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RESEARCH PAPER

PROXIMATE COMPOSITION OF FROG (*DICROGLOSSUS OCCIPITALIS*) AND ACUTE MUDSNAIL (*VIVIPAROUS CONTECTUS)*

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ABSTRACT

In this work, the proximate composition and mineral content of fresh water frog (*Dicroglossus occipitalis*) and acute mud snail (*Viviparous contectus*) were studied. This was done in accordance with AOAC standards to gain insight into the health benefits of the samples. Results show that these samples contained acceptable concentrations of crude lipids, crude protein, fibre, nitrogen free extract, calcium, magnesium, iron and zinc implying that frog and acute mud snail could be used as good sources of nutrient and minerals for human diet and animal feed production. Also, the drying rates as a function of drying temperatures (60, 80, and 100^{o}C) for both samples shows that they all dried faster as temperature was increased. However, a drying temperature of 80^{o}C is recommended as both samples presented better dried product at this temperature.

Keywords: mineral content, proximate composition, frog, acute mud snail, temperature

INTRODUCTION

The need for nutritional information on any edible food product, ever known to man, cannot be over-emphasized. This information serves as a guide to consumers on the quality assurance for already existing food products and establishes acceptability for new ones. Generally, agricultural materials and food products are known to consist of different chemical compositions such as moisture content, fibre, carbohydrate, ash, fat, protein, vitamins and minerals. Thus, the percentage of the chemical composition in a food product, to a large extent, determines the acceptability or fitness for consumption.

Consequently, several scientist and food process engineers have studied the nutritional value of various agricultural materials and food products. This includes Shumaila and Maphara (2009) for Cinnamon; Inighe et al (2009) for acalypha species; Akindahunsi and salawu (2005) for tropical green leafy vegetables; Burubai and Amber (2014) for Ipoli fruits; Fawole *et al* (2007) for fresh water fishes; Sadiku and Oladimeji (1991) for Catfish and Adewole and Omotosho (1997) for selected fresh water fishes.

Frog (*Dicroglossus occipitalis*) and Acute mudsnail (*Viviparous contectus*) are freshwater-based biomaterials that are consumed by a few in most parts of the world especially Africa. In Nigeria, these two biomaterials are not too generally accepted, perhaps, due to the lack of information on the nutritional capacity of the products. They are in abundance during the wet seasons (April to November) and can be preserved for the off-seasons as means of curbing food insecurity in Africa if the nutritional values of both products are known. The objective of this work is therefore to study the proximate composition of both freshwater frog and acute mudsnail for purposes of improving their acceptability for immediate consumption and preservation.

MATERIALS AND METHODS

Sample collection and preparation: Fresh frog (*Dicroglossus Occipitalis*) and acute mudsnail (*Viviparous contectus*) were harvested from the freshwater swamps in Amassoma community in Bayelsa State, Nigeria in October, 2015 and were taken to the Food Processing Laboratory of the Niger Delta University for processing and analysis. After processing, the moisture content of both samples was determined using the oven method and the remaining taken to the Chemistry Laboratory for proximate composition and mineral analysis.

Proximate Composition: Proximate analysis was conducted on both the frog and acute mudsnail samples and the parameters considered were moisture content, ash content, crude protein, crude lipid extract, crude fibre, and nitrogen free extract.

Moisture content: The moisture content was determined using the oven drying method. 5g of sample was introduced into a clean and dried crucible and weighed (W_1). The crucible with the content was placed in an oven at 60^0 C for 25hrs during which a constant weight was obtained. It was then allowed to cool in a desiccator for 30min and re-weighed (W_2). This was repeated thrice for both frog and acute mudsnail and the average percent moisture recorded as recommended by AOAC (2000).

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

These moisture free samples were used for other analysis.

Ash Content: For ash analysis, 2g of moisture-free sample was weighed into a crucible of known weight. The crucible and content (W_2) were then covered and ignited in a muffle furnace at 550^0 C for 24hrs. The appearance of gray white ash indicated complete oxidation for all organic matter in the sample. The sample was then cooled and weighed (W_3). This procedure was replicated thrice and repeated for both samples and the percent ash was calculated as

$$\%\ Ash = \frac{W_3 - W_2}{Weight\ of\ Sample} \times 100$$

Where:
$W_3 - W_2$ = difference in weight of Ash.

