PROXIMATE COMPOSITION OF EDIBLE SHELLFISHES FROM BUGUMA CREEK, RIVERS STATE, NIGERIA.

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Abstract
This study was conducted in order to determine the proximate composition of selected shellfishes from the Buguma creek in Rivers State, Nigeria. The edible parts of shell fishes (Tympanotonus fuscatus, Thais coronata, Callinectes amnicola, Cardisoma guanhumi, and Crassostrea gasar) were analysed for their proximate composition (ash, fat, moisture and protein content). T. fuscatus had the lowest moisture content (32.6 ± 0.05%) and the highest crude protein level (64.2 ± 0.04%). The results of the study showed that the shellfishes contain low fat (9.59 ±0.27), carbohydrates (0.75 ± 0.21%) and ash (9.59 ± 0.27%) and therefore will not enhance obesity. These values are useful references for consumers in order to choose shellfish based on their nutritional contents.
Keywords: Protein, Fat Content, Moisture Content, NFE, Shell Fish.

Introduction

Shellfishes are invertebrate animals and some examples include periwinkles, rock snails, oysters and crabs. They possess exoskeleton called shells which may be single or double over the body. Shellfishes are balanced foods that contain excellent sources of proteins, high minerals and some vitamins, which belong to a family of low fats and cholesterol (Ifon and Umoh, 1987). Baby *et al.,* 2010 reported that the difference in the nutritional composition of *Egreria radiate* (a shellfish) could be attributed to the species of the fish, environment and their region. Shellfishes have been found to be a major source of protein to the general population especially the riverine communities and they occur abundantly in the brackish and fresh waters (Davies and Jamabo, 2016). They also provide high quality protein with all the dietary essential amino acids for maintenance and growth of the human body.

There has been a lot of investigation into the proximate composition and fatty acid contents of other food items (Luzia *et al.,* 2003). The consumption and utilization of these natural resources for human needs has improved rapidly over time as population increases. In general, shellfishes like Rock snail (*Thais* coronata), Mud-flat periwinkle (*Tympanotonus fuscatus*), Mangrove oyster (*Crassostrea gasar*), Marine crab (*Callinectes amnicola*), Land crab (*Cardisoma guanhum*i) and others have been given credit for their health benefits which includes; good source of omega-3 fatty acids, which provide protection to the heart there by reducing the risk of heart attack and stroke (as much as 27%) as well as low blood pressure. (Health guide, 2008). Some shellfishes like the molluscs can be seen in shallow waters and sometimes around the inter-tidal zones where they burrow into sediments of the rivers. They are mainly algae and diatom feeders (Okon, 1987). Periwinkle like other shellfishes has a high commercial value in the Niger Delta area of Nigeria. Their economic and nutritional value can be compared with those of domestic livestock and fish. There were studies conducted on the nutritional qualities of Nigerian snails which are in the same class with the Nigerian periwinkle. However, information on the nutritional qualities of most shellfishes in Rivers state (periwinkle, marine crab, oyster etc.) is scanty (Ehigiator and Oterai, 2012). The meat is used domestically as human food, livestock feed and their colourful shells can be used for ornamental purposes. They are widely eaten because they are nutritious with good mineral content (Ogogo, 2004), by the people of the Niger Delta region of Nigeria. However, after consuming the soft flesh, their shells are often discarded as refuse, in spite of their plausible economic value (Claude, 2002). The chemical and nutritious status of different species of shellfishes have been dealt with in various parts of the world (Naczk *et al.,* 2004;

Omotoso, 2005; Zhu and Bai. 2007; Jimmy and Arazu 2012; Adeyeye *et al.*, 2016). However, information on the proximate composition like crude protein, crude fat, calcium, ash and moisture content of *Callinectes amnicola*, *Thais coronata*, *Tympanotonus fuscatus*, *Cardiso maguanhumi* and *Crassostrea gasar* is rare in Rivers state, Nigeria. This information will be useful to consumers in their preferred choice of shellfish based on the nutrient values.

