



# **Comparative Study on the Biochemical Composition of the Flesh of *Egeria radiata* (Bivalvia: Donacidae) and *Crassostrea rhizophorea* (Percypode: Lameillebrachia) of the Cross River State, Nigeria**

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## **Author's contribution**

*The sole author designed, analyzed, interpreted and prepared the manuscript.*

## **Article Information**

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## **ABSTRACT**

The food and mineral contents of flesh of the two bivalve species (*Egeria radiata* and *Crassostrea rhizophorea*) of Cross river, Nigeria were investigated. The study revealed that the moisture content of *E. radiata* and *C. rhizophorea* was 52.46% and 54.01%, crude protein was 24.37% and 20.49%, fat was 9.03% and 14.22%, crude fibre was 0.01% and 1.30%, ash was 1.43% and 9.05%, carbohydrate was 12.7% and 2.23% and energy was 229.58J and 218.84J. The mineral content of *E. radiata* and *C. rhizophorea* showed a significant difference ( $P < 0.05$ ) in Ca<sup>+</sup>, Na<sup>+</sup>, K, Mg, while the Zn, Pb, Cu, Fe, P and Mn were similar ( $P > 0.05$ ). Based on the findings of this study, biochemical profile of *E. radiata* is high in nutrients and is suitable for human consumption. Therefore, concerted efforts should be made to enlighten the populace on the increased nutritional benefits of consuming *E. radiata*.

**Keywords:** *Egeria radiata*; *Crassostrea rhizophorea*; food value; mineral content.

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## 1. INTRODUCTION

Nigeria is among the protein and minerals deficient nations in the world. A sufficient amount of dietary protein, required for survival, growth and development, reproduction and maintenance of good health, is in short supply in the country. To salvage this situation, shellfish can serve as an alternative source of proteins and minerals for human [1] and [2].

Bivalves are one of the most nutritive shellfish resources in the world; they are used in several ways as a source of food for mankind [3]. Bivalve mollusks like mussels, clams and oysters constitute highly nutritive seafood with an increasing demand and source of income in international markets [4] and [5]. Shellfish meat has been recommended in several dietary regimes for their protein content, low caloric values, low fat/cholesterol profile and lower proportion of saturated fat, the presence of good lipids, significant amounts of omega-3-fatty acid, dietary essential amino acids such as iron, zinc and copper has been reported Krzynowek et al. [6] and Dong MF [7].

Oyster is the common name applied to various bivalve mollusks, and in particular the "true oysters" comprising family Ostreidae of the Ostreoida order and the pearl oysters of family Pteriidae (syn. Aviculidae) in the Pterioidea order. The shell of oysters consists of two usually highly calcified valves (shells) that surround a soft body. Gills filter plankton from the water, and strong adductor muscles are used to hold the shell closed. Most oysters live in marine habitats or brackish water and are widely distributed in shallow, warm, coastal waters of the world's oceans [8]. As filter feeders, oysters are known for their role of filtering and removing pollutants and nutrients, such as nitrogen, from water, however, some species of oysters are popular in Nigeria that includes *Ostrea* species, *C. rhizophora* species and *Saccostrea* species [9].

There is paucity of the knowledge especially of the nutritional values of *E. radiata*, so consumption of these nutrient-rich molluscs is restricted to communities to communities situated along coastal States. Hence, there is a need to determine nutrient compositions of clams with the view of creating awareness on the nutritional benefits of consuming them.



Fig. 1. Picture of clam (*Egeria radiata*)



Fig. 2. Image of *Crassostrea rhizophorea*

## 2. MATERIALS AND METHODS

### 2.1 Collection and Preparation of Samples

Freshly caught *E. radiata* and *C. rhizophorea* were purchased from the watt market, Calabar, Cross river state. They were taken to Central Laboratory, Faculty of agriculture, University of Calabar for proximate indices.

