask before and after extraction.

Calculation

% ether extract = Weight of extract (g) X 100
Weight of dry samples(g)

DETERMINATION OF CARBOHYDRATE CONTENT

Procedures:

The carbohydrate content was obtained by the difference methods, that is the difference obtained after the subtraction of the crude protein, ash content, fibre content, moisture content and fat contents from the total dry matter (100).

Carbohydrates % = 100 - (Fat + protein + fibre + moisture + Ash) contents.

Statistical analysis

Proximate analysis on each of the fresh, smoked and sun dried fish of *Heterotisniloticus*, as protein, fat, fibre, moisture, ash, and carbohydrate contents were been measured.

Data collected were compared using a one-way analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT) to determine significant differences among means ($P< 0.05$).

RESULTS AND DISCUSSION

Table 1: Proximate composition of *Heterotisniloticus* (g/100g dry weight)

Samples	Moisture (g)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
Fresh	84.83±0.01	10.74±0.01	9.58±0.02	10.64±0.02	0.11±0.01	68.35±0.02

Smoked	18.81±0.02	7.54±0.10	8.95±0.03	17.53±0.04	0.15±0.02	65.62±0.02
Sun-dried	75.30±0.20	6.53±0.02	8.75±0.01	7.74±0.20	0.13±0.01	76.60±0.01

Mean of the determination ± standard deviations (SD)

MOISTURE CONTENT

The moisture content was measured in the fresh sample at its peak with a value of 84.83 ± 0.01g followed by the sun dried of 75.30 ± 0.2g, while the smoked sample recorded the least moisture content with a value of 18.81 ± 0.02g, which these indicated a higher differences in the water content which was released into the fire during smoking processes in form of oil. Moisture is one of the most important and most widely used measurements in the processing of food.

The effects of moisture on the stability and quality of fish while consuming is great; as a useful index in determining the nutrient content, is a major component of body cells. (FAO/WHO, 1990).

ASH CONTENT

The percentages of ash content of fresh, sun-dried and smoked samples ranges from 10.74 ± 0.01%, 6.53 ± 0.02% and 7.54 ± 0.1% respectively, with the sun-dried sample of recording the lowest ash content. The ash content gives an indication of the level of mineral elements present in any fish; however from the data, it could be suggested that, the fresh contains the maximum and the sun-dried contains the minimum quantities of elements respectively, when compared to the smoked sample.

PROTEIN CONTENT

The results obtained on analysis shows a protein content ranging from 9.58 ± 0.02% in fresh, 8.95 ± 0.03% in smoked and 8.75 ± 0.01% in sun-dried as all these three (3) samples whether in fresh or smoked or sun-dried state have a similar value in their nutritive values. (FAO/WHO, 1970)

FAT CONTENT

The fat contents obtained from the analyzed indicated a high fat content of 17.53 ± 0.04% in smoked while the fresh and sun-driedEcomog fish ranges from 10.64 ± 0.02% and 7.74 ± 0.2% respectively. This means that, more fat content is built during fish smoking.

FIBRE CONTENT

The percentage crude fibre content were determined as 0.13 ± 0.01% in the sun-dried Ecomog fish being the lowest value, fresh samples having the intermediate value of 0.11 ± 0.01% and the smoked Ecomogfish with the highest value of about 0.15 ± 0.02%.

Dietary fibre is known to enhance the gastric motility, emptying, water retention and soft bulky stools (Eastwood, 1975). A low fibre would cause constipation as well as other diseased conditions. Dietary fibre would also make a good dietary inclusion in the regimens of hypertensive and atherosclerosisss patients as they would aid in lowering plasma cholesterol levels by reducing bile acid re-absorption (Truswell and Kay, 1977).

CARBOHYDRATE CONTENT

Values which were obtained from the analysis of the three (3) preservative states of Ecomog fish indicates they highest value when it was sun-dried as 76.60 ± 0.01% followed by fresh 68.35 ± 0.02% and smoked value of 65.62 ± 0.02%.

CONCLUSION

Heterotisniloticus is an excellent source of nutrients with sufficient amount of substances that facilitate body repairs,rapid growth and good health to mankind,these substances includes, protein,fat, carbohydrate,moisture,fibre and ash which serves as diet when digested and assimilated. The results in this study showed the nutrients (proximate compositions) presence in the three (3)preservative states(fresh,sun-dried and smoked) of *Heterotisniloticus*. The high level of carbohydrate in this work also confirms the fact that this fishes are rich sources of carbohydrates and may be used as energy given food in time of stress.

However, it is observed that the fresh *Heterotisniloticus* gave the highest animal protein of (9.55 ± 0.02%) and the smoked fish gave the highest fat content (17.53 ± 0.04%), and we may therefore conclude that these local sources of proteins and carbohydrates are important not only in aiding to reduce the high incidence of protein energy malnutrition (PEM) among the lower socio-economic populace, but inalleviating anaemia and as energy given source.

Recommendations

From this research done, it is recommended that:

1. More research and improvement be carried out to discover other local sources of proteins among the peasant groups in Nigeria as a whole, in order to reduce the high rate of protein energy malnutrition that occurs among individuals.
2. The fish dealers in Cross River State and Nigeria as a whole should engage in 'Ecomog Fish' *Heterotisniloticus* supplies as it is a major source of protein among other species of aquatic animals in the wild.
3. Aquaculturists should also engage in culturing *Heterotisniloticus*,as it serves as a major source of animal protein, in order to reduce high protein demand in the environment.

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