

Proximate and Mineral Composition of Internal Organs of *Clarias Garie Pinus* (Catfish)

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Abstract

The proximate and mineral composition of internal organs of catfish (*Clarias Garie Pinus*), obtained from a fish farm were examined. Parameters of proximate composition analyzed were moisture, ash, protein, fiber, fat and carbohydrate from the gills, intestines and liver. Mineral compositions such as calcium, sodium and potassium were also analyzed. Analysis of variance showed a significant difference ($p < 0.05$) in the moisture contents of internal organs of fish. There was also a significant difference ($p < 0.05$) in ash contents of gills, intestine and liver of catfish. The crude fat content ranged from 19.67 ± 0.167 in intestine to 36.00 ± 0.289 in gills. Crude fat contents of gills were higher than those of intestines and liver. There was no significant difference ($p > 0.05$) in the crude fiber contents. The highest protein value (41.417 ± 0.583) was recorded in gills and the least value (9.333 ± 0.583) was recorded in liver. There was a significant difference ($p < 0.05$) in protein contents of fish internal organs. The highest carbohydrate value (62.083 ± 0.083) was recorded in the intestine and least (6.450 ± 0.278) in gills. There was a significant difference ($p < 0.05$) in total carbohydrate contents of fish internal organs. The gills contained a higher amount of calcium ($6.53 \pm 0.24 \text{ mg/100g}$) as compared to liver ($6.28 \pm 0.10 \text{ mg/100g}$) and intestine ($5.94 \pm 0.07 \text{ mg/100g}$). The highest concentration of sodium ($2.31 \pm 0.06 \text{ mg/100g}$) was recorded in the gills while intestine contain ($2.30 \pm 0.10 \text{ mg/100g}$) and (2.27 ± 0.30) in liver. There was no significant difference ($p > 0.05$) in the sodium concentration of fish internal organs. The concentration of potassium ranged from 3.94 ± 0.14 in gills to 3.51 ± 0.50 in intestine. There was no significant difference ($p > 0.05$) in potassium concentration of fish internal organs. Results from this study therefore showed that fish internal organs are good source of protein and minerals. Thus, may be useful component for protein nutrients.

Key words: *Clarias Garie Pinus*, Internal organs, Minerals, Proximate, Protein Nutrients,

Introduction

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Fish is one of the cheapest known sources of animal protein widely consumed in the diets of rural and urban dwellers [1]. Fish and fish products are highly nutritious with high protein content of 15-20% and are particularly efficient in supplementing the cereal and tuber diets widely consumed in [2]. In Nigeria, fish are regarded as a major food item contributing a total of 40% to dietary protein. It is also a preferred and reliable source of animal protein with balanced amino-acids, vitamins and essential minerals for healthy human growth. Fish has a high biological value in terms of high protein retention in the body compared to another animal source [3]. Nigeria has become one of the largest importers of fish in the developing world, importing about 600,000 metric tons annually [4]. The major commercially important fishes include *Gymnarchids Nilotic us*, *Clarias Garie Pinus*, *Heterotrishes dorsalis* and *C. anguillids* [2]. Fish is a high protein food widely consumed because of its availability and palatability [5]. From amino acid composition and protein digestibility, fish is one of the safest, healthiest and known excellent sources of protein when compared to other protein source like goat and chicken meat. The flesh of oil-rich fish, such as herring, mackerel and catfish are important sources of the long chain n-3 polyunsaturated fatty acids (PUFA) including eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA), due to the large amounts of these fatty acids in marine algae upon which the fish feed [6]. Fish is very susceptible to damage once caught and so processing and cooking methods such as salting, boiling, frying, sun drying, grilling, roasting and smoking have been used to preserve and increase its availability to consumers [7]. Most of these processing methods involve the removal of the internal organs which may have positive or negative effects on the nutritional composition of the entire fish. The chemical compositions vary widely, not only from fish to fish of the same species but also within the same fish [8]. However, the nutritional value of fish comprises the contents of moisture, protein, lipids, vitamins, minerals and caloric value. Fishes are classified most commonly according to the type of food they consume. They are either herbivore if they feed on plant materials, carnivores if they feed on animal material or omnivores if they feed on a combination of both plants and animal material.

