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Proximate Composition of Edible Parts of Shellfishes from Okpoka Creeks in Rivers State, Nigeria

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Abstract: **The AOAC (2005) method was used to determine the proximate composition of the edible parts of the shellfishes from Okpoka creek.The results shows that all five shellfishes recorded high moisture content and their values were *T. fuscatus* (70.1±0.04), *T. coronate* (78.6±0.61) *C. gasar* (72.1±0.20), *C. guanhumi* (73.8±0.30) and *C. amnicola* (70.4±0.45) respectively. The ash content of the shellfishes showed no significant difference (p>0.05) between the five shellfishes. However, *C. guanhumi* (7.38±0.45%) recorded the highest value followed by *C. amnicola* (6.70±0.23) while *T. coronata* (2.08±0.75%) had the least value.The fat content of all the shellfishes from Okpoka Creek revealed significant differences (p<0.05) with *C. amnicola* (1.81±0.90%) recording the highest fat content while *C. gasar* (0.27±0.22%) recorded the least fat content.Moreover, there was significant differences (p<0.05) between the crude protein content of all five species of the shellfishes with *T. fuscatus* (23.7±0.36) recording the highest crude protein content followed by *C. gasar* (20.95±0.05%) while *T. coronata* (15.82±0.28%) had the least crude protein content.*T. coronata* (8.19±0.19%) recorded the highest carbohydrate content followed by *T. fuscatus* while *C. gasar* (0.66±0.25%) recorded the least carbohydrate content.The five shellfishes are good sources of protein, low in carbohydrate and fat contents.The variation in their nutritional composition could be attributed to the different environmental factors that governs their distribution and since all five shellfish species from this creek shows low fat content and low nitrogen free extract concentration, therefore, will be beneficial for lowering triglycerides which is the main fat-carrying particle in the bloodstream which will not enhance obesity too.**

Keywords: **Moisture, Fat, Ash Protein, NFE and Shell fish.**

1. INTRODUCTION

Shellfishes are highly balanced food that contain excellent sources of proteins, minerals and some vitamins, which belong to lower fats and cholesterol group [1]. [2] reported that the difference in nutritional composition could be attributed to species, region and environment. Shellfishes have been found to be a major source of protein to both riverine and the general population at large, as they occur abundantly in the brackish and fresh waters [3]. They also provide high quality protein with all the dietary- essential amino acids for maintenance and growth of the human body.

Shellfishes are of invertebrate animals such as periwinkles, rock snails, oysters and crabs which possess exoskeleton called shells which may be single or double over the body. There has been a lot of investigation into the proximate composition and fatty acid contents of food items [4]. The consumption and utilization of these natural resources for human needs has improved rapidly over time. In general, shellfishes which include Rock snail (*Thais coronata*), Mud-flat periwinkle (*Tympanotonus fuscatus*), Mangrove oyster (*Crassostrea gasar*), Marine crab (*Callinectes amnicola*), and Land crab (*Cardisoma guanhumi*) have been given credit for their health benefits.

Some shellfishes like the molluscs can be seen in shallow waters and sometimes in the inter-tidal zones where they burrow into sediments of the rivers. They are mainly algae and diatom feeders [5]. Periwinkle like other shellfishes has a high commercial value in the Niger Delta area of Nigeria. Their 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 (periwinkle, marine crab, oyster etc.) is scanty in Nigeria. The meat is domestically used 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 [6], by the people of the Niger Delta region of Nigeria. However, after consuming the soft flesh, their empty shells are often discarded around settlements as refuse, in spite of their plausible economic value [7].

The chemical and nutritious status of different species of shellfishes have been dealt with in various parts of the world [8]; [9]; [10]; [11]; [12]; [13]. However, information on the proximate composition of *Callinectes amnicola*, *Thais coronata*, *Tympanotonus fuscatus*, *Cardisoma guanhumi* and *Crassostrea gasar* is rare. This information will be useful to consumers in choosing shellfish based on their nutrient values.