Study Area:

The Buguma Creek is a tributary of the Bonny River which is located Southeast of the Niger Delta between longitude 6º51'E and 49º8'E, and latitude 4º43'N and 47º8'N in Asari-Toru Local Government Area of Rivers State, Nigeria. (Figure 1)

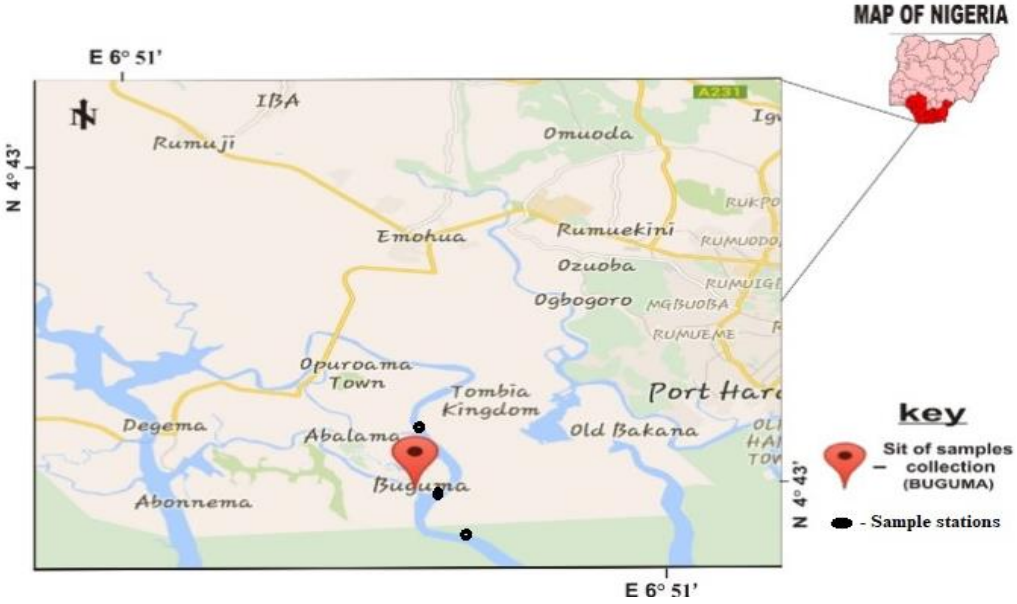

Figure 1. A map showing the site of samples collection in Buguma Cree

Materials and Methods

Collection of Samples

The samples of the edible parts of the shellfishes were collected from the Buguma creek. *T. fuscatus* and *T. coronata* were handpicked from the mud flat, while *C. gasar* was harvested from the prop roots of the mangrove trees during low tide. The swimming crabs were caught using a drag net and *Cardisoma guanhumi* was caught using a trap and each sample was collected randomly in triplicate. The samples collected were preserved in an ice-chest before they were transferred to the laboratory for analysis.

Proximate Analysis

Moisture

The moisture content of the samples were determined by weighing two grams of each sample in moisture Can which was then kept in an air-current oven at a temperature of 105^0C for three (3) hours as described by A.O.A.C (2005). The Can was then removed and cooled in a desiccator and weighed. This process was repeated until a constant weight was obtained. The difference in weight represented the moisture content.

$$\% \text{ Moisture content} = \frac{-\text{Wt of Can} + \text{Sample after drying}}{\text{Initial Wt of Can} + \text{sample}} \times 100 \text{ (Geda } et\ al., 2015)$$

Ash

One gram of the sample was weighed into a previously ignited and cooled porcelain crucible with the lid. The crucible with the sample was heated on a heating mantle in a fume cupboard until the smoke ceased. The crucible and content was then transferred

to a muffle furnace and allowed to ash for 3hours at a temperature of 600ºC. At the end, the crucible with its content was removed from the furnace and cooled in a desiccator, and weighed again. The percentage ash content of the samples was calculated using the formula;

$$\% \, Ash = \frac{\text{Weight of ash}}{Weight of sample} \times 100 \text{ (Geda } et \, al., 2015)$$

Crude Fat

Crude fat content was determined by the Soxhlet extract method. A 250ml round bottom flask was washed and dried at 105^0C for 30 minutes. It was allowed to cool at room temperature in a desiccator, and then weighed. Then 0.5g of dried sample was weighed, wrapped in a whatman filter paper and extracted in the extraction unit for 3 hours us ing petroleum ether as solvent. At the end of the extraction process, the ether was evaporated and the weight of the extraction flask recorded as the amount of fat extract.