### 2.2 Treatment of Sample

The two species; *E. radiata* and *C. rhizophorea* were open to extract the flesh from the shell. They were washed properly with clean water. Later some pieces were weighed in an electronic balance to determine the moisture contents. They later dried in an oven for about 75°C for 10 hours, thereafter for further blending to powder from where there proximate composition was analysed for protein, moisture, fat, crude protein, moisture, fat, crude fibre and ash and the mineral composition were determined by spectrometry method for calcium, magnesium, phosphorus, iron and manganese.

## 2.3 Laboratory Analysis

Proximate composition including ash, crude protein, fat and moisture content were determined by methods of Association of official Analytical Chemist (2000). Milled samples were prepared for amino acid determination by acid hydrolysis using 6 N HCl for 24 hours at 110°C in vial under vacuum and 2 N atmospheres. The sample solution was evaporated and dissolved in sodium citrate (Na<sub>3</sub>C<sub>6</sub>H<sub>5</sub>O<sub>7</sub>) buffer pH of 2.2 according to Na et al. (1986). The following elements calcium, magnesium, sodium, potassium, zinc, were determined by the methods recommended by AOAC [10].

## 2.4 Statistical Analysis

The data obtained were subjected to one way analysis of variance laid in a completely randomized design in triplicates. Significantly different treatment means were separated by Duncan Multiple Range Test at 5% probability level.

## 3. RESULTS

### 3.1 Food Value and Mineral Content of *E. radiata* and *C. rhizophorea*

Table 1 shows the proximate composition of *E. radiata* and *C. rhizophorea* flesh. The moisture content of *E. radiata* flesh was 52.46% and 54.01% for *C. rhizophorea* flesh. Crude protein value of *E. radiata* was 24.37% and 20.49% for *C. rhizophorea*. Fat content was 9.03% for *E. radiata* and 14.22% for *C. rhizophorea*. Crude fibre of *E. radiata* was 0.01% and 1.30% for *C. rhizophorea*. Ash content of *E. radiata* was 1.43% and 9.05% for *C. rhizophorea*. Carbohydrate for *E. radiata* was 12.7% and 2.23% for *C. rhizophorea*. Energy for *E. radiata* was 229.58J and 218.84J for *C. rhizophorea*. The moisture, protein, fat, ash, carbohydrate and energy (Calories) shows a significant difference ( $P < 0.05$ ) in both species while the crude fibre of the flesh of both species was smaller ( $P > 0.05$ ) (Table 1).

The mineral content of *E. radiata* flesh and *C. rhizophorea* shows the significant difference ( $P < 0.05$ ) in Ca<sup>+</sup>, Na<sup>+</sup>, K, Mg, while in Zn, Pb, Cu, Fe, P and Mn were similar ( $P > 0.05$ ) (Table 2).

## 4. DISCUSSION

Biochemical studies in nutrition are important. This is known to vary with season, size of the

animal, stage of maturity, temperature and availability of food. Protein, carbohydrates and lipids are essential for body growth and maintenance [11]. Protein is essential for the sustenance of life and exists in largest quantity of all nutrients as a component of the human body [12]. Molluscs or bivalves contain a high amount of protein ranging from 40-78% [13]. The fat content of *E. radiata* and *C. rhizophorea* is higher than the finding of Eghiator and Akise [13] but lower than the finding of Amanda et al. [14] who reported that the lipid content ranges from 15.0% to 23.6% in *Hemifusus pigilinus*. Since ash is a measure of the mineral content of any food, the higher mineral content in *C. rhizophorea* shows the richness of food items in elemental composition [15]. The flesh of *E. radiata* and *C. rhizophorea* was 229.58% and 218.84%. However, FAO [16] reported that oyster are lower in energy value when compared to other species of bivalves. The low energy value may be attributed to high current in some fresh water which oyster lost high amount of energy to overcome current action. Mineral is a chemical element required as an essential nutrient by organisms to perform functions necessary for life [17].