Crude Protein: Crude proteins in both samples were determined using the Kjeldahl method. 0.5g of samples was weighed and digested by heating with concentrated sulphuric acid (H_2SO_4) in the presence of digestion mixture which contains 1.5g of Na_2SO_4 and 1.5g of $CuSO_4$. The mixture was then made alkaline. The ammonia evolved was steam distilled into an Erlenmayer flask containing 10ml of 5% boric solution into which 2 drops of double (Methylred – Methyl blue) indicator has been added. This was titrated against 0.1N HCl solution until a purple-pink colour was obtained as the end point. The total protein was then calculated by multiplying the amount of nitrogen with gravimetric factor of protein (6.25) as

$$\%\ Nitrogen = \frac{(X - Y) \times N \times 0.014 \times D \times 100}{Weight\ of\ Sample \times V}$$

Thus,

$$\%\ Crude\ Protein = 6.25 \times \%\ Nitrogen$$

Where:
X = Sample titration reading
Y = 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

Crude lipid: The crude fats were determined using the soxhlet method. 5g of the oven dried samples were weighed into a thimble. 200ml of petroleum ether was poured into a previously weighed round bottom flask containing weighed antidumping granules. The soxhlet extractor, into which the thimble with its contents had been introduced, was fitted into the flask and the extractor was setup with flask sitting in the heating mantle. The flask was heated slowly for 24hrs to ensure complete extraction. The thimble was then removed and air dried. The extracted lipid in the round bottom flask was concentrated using a rotary evaporator. This was further dried in a desiccator and re-weighed. The amount of lipid extracted was obtained from the difference between the weight of flask before and after extraction. Thus, percent crude fat was calculated as

$$\% \text{ Crude Lipid} = \frac{\text{Weight of lipid in sample}}{\text{Weight of dried sample}} \times 100$$

This was replicated thrice for both frog and acute mud snail and averages recorded.

Crude fibre: 2g of the fat free sample was weighed and transferred into a 400ml beaker. 50ml of 1.25% H_2SO_4 was added and the mixture made up to 200ml with distilled water. The content of the beaker was then boiled for 30 minutes and filtered through a Buchner funnel with the aid of a suction pump. The residue was washed with hot water until it was acid free. The residue was transformed into the 40ml beaker and then 50ml of NaOH solution was added and made up to 200ml with distilled water. The mixture was again heated for 30 minutes with constant stirring. The content of the beaker was again filtered through the funnel and washed several times with hot water until it was free from NaOH. The residue was washed twice with 95% methane and quantitatively transferred into a crucible and dried at 100^0 C. The weight of the oven-dried residue was noted (W_1) and was later ignited in a furnace at 550^0 C for 4hrs, cooled in a dessicator and weighed again (W_2). The percentage crude fibre was calculated using the formula

$$\% \text{ Crude Fibre} = \frac{W_1 - W_2}{W_0}$$

Where W_1 is weight of oven-dried sample, W_2 is weight of ignited sample and W_0 is original weight of sample before digestion. This was conducted for both frog and acute mudsnail samples at three replications.

Nitrogen free extract: The Nitrogen Free Extract (NFE) was calculated by difference method after analyzing all the other parameters in the proximate analysis. Therefore

$$NFE = 100 - (\% \text{ moisture} + \% \text{ crude Protein} + \% \text{ crude lipid (fat)} + \% \text{ crude fibre} + \% \text{ ash})$$

Mineral Analysis: Mineral content of both frog and acute mud snails were analyzed using atomic absorption spectrophotometer (AOAC, 2000). The minerals Ca, Mg, Fe, Zn and Mn were investigated for both samples. Samples were acid-digested (wet digestion); Aqua Regia (HNO_3 and H_2SO_4 in ratio of 3:1) in the fume-cupboard until a clear mixture was obtained. This was then diluted and filtered into 100ml volumetric flask and made up to 100ml mark with distilled water. The sample so prepared was then taken for the mineral analysis in the atomic absorption spectrometer machine.