The African catfish *Clarias Garie Pinus* is one of the most suitable species for aquaculture in Africa [9]. It is mainly a fresh water species belonging to the family *Claridge* (the air breathing catfish). The diversity of these cat fishes is highest in Africa [10]. In Nigeria, *Clarias Garie Pinus* is highly relished due to its fast growth and table value of the fish. It is popularly known in English as walking cat fish. The diet habit of a cat fish is omnivores as they feed on diet including plants and animal material. *Clarias* species are recognized by their long-based dorsal and anal fins, which give them a rather eel-like appearance. These fish have slender bodies, a flat bony head, and broad terminal mouth with four pairs of barbels. They also have a large, accessory breathing organ composed of modified gill arches. Fish internal organs such as liver, gills and intestines are usually discarded off after consumption of outer body parts; however, [11], reported that these organs contain compounds that are good source of polyunsaturated fatty acids, which are beneficial to health. There is therefore need to evaluate the nutritive value of catfish in order to improve the utilization of these organs that usually go to waste. The present study was carried out to determine the proximate composition of the internal organs of cat fish. The aim of the study was to evaluate the proximate compositions of cat fish internal organs.

Materials And Methods

Collection and Preservation of Specimen

Fresh catfish, *Clarias Garie Pinus* were purchased from a fish farm in Bosso Local Government, Minna, Niger State. They were transported live to the laboratory for analysis.

Sample preparation

The fish were measured for standard weight using a digital weighing balance model C830 to determine the weight in gram. The fish specimens were dissected, to remove internal organs and weighed to determine the organ weight composition of the fish. They were then placed in an oven to dry at 40°C. After drying samples were crushed and weighed for further analysis

Proximate analysis of internal organs of fish

The proximate analysis of the samples for moisture, total ash, crude fiber, fat was carried out using the methods described by [12]. The nitrogen was determined by micro-Kjeldahl method described by [12] and the nitrogen content was converted to protein by multiplying with a factor of 6.25. Total carbohydrate content was estimated by 'difference'. All the proximate values were reported in percentage (%).

Determination of Moisture content

Two grams of fish samples was accurately weighed in clean, dried crucible (W_1). The crucible was allowed in an oven at 100-105°C for 6-12 hours until a constant weight was obtained. Then the crucible was placed in the desiccator for 30 minutes to cool. After cooling, it was weighed again (W_2). The percentage moisture was calculated formula as follows;

$$\% \text{ Moisture} = \frac{W_1 - W_2 \times 100}{\text{Weight of Sample}}$$

Where;

W_1 = Initial weight of crucible + Sample 1

W_2 = Final weight of crucible + Sample 2

Determination of Ash content

Clean empty crucible was placed in a muffle furnace at 550°C for an hour, cooled in desiccator and then weight of empty crucible was noted (W_1). Two grams of each of fish sample was taken in crucible (W_2) and was purchased over a burner, until it was charred. Then the crucible was placed in muffle furnace for aching at 550°C for 2-4 h. the appearance for gray white ash indicate complete oxidation of all organic matter in the sample. After aching the crucible was cooled and weighed (W_3). Percentage ash was calculated using the formula.

$$\% \text{ Ash} = \frac{\text{Difference in Weight of Ash} \times 100}{\text{Weight of Sample}}$$