2. MATERIALS AND METHODS

Collection site:

Okpoka Creek is one of the several adjoining creeks off the Upper Bonny River estuary in the Niger Delta. It lies between Latitude 4°47 North and Longitude 7°15 East and it is about 6 km long. It is strategically located at South-western flanks of Port Harcourt and Okrika in Rivers State. The Creek area is typically characterised by estuarine tidal water zone with little fresh water input but with extensive mangrove swamps, inter-tidal mud flats, and influenced by semi-diurnal tidal regime. Along the shores of the creek are located several establishments, the Port Harcourt Trans- Amadi Industrial layout, a slaughter market, the main Port Harcourt Zoological garden and several communities.

Collection of Samples:

The samples of the edible parts of the shellfishes were collected from the creeks. *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. The samples collected were preserved in an ice-chest before they were transferred to the laboratory for analysis.

Proximate Analysis:

Moisture:

Moisture content of the shellfish sample was determined by weighing two grams of each sample in moisture Can which was later kept in an air-current oven at a temperature of 105^{0}C for three (3) hours as described by [14]. The Can was then removed and cooled in a desiccator and the weight taken. This process was repeated until a constant weight was obtained. The difference in weight represented the moisture content.

$$\text{\% moisture content} = \frac{\text{Wt of Can + Sample after drying}}{\text{Initial Wt of Can +sample}} \times 100$$

Ash:

One gram of the shellfish 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 600^{o}C. 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;

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

Crude Fat:

The crude fat content was determined using the Soxhlet extract method. A 250ml round bottom flask was washed and dried at 105^{0}C 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 using 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.

$$\% \text{ Crude fat} = \frac{\text{Wt of ether extract}}{\text{Wt of sample}} \times 100$$

Crude Protein:

Crude protein content of each of the sample 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 a 0.046N H_2SO_4.

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

% Crude protein = % N x 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 [15]. All determinations were in triplicates and the same was repeated for all the species and the values recorded.

NFE = 100% - (% Moisture + % Protein % Fat + % Ash).

3. STATISTICAL ANALYSIS

The data was analyzed using a one way ANOVA and Duncan's multiple range tests 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 level.

4. RESULTS AND DISCUSSION

The proximate composition of the edible parts of the shellfishes from Okpoka creek is presented in Tables 1. From the results, *T. coronata* (78.6±0.61%) had the highest moisture content, followed by *C. guanhumi*, and *C. amnicola* while *T. fuscatus* (70.1±0.04%) had the least. It was observed that the different species of shell fish from the creeks recorded high moisture content (Table 1). The ash content of the shellfishes showed no significant difference ($p>0.05$) between the five shellfishes, however, *C. guanhumi* (7.38±0.45%) recorded the highest value followed by *C. amnicola* while *T. coronata* (2.08±0.75%) had the least value (Table 1). The fat content of all the shellfishes from Okpoka Creek revealed significant differences ($p<0.05$) with *C. amnicola* (1.81±0.90%) recording the highest fat content while *C. gasar* (0.27±0.22%) recorded the least fat content. No significant difference ($p>0.05$) was observed between the fat content of the different shell fishes from the two creeks (Table 1). There was significant differences ($p<0.05$) between the crude protein content of all five species of the shellfishes with *T. fuscatus* (23.7±0.36) recording the highest crude protein content followed by *C. gasar* (20.95±0.05%) while *T. coronata* (15.82±0.28%) had the least crude protein content (Tab.1). The result from the nitrogen free extract content of shellfish revealed that there was significant difference ($p<0.05$) between them. *T. coronata* (8.19±0.19%) recorded the highest NFE content followed by *T. fuscatus* while *C. gasar* (0.66±0.25%) recorded the least (Table I).

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TABLE 1: The mean values of the proximate composition (%) of flesh of the shell fishes from Okpoka Creek

Species	**T. *fuscatus***	***T. coronata***	***C. gasar***	***C. guanhumi***	***C. amnicola***
Moisture %	70.1 ± 0.04^{d}	78.6 ± 0.61^{a}	72.1 ± 0.20^{c}	73.8 ± 0.30^{b}	70.4 ± 0.45^{d}
Ash %	2.73 ± 0.12^{d}	2.08 ± 0.75^{d}	5.72 ± 0.25^{c}	7.38 ± 0.45^{a}	6.70 ± 0.23^{b}
Fat %	1.16 ± 0.36^{b}	1.32 ± 0.35^{b}	0.27 ± 0.22^{c}	0.97 ± 0.50^{b}	1.81 ± 0.90^{a}
Crude protein%	23.7 ± 0.36^{a}	15.82 ± 0.28^{e}	20.95 ± 0.05^{b}	16.05 ± 0.69^{d}	19.12 ± 0.81^{c}
NFE %	2.94 ± 1.02^{b}	8.19 ± 0.19^{a}	0.66 ± 0.25^{c}	2.41 ± 1.74^{bc}	2.02 ± 0.62^{bc}