Drying Characteristics: The dehydration characteristics of both frog and acute mudsnail samples were also carried out. About 17.6g each of both samples were oven-dried at 60^0 C, 80^0 C and 100^0 C in a convective type oven. While drying, samples were withdrawn at specific time intervals and weighed until a constant weight was achieved in two consecutive measurements as recommended by ASAE (2000). The drying rate of samples were calculated as

Drying rate, D_R

$$D_R = \frac{M_{t+\Delta t} - Mt}{\Delta t}$$

Where:
D_R = drying rate (gH_2O/min)
Δt = change in time (minutes)
$M_{t+\Delta t}$ = moisture content at $t + \Delta t$ (% db)
Mt = moisture content at time, t (% db)

RESULTS AND DISCUSSIONS

Using standard procedures, the proximate compositions, mineral contents and drying rates of both frog (*Dicroglessus occipitalis*) and acute mud snail (*Viviparous contectus*) were evaluated and results presented in Tables 1, 2 and 3.

Table 1: Proximate composition of frog and acute mudsnail

S/N	Nutrients Composition	Frog (M ± SD)	Acute Mudsnai l (M ± SD)
1.	Moisture content (%)	78.6 ± 0.02	68.66 ± 0.01
2.	Ash content (%)	11.82 ± 0.001	4.76 ± 0.41
3.	Crude lipid (%)	6.74 ± 0.12	3.56 ± 0.9
4.	Crude protein (%)	28.68 ± 0.14	17.28 ± 0.43
5.	Crude fibre (%)	2.42 ± 0.3	0.38 ± 0.35
6.	Nitrogen Free Extract (NFE) (%)	50.34 ± 0.21	74.02 ± 0.24

As shown in Table 1, fresh water frog contains 78.6% moisture, 11.82% ash, 6.74% fat, 28.68% protein, 2.42% fibre and 50.34% nitrogen free extract. For acute mud snail 68.66% moisture, 4.76% ash, 3.56% fat, 17.28% protein, 0.38% fibre and 74.02% nitrogen free extract was obtained. The high moisture contents of both frog and acute mud snail as presented in Table 1 shows the availability of water for chemical reactions and microbial growth. Therefore preservation must commence immediately after their harvest to control deterioration. The moisture contents recorded here are higher than those of beef meat (68.3%), chicken (59.5%) and catfish (58.0%) as reported by Nielsen (2002).

Protein which forms the building blocks of all cell structures were present in significant quantities in both samples (Table 1). Frog and acute mud snail had average values 28.68% and 17.28% of proteins respectively. The protein values of frog are higher than those of clarias (20.83%), Tilapia (20.78%) and electric fish (18.35%) as reported by Adeniyi *et al* (2012) and also higher than beef meat (28.5%) and Tuna fish (24.2%) as reported by Nielsen (2002).

The Nitrogen free extract (i.e. carbohydrate) play a vital role in human nutrition as energy reserves. Both frog and acute mud snails contains high amounts of nitrogen free extracts. Average nitrogen free extract values of 50.34% and 74.02% were recorded for frog and acute mud snail respectively. These NFE values are higher than those of Clarias (3.85%), Tilapia (6.85%), electric fish (8.86%) as reported by Adeniyi *et al.* (2012) and beef meat (2.25%), broiler meat (2.83%) as presented by Olayemi *et al.* (2011).

Lipids are a group of substances that are soluble in organic solvents and are sparingly soluble in water. When lipids combine with proteins and carbohydrates, they constitute the principal structural components of foods. Lipids are also considered as a store house for energy. The lipid content in frog and acute mud snail were recorded as 6.74% and 3.56% respectively. These lipid values are in the same range with those reported for Clarias (13.86%), Tilapia (6.53%), electric fish (10.82%) by Adeniyi *et al*. (2012) and beef meat (4.59%), broiler meat (4.34%) by Olayemi *et al.* (2011) and Cod fish (0.4%), but lower than those of pork (33%) and bacon (65%) as presented by Nielsen (2002).