Difference in weight of ash = $W_3 - W_1$

Determination of Crude Protein content

Protein content in fish sample was determined by keddah method. 0.25g of dried samples was taken in digestion flask, with 6ml of concentrated H₂SO₄ and a speck of kjeldahl catalyst (mixture of 10g Na₂SO₄+5g CuSO₄+ 0.05g selenium). The flask was swirled in order to mix the contents thoroughly then digested on the digestion block till the mixtures become clear (colorless or greenish in color). The digest was cooled and transferred to 100ml volumetric flask and volume was made up to mark by the addition of distilled water. Distillation of the digest was performed in Markham Distillation Apparatus. Ten milliliters of digest was introduced in the distillation tube then 10 ml of 40% NaOH was gradually added through the same way. Distillation was continued for at least 10 min and NH₃ produced was collected as NH₄OH in conical flask containing 5ml of 4% boric acid solution with few drops of methyl red indicator. During distillation yellowish color appears due to NH₄OH. The distillate was then titrated against standard 0.1 N HCl solutions till the appearance of pink color. Percentage crude protein content of the fish sample was calculated using the following formula;

% Crude Protein = 6.25* x %N (*. Correction factor)

$$\% \text{ Nitrogen} = \frac{(S-B) \times N \times 0.014 \times D \times 100}{\text{Weight of the sample} \times V}$$

Where;

S = Sample titration reading

B = Blank titration reading

N = Normality of HCl

D = Dilution of sample after digestion

V = Volume taken for distillation

0.014 – Milli equivalent weight of Nitrogen

Determination of crude Fat:

Crude fat was determined by ether extract method using Soxhlet apparatus. Approximately 2g of moisture free sample was wrapped in filter paper, placed in fat free thimble and then introduced in the extraction tube. A weighed, cleaned and dried receiving flask was filled with petroleum ether and fitted into the apparatus. The Soxhlet apparatus was assembled and allow refluxing for 6hrs; extract was transferred into clean glass dish with either washing which was evaporated on water bath. Then the dish placed in an oven at 105⁰C-110⁰C for 1hour and cooled in a desiccator. The percentage crude fat was determined using the following formula:

$$\% \text{ Crude Fat} = \frac{\text{Weight of ether} \times 100}{\text{Weight of sample}}$$

Determination of crude Fiber content

Two grams of sample was defatted with petroleum ether; boiled under reflux for 30minutes with 200ml a solution containing 1.25g of H₂SO₄ per 100ml of solution. The solution was filtered through several layers of cheese cloth on fluted funnel, washed with boiling water until the washings are no longer acidic then the residue was transferred into a beaker and boiled for 30minutes with 200ml of solution containing 1.25g of carbonate free NaOH per 100ml, the final residue was filtered through a thin but close pad of washed and ignited asbestos in a Gooch crucible, then dried in an electric oven and weighed

after which it was incinerated, cooled and reweighed. The loss in weight after incineration x 100 is the percentage crude fiber.

Determination: Carbohydrate Content

The nitrogen free method described by A.O.A.C (1990) was used. The carbohydrate content was calculated as weight by difference between 100 and the summation of other proximate parameter as Nitrogen free Extract (NFE) percentage carbohydrate (NFE) = 100- (m+p+F+A+F₂).

Where;

M=moisture, P=protein, F₁=Fat, A=ash and F₂=crude fiber

Results and Discussion

Results

The proximate composition of the analyzed internal organs of fish is shown in Table 1. The moisture contents of internal organs of fish ranged from 0.167±0.144 in liver to 2.18±0.333 in gills. There was a significant difference (p<0.05) in the moisture contents of internal organs of fish. The ash contents ranged from 5.500±0.000 for intestine to 13.600±0.458 for gills. There was a significant difference (p<0.05) in ash contents of gills, intestine and liver of fish. The crude fat content of gills was 19.667±0.167 to 36.000±0.289. The crude fat contents of gills were higher than those of intestines and liver. The crude fiber contents of fish internal organs ranged from 0.000±0.000 to 2.500±0.000. There was no significant difference (p>0.05) in the crude fiber contents. The highest protein value (41.417±0.583) was recorded in gills and the least value (9.333±0.583) was recorded in liver. There was a significant difference (p<0.05) in protein contents of fish internal organs. The highest carbohydrate value (62.083±0.083) was recorded in intestine and least (6.450±0.278) in gills. There was a significant difference (p<0.05) in total carbohydrate contents of fish internal organs.