Shell fish especially bivalves like clam and oyster are known to be good source of calcium [18,19]. In this study calcium content in *C. rhizophorea* flesh was higher than the calcium content of *E. radiata*. However the calcium level in the flesh of *C. rhizophorea* and *E. radiata* was within the FAO recommended value of 19.881 mg per 100 g. The sodium concentration level in the flesh of both species was observed to be lower than the FAO recommendation of 30-134 mg per 100 g. The low concentration in the in the flesh of *E. radiata* and *C. rhizophorea* does not reinforce its place as good for muscle functioning source. Zinc values in this were lower than 0.23 – 21 mg/100 g recommended by FAO [20]. The low concentration does not reinforce its place as good source to ameliorate stunt growth in Children. Potassium composition of the two species fall below FAO recommended range of 30 – 134 mg/100. The relatively low value of potassium composition in this present study further suggests the low concentration of potassium in Calabar Estuary. Magnesium concentration in *E. radiata* range was within the FAO range of 4.5 -452 mg per 100 g while *C. rhizophorea* was lower than the FAO range.

**Table 1. Proximate composition of *E. radiata* and *C. rhizophorea* flesh. Dry sample of the Cross river, Nigeria (%)**

Source	Moisture	Protein	Fat	Crude fibre	Ash	Carbohydrate	Energy
<i>E. radiata</i>	54.46±0.15 <sup>a</sup>	24.37±0.15 <sup>a</sup>	9.03±0.02 <sup>a</sup>	0.01±21 <sup>a</sup>	1.43±0.21 <sup>a</sup>	12.7±1.53 <sup>a</sup>	229.58±58 <sup>a</sup>
<i>C. rhizophorea</i>	54.46±0.02 <sup>b</sup>	20.49±0.05 <sup>b</sup>	14.2±0.16 <sup>b</sup>	1.30±0.26 <sup>a</sup>	9.05±0.04 <sup>b</sup>	2.23±0.18 <sup>b</sup>	218.84±0.97 <sup>b</sup>

\*column with different alphabet are significantly different

**Table 2. Mineral composition of *E. radiata* and *C. rhizophorea* flesh in cross river, Nigeria (Mg/100 g)**

Parameters	<i>E. radiata</i>	<i>C. rhizophorea</i>
Calcium	28.53±0.38 <sup>a</sup>	36.37±0.21 <sup>b</sup>
Sodium	3.05±0.03 <sup>b</sup>	2.43±0.04 <sup>a</sup>
Zinc	0.16±0.02 <sup>a</sup>	0.30±0.05 <sup>b</sup>
Lead	0.08±0.04 <sup>b</sup>	0.11±0.05 <sup>a</sup>
Copper	0.08±0.07 <sup>a</sup>	0.05±0.03 <sup>b</sup>
Potassium	4.06±0.05 <sup>a</sup>	5.17±0.03 <sup>b</sup>
Magnesium	15.29±0.27 <sup>a</sup>	18.3±0.26 <sup>b</sup>
Phosphorus	0.07±0.04 <sup>b</sup>	0.11±0.04 <sup>a</sup>
Iron	0.61±0.05 <sup>a</sup>	0.58±0.02 <sup>a</sup>
Manganese	0.05±0.03 <sup>b</sup>	0.08±0.05 <sup>a</sup>

\*column with different alphabet are significantly different

## 5. CONCLUSION

*E. radiata* and *C. rhizophorea* is an excellent source of nutrient with sufficient amount of substances that facilitate body repairs, rapid growth and good health of mankind, these substances include; moisture, protein, fat, crude fibre, carbohydrates and ash which serve as diet when digested and assimilated. The result in this study shows nutrient (proximate composition) present in two (2) preventative states i.e *E. radiata* and *C. rhizophorea* flesh as the high level of carbohydrate in this work also confirms the fact that this bivalve and oyster flesh are rich sources of carbohydrates and may be used as energy given food in time of stress. Since *E. radiata* and *C. rhizophorea* are good sources of animal protein and minerals, accelerated research should be carried out on how to effectively culture these two species in commercial quantities for the development of Nigeria's economy.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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