$$\% \text{ Crude fat} = \frac{\text{Wt of ether extract}}{\text{Wt of sample}} \times 100 \text{ (Geda } et \, al., 2015)$$

Crude Protein

Crude protein content was determined using the Kjeldahl procedure. 0.5g of the sample was digested with 10ml of concentrated sulphuric acid (H_2SO_4) and Kjeldahl catalyst. This was heated under a fume cupboard for 45 minutes to obtain a clear light green colour solution. The digested sample was diluted to 100ml with distilled water. This was followed by distillation using boric acid indicator and 45% NaOH to neutralize the acid and consequent release of ammonia gas (NH_3). The distilled samples were titrated using 0.046N H_2SO_4.

$$\% \text{ N} = \frac{\text{Tr} \times \text{n} \times 14\text{g}}{\text{Wt of sample}}$$

$$\% \text{ Crude protein} = \% \text{ N} \times 6.25$$

Where **n** = number of sample,
Tr= sample titre,
14g= the molecular weight of Nitrogen and
6.25 = protein conversion factor.

Nitrogen Free Extract (NFE)

The nitrogen free extract content was determined by subtracting the percentage of moisture, protein, fat and ash from100. All determinations were in triplicates and the same was repeated for all the species and the values recorded.

$$\textbf{NFE} = \textbf{100}\% - \% \textbf{Moisture} + \% \textbf{Protein} \% \textbf{Fat}$$

Statistical Analysis

The data was analyzed using a one way ANOVA and Duncan's multiple range tests (95% confidence interval for mean) was used to compare the mean values of the samples and to avoid error inherent in performing multiple *t*-tests. Results were tested for statistically significant differences at the 0.05 significant levels. A completely randomized design (CRD) method was used.

Results

The proximate composition of the edible parts of the shellfishes is presented in Fig2. The result of the moisture content of the edible parts of the shellfish showed that *C. gasar* had the highest moisture content (76.6±0.18%) followed by *T. coronate* (74.1±0.15%) and *C. guanhumi* (71.8±0.09%) with a significant difference ($p<0.05$) while *T. fuscatus* (32.6 ± 0.05%) had the least. The result of ash showed a significant difference ($p<0.05$) between the shellfishes. *C.amnicola* (9.59±0.27%) record the highest ash content followed by *C. guanhumi* and *T. fuscatus* (0.87±0.04%) had the least value Fig2.

There was significant difference ($p<0.05$) among the five shellfishes in ash content. *C. amnicola* (1.86±0.98%) record the highest fat content followed by *C. guanhumi* and *C. gasar* while *T. fuscatus* (0.53±0.03%) consistently recorded the least value. The results of the crude protein content showed significant differences ($p<0.05$). *T. fuscatus* (64.2±0.04%) had the highest crude protein content followed by *T. coronate* and *C.amnicola. C. guanhumi* (17.47±0.14%) had the least crude protein content. The NFE content differed significantly ($p<0.05$) between four of the shellfish except *C. guanhumi* which was significantly different from others; none was recorded in *T. fuscatus, T. coronata, C.amnicola* and *C. gasar.*