Table 2: Mineral composition of Frog and Acute mudsnail

S/N	Minerals	Frog (mg/g)	Acute Mudsnail (mg/g)
1.	Ca	19.48	17.63
2.	Mg	27.43	9.36
3.	Fe	3.48	1.32
4.	Zn	4.65	0.43
5.	Mn	2.56	0.32
6.	PO_4	0.34	0.23

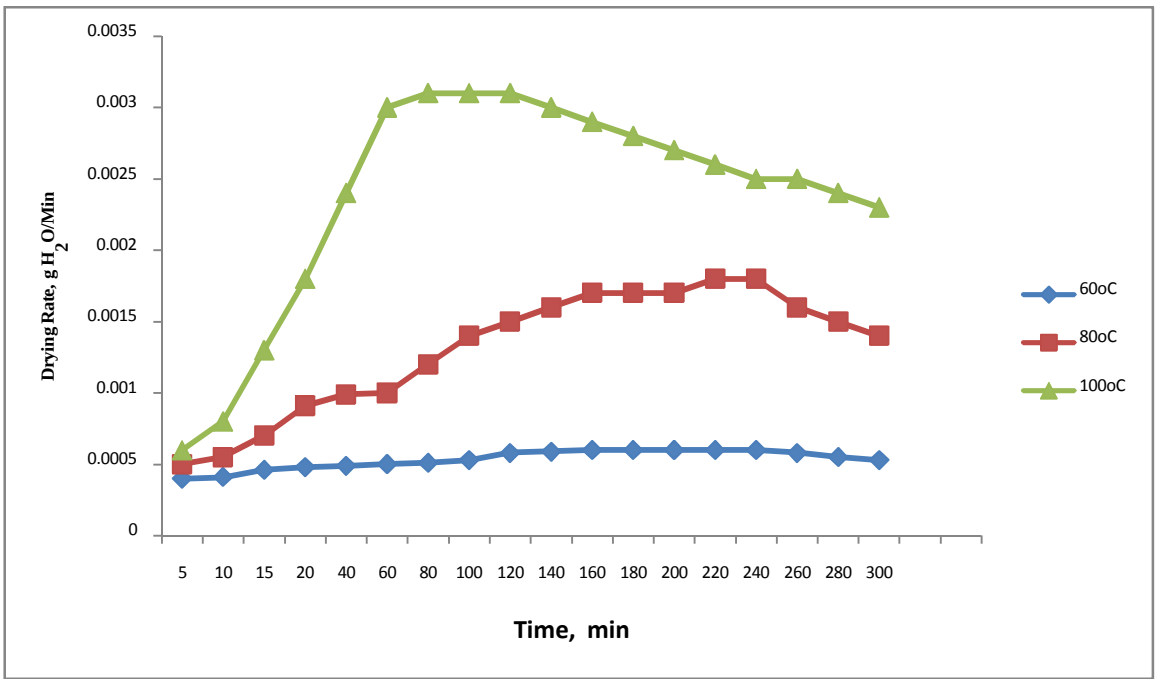

Fig. 1: Drying characteristics of frog at different temperatures

Minerals are substances needed in the body for neural conduction, muscle contraction and relaxation and other specific biochemical roles in maintaining body functions. Table 2 therefore shows the mineral compositions of both frog and acute mud snail. For Frog, magnesium recorded the highest value with 27.43mg/g and followed in descending order by calcium (19.48mg), Zinc (4.65mg), Iron (3.48mg), Manganese (2.56mg) and Phosphate (0.34mg). However, for acute mud snail, calcium had the highest value of 17.63mg followed by magnesium (9.36mg) and iron (1.33mg). The mineral composition of both frog and acute mud snail were lower than those reported by Adeniyi *et al*. (2012) on Clarias which had Ca (24.53mg), Mg (29.61mg), Fe (85.67mg), Zn (38.24mg) and tilapia with Ca (17.63mg), Mg (41.44mg), Fe (67.75mg), Zn (34.21mg). The sharp difference in mineral values between the test specimen and Clarias and Tilapia could be attributed to the fact that clarias and tilapia were trained or cultured samples which were always given mineral supplemented or fortified feeds while frog and acute mud snails were harvested from the wild and had no supplemented feeding.

However, Calcium, Magnesium, Iron and Zinc which were in high concentrations in both frog and acute mud snails are relevant to several biochemical activities in the body. Calcium and magnesium are needed for carbohydrate metabolism, nucleic acid production and teeth development. Magnesium is also essential for enzymatic activities and in regulating the acid-alkaline balance and resistance to heart diseases. Iron is needed for red blood cell formation while zinc is essential for prostrate health.

Drying Rates

Drying rate, which is defined as the amount of water evaporated from biomaterial overtime, has serious engineering implications. Prominent amongst its importance is the prediction of total drying time, for the storage of agricultural products. The drying rates of both frog and acute mud snail at temperatures 60^0, 80^0 and 100^0 C are presented in Figures 1 and 2 respectively.