Table 1: Proximate composition of fish internal organs (%)

Parameters/Fish organs	Gills	Intestines	Liver
Moisture	2.187±0.333 ^b	0.667±0.167 ^a	0.167±0.167 ^a
Ash	13.600±0.458 ^c	5.500±0.000 ^a	8.750±0.144 ^b
Crude fiber	0.000±0.000 ^a	0.000±0.000 ^a	2.500±0.000 ^b
Crude Fat	36.000±0.289 ^c	21.833±0.333 ^b	19.667±0.167 ^a
Crude Proteins	41.417±0.583 ^b	9.917±0.583 ^a	62.083±0.083 ^b
Carbohydrates	6.450±0.278 ^a	9.333±0.583 ^a	63.083±2.459 ^b

Values are represented as means of triplicate determinations ± SEM

Values on rows with different superscripts are termed significantly different ($p>0.05$).

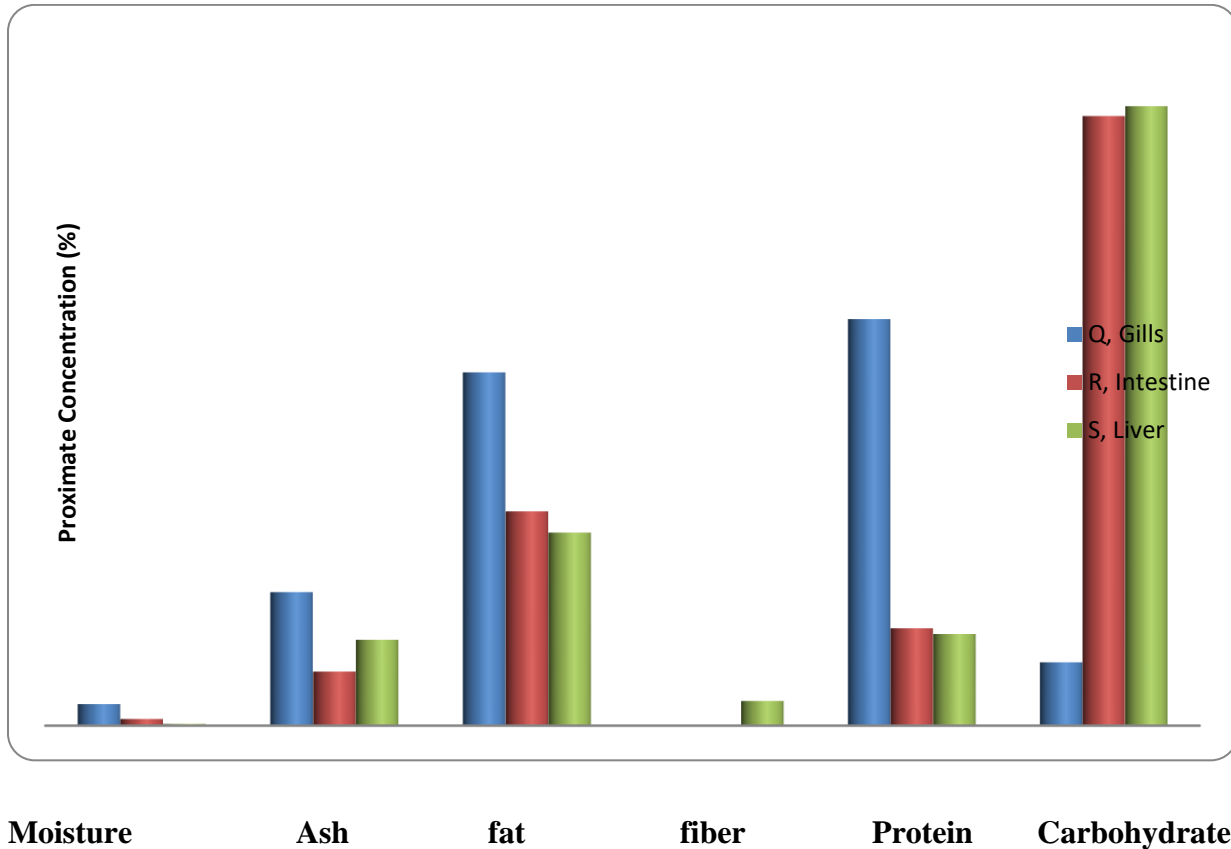


Figure 1: Mean values of proximate composition of fish internal organs

Table 2 showed the mineral composition of internal organs of fish. The gills contained a higher amount of calcium ($6.53\pm 0.24\text{mg}/100\text{g}$) as compared to liver ($6.28\pm 0.10\text{mg}/100\text{g}$) and intestine ($5.94\pm 0.07\text{mg}/100\text{g}$). The highest concentration of sodium ($2.31\pm 0.06\text{mg}/100\text{g}$) was recorded in the gills while intestine contained ($2.30\pm 0.10\text{mg}/100\text{g}$) and 2.27 ± 0.30 in liver. There was no significant difference ($p>0.05$) in the sodium concentration of fish internal organs. The concentration of potassium ranged from 3.94 ± 0.14 in gills to 3.51 ± 0.50 in intestine. There was no significant difference ($p>0.05$) in potassium concentration of fish internal organs.

Table 2: Mineral Composition of Fish internal organs

Parameters/Sample	Gills	Intestines	Liver
Calcium (mg/100g)	6.53 ± 0.24	5.94 ± 0.07	6.28 ± 0.10
Sodium (mg/100g)	2.31 ± 0.06	2.30 ± 0.56	2.27 ± 0.30
Potassium (mg/100g)	3.94 ± 0.14	3.51 ± 0.50	3.70 ± 0.18

Values are represented as means of triplicate determinations \pm SEM

Values on rows with different superscripts are termed significantly different ($p>0.05$).