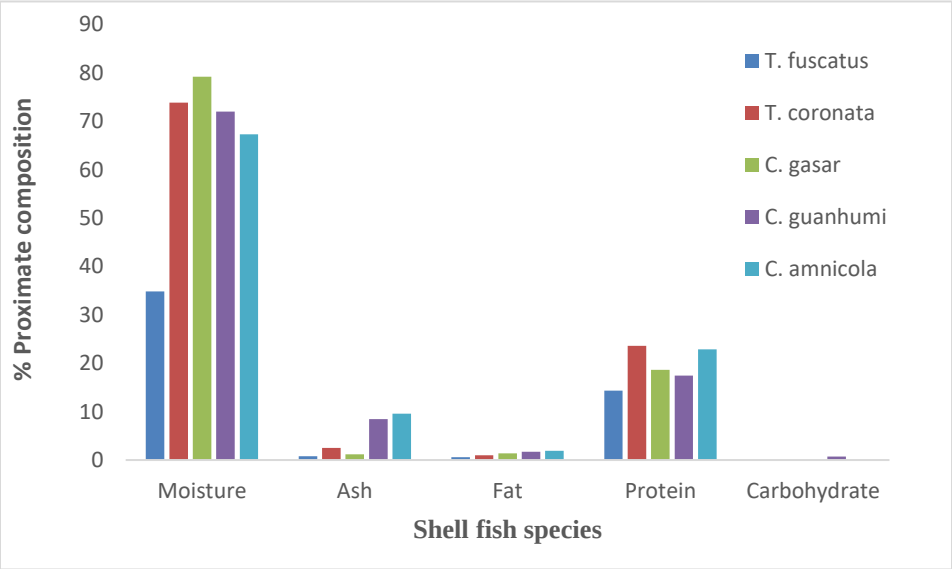

Figure 2. The mean values of the proximate composition (%) of flesh of the shell fishes from Buguma Creek

Discussion

The high moisture content in the flesh of the shellfishes may be as a result of the water from the interstitial flats where they tend to absorb water from the external environment into their cells, which are of higher concentration in order to balance the osmotic pressure between the cell and the surrounding environment. The results agree with earlier works reported by A.O.A.C (2005) on *Pachymelania aurita* and *T. fuscatus.* High moisture content in an organism is considered advantageous because of its contribution in the stabilization of the organisms during locomotion (Suzanne, 2002). Bukola *et al.,* 2006 stated that knowing the moisture content of an organism could help in the preservation of the qualities against the susceptibility to fungus infestation.

The difference in the value of the ash content could be attributed to the variation in the sizes of the organisms, salinity or seasonality of this environment. Bassey *et al.*,(2011) reported that the ash content of an organism can reflect the level of mineral concentration in that organism. The ash content of the flesh of the shell fishes was similar to the previous value range reported by Eddy *et al.*, 2004.

The percentage of fat recorded in this study shows that these shell fishes falls in the low fat class of organisms and *C. amnicola* had the highest fat content. Fagbuaro *et al.* 2013 reported in their study on quality analysis of *Cardisoma armatum and Callinectes amnicola* that the percentage of storage fat in crabs is influenced by environmental variables like temperature and fat plays a major role as food reserve along with protein. According to Nagab hushaman and Faroojii (1982), lipids are highly productive sources of energy which contain twice the energy of carbohydrates and proteins.

T. fuscatus recorded the highest percentage of crude protein. This compares favorably with what was recorded by Ogungbenle and Omowole, 2012 in *T. fuscatus.* This further agrees with their earlier findings that any diet containing periwinkle (*T. fuscatus*) will repair worn-out tissues and built the body. The high protein content in *T. fuscatus* also could be attributed to its omnivorous feeding habit.

There was a low NFE content in all the

shellfishes in this study. *C. guanhumi* recorded the highest and the result agrees with previous study by Omotoso, 2005 on the chemical composition and nutritive significance of the land crab, *Cardisoma armatum*. The low NFE content recorded in this study agrees with Ogungbenle and Omowole, 2012 who stated that NFE constitute only a minor percentage of the total biochemical composition of sea foods. However, the NFE of the shellfishes recorded in this study were lower than that reported by Ehigiator and Oterai. 2012. This difference could be attributed to the difference in the geological location of the aquatic environment, variation in the physico-chemical composition of the aquatic ecosystem (Udo and Vivian, 2012) and the physiological processes of aquatic life Cardoso *et al.*, 2009.

Conclusions

Generally, these shellfishes could be excellent sources of protein that may be low in carbohydrate and fat contents. Therefore, they can be used as substitutes for meat, finfish and as additive in animal feed formulation. They will be beneficial to human health and can aid important metabolic processes. All the five shellfish species from creek belong to a low fat group and are also low in NFE and therefore will not enhance obesity.

Recommendation

Consumption of any of these species of shellfishes from Buguma Creek should be encouraged as an alternative source of essential nutrients. This shellfish can improve the nutritional and health status of coastal region dwellers; provide gainful employment to the community and diversifying the aquaculture base of the region. Considering the enormous nutritional, commercial and industrial importance of these shellfishes, it is therefore recommended that pollution of the aquatic environment by anthropogenic activities and deforestation of the mangrove ecosystem should be discouraged because it serves as a home and a breeding ground of these shellfish culture and production. Lastly, mariculture of these shellfishes should be encouraged since there are prospects in their culture and has been carried out successfully in other parts the world.

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