** In each row, mean with a common letter are not significantly different (P>0.05).*

The moisture content in the flesh of *C. gasar*, *T. coronata C. guanhumi*, *T. fuscatus* and *C. amnicola* from and Okpoka Creeks were found to be high although *T. coronata* had the highest content of moisture followed by *C. guanhumi*. The high moisture content in their flesh could be be attributed to the quantity of water from they absorb from the external environment into their cells which are of higher concentration in order to balance the osmotic pressure in their cells and the surrounding water. This results agree with earlier works reported by [16] on *Pachymelania aurita* and *T. fuscatus*. High moisture content in an organism is advantageous because of its contribution in the stabilization of the movement of organisms [17]. [18] stated that knowledge of the moisture content in an organism could give a useful information to aid preservation of the qualities and susceptibility to fungi infection.

C. guanhumi had the highest ash content. However, the difference in the ash content could be as a result of the difference in the sizes of the shellfishes, seasonal change of their environment and the salinity. [17] and [19] stated that ash content in an organisms shows the mineral concentration in that organism. The ash content of the flesh of the shell fishes was similar to the previous range reported by [20].

From the study, the concentration of fat recorded shows that these shellfishes belong to the low fat class of organisms. However, *C. amnicola* had the highest fat content. The percentage storage of fat in crabs depends on periodic change that is influenced by environmental variables like temperature [21]. Fat plays a major role as food reserve along with protein. According to [22], lipids are highly productive sources of energy which also contain twice the energy of carbohydrates and proteins.

The concentration of crude protein in *T. fuscatus* was higher in both creeks although *T. fuscatus* from Buguma recorded the highest crude protein content. The protein content of *T. fuscatus* compares favourably with what was recorded by [23] on the same species. This further agrees with earlier findings that any diet containing periwinkle (*T. fuscatus*) will act as repairs of worn-out tissue and body builder [23]. The high protein content in *T. fuscatus* could be attributed to its omnivorous feeding habit.

The nitrogen free extract concentration in the flesh of the shellfishes were low with *C. guanhumi* recording the highest. The results agree with a previous study carried out by [24] on *Macrobrachium vollenhovenii* and *T. fuscatus*. The low nitrogen free extract content recorded in this study agrees with [22] and [24] who reported that nitrogen free extract constitute only a minor percentage of total biochemical composition of most sea foods. However, the nitrogen free extract content of the shellfish recorded in this study was lower than that reported by [9] and [25]. This difference could also be attributed to the difference in the geological location of the aquatic environment since variation of water quality influences the physico-chemical composition of the ecosystem [25] and their physiological processes [27].

5. CONCLUSION

These shellfishes are good sources of protein, low in carbohydrate and fat contents. The variation in nutritional value of the shellfishes could be attributed to the difference environmental factors and the anthropogenic activities around the Okpoka Creek. They could be used as substitutes for finfishes, meat and animal feed formulation. They could be beneficial to humans as catalyst for metabolic processes, as food for man and farmed animals. Since all five shellfish species from this creek belong shows low fat content and low nitrogen free extract concentration, they will not enhance obesity when consumed and would help to prevent nutritional deficiencies.

6. RECOMMENDATION

Consumption of these five species of shellfishes from Okpoka Creek is recommended and should be encouraged as it provides a good source of essential nutrients at a lower cost. This can also enhance the nutritional and health status of the people living around this coastal area by provide high quality protein with all the dietary-essential amino acids for the maintenance of their boy and growth. It can also provide gainful empowerment to the community and diversifying the mariculture base of the region. Finally, the culture of these shellfishes should be encouraged around this region since they have good prospects and has been successfully cultured in other parts the world.

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