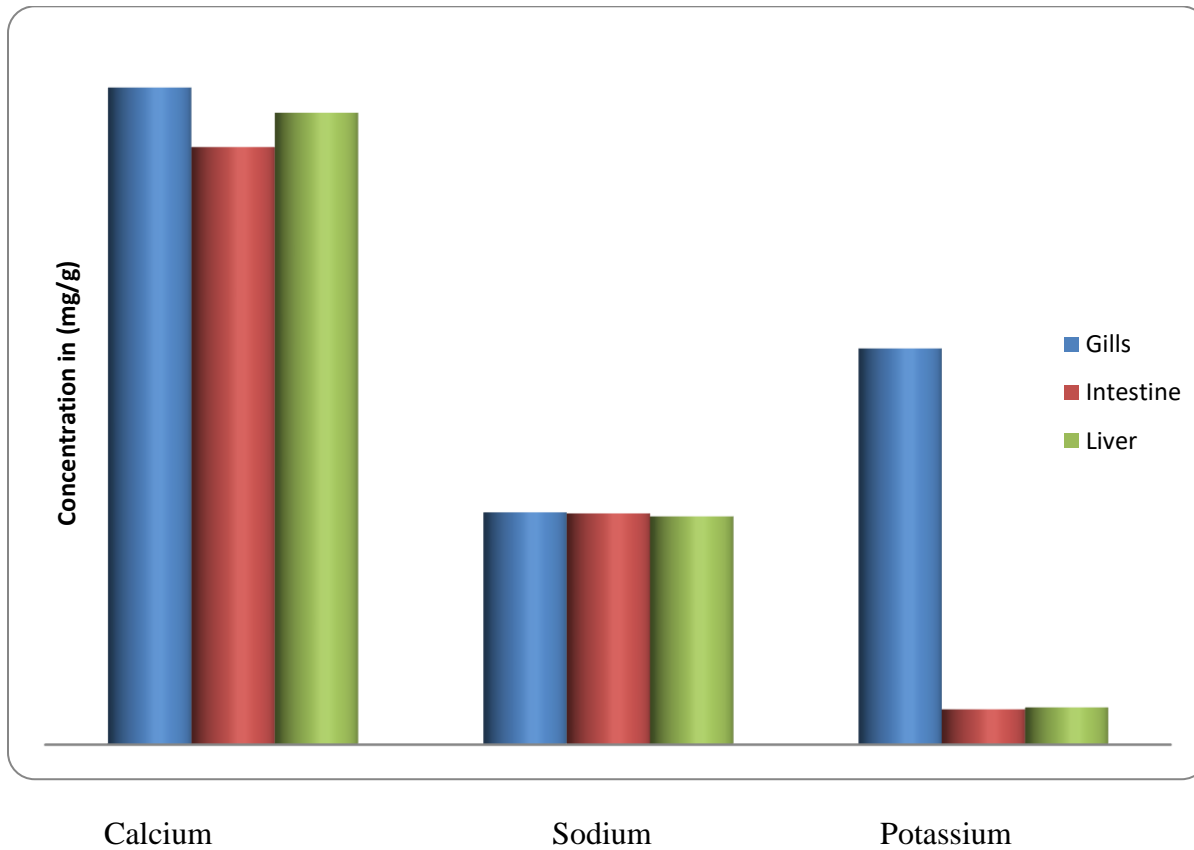


Figure 2: Mean values of mineral composition of fish internal organs

Discussion of results

Proximate composition of fish internal organs

Results from this study (Table 1) have shown that fish internal organs are good source of proteins and may serve as useful component for a healthy diet in humans [13]. The fish internal organs are high in proteins and contained lower calorie contents [14]. This is in agreement with several studies of [14], that fishes are generally higher in protein than other traditional source of proteins such as meat, dairy products and seeds. Proteins are macronutrients generally known as body building foods. They are essential components of cells and perform various functions as enzymes and hormones. The high protein contents in fish internal organs suggest that they may find relevance in protein deficient diets.

The moisture contents in fish internal organs were generally low as shown Table 1. The low moisture content of fish internal organs suggests that they may be kept for long periods without deterioration or spoilage. The ash content of a food material represents its total mineral contents [13].

The ash contents in gills were higher than that of liver and intestine, suggesting that gills may be a better

source of minerals as compared to liver and intestines. The relatively high to moderate percentage crude fat in the fish internal organs shows that fish internal organs such as the gills, liver and intestines are good sources of fats.

The fiber contents of fish internal organs were generally low and there was no fiber recorded for gills and intestine. This may be attributed to the differences in method of determinations. The high carbohydrate content recorded in intestine and liver could be attributed to the different fish feed composition. Results from this study therefore suggest that gills having lower carbohydrate content may not be good source of carbohydrate.

Mineral composition of fish internal organs

The levels of sodium in fish internal organs as shown in Table 2 were generally low. The high calcium levels of fish organs are of significance because calcium has been shown to play a key role in bone formation and development [15]. The concentration of potassium in internal organs of fish was also high and this is of importance since, potassium is a cofactor in energy metabolism, glycogenesis and cell growth. Potassium has been shown to play an important role in coronary heart diseases as increased intake reduces blood pressure by increasing the excretion of sodium [16].

Conclusion and Recommendations

The results obtained from this study were intended to provide basic information on proximate and mineral composition of the internal organs of cat fish. The selected organs such as the gills, intestines and liver were found to be good source of proteins, fats and minerals. The study therefore reviewed that fish internal organs may be useful component for healthy diets. It is therefore suggested that further analysis should be carried out to ascertain its utilization in human foods.

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