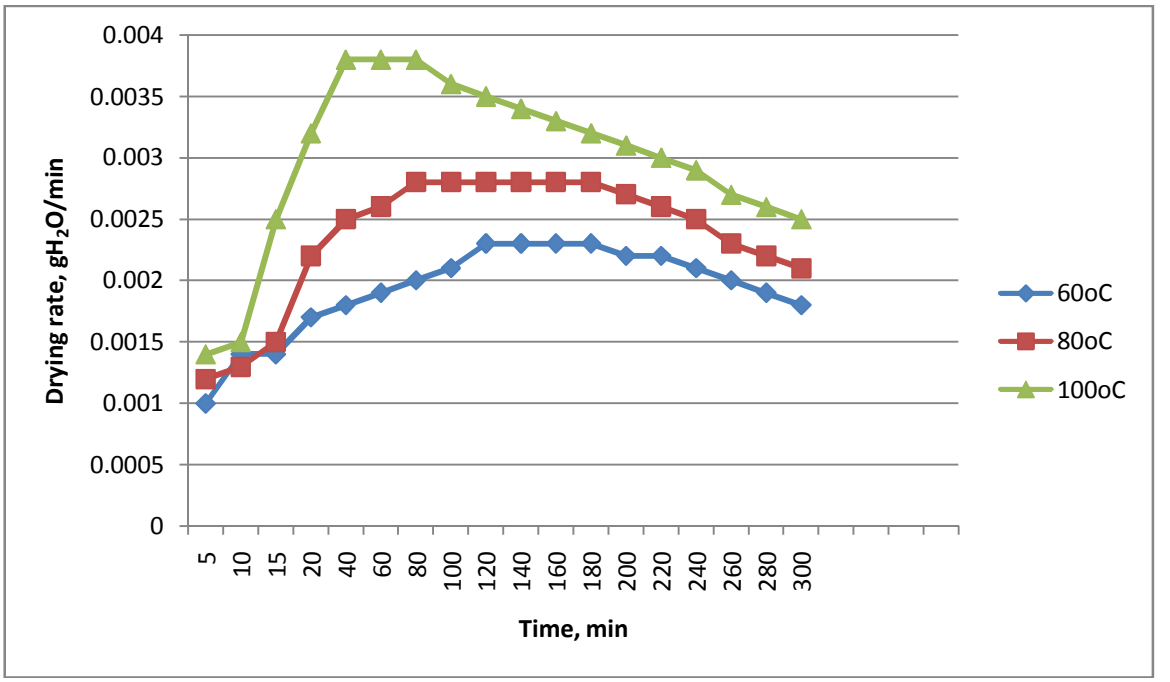

Fig 2 Drying rates of acute mud snail at different temperatures

Generally, drying rates for both samples increased with increase in temperature levels. For frog and at 60°C, drying rate increased steadily for 2.4hrs and became constant for the next 1hr and then decreased steadily for the remaining 1hr of drying. Similar drying behaviour was observed for frog samples when subjected to the other temperature levels, although, at shorter drying times (Fig. 1). For acute mud snail (Fig 2) and at 60°C, drying rates steadily increased to 0.0021g/min for the first 1.4hrs and became constant at 0.0023g/min for the next 1hr and decreased steadily for the remaining period of drying. Also, at 100°C, drying rates increased to 0.0032g/min in the first 20min and became constant at 0.0038g/min for the next 40min and decreased steadily for the rest of the drying periods. Therefore, the drying rates were observed to increase with increase in drying temperatures levels, and higher drying temperatures also found to encouraged shorter drying times for both samples. The decrease in drying rates at the later stages of drying could be attributed to difficulties in diffusion of low concentration of moisture from the interior to the surface of the samples for evaporation. Similar observations have been made on other biomaterials during drying (Bala and Mondol, 2001; Zhiqiang *et al.*, 2013; Oyinge *et al*, 2015).

CONCLUSIONS

The proximate composition and mineral content of fresh water frog and acute mud snails were investigated. Results indicated that frog and acute mud snails contains acceptable levels of nutrients and minerals. They can therefore be used as good sources of crude proteins, crude lipids, fibre, and minerals such as calcium, magnesium, iron and zinc.

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