PROXIMATE COMPOSITION AND MINERAL CONTENT OF THE LAND CRAB *SUDANONAUTES AFRICANUS*

BY

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ABSTRACT

The proximate and valuable minerals were determined in freshwater crabs. Samples were collected from male and female exoskeleton, flesh and whole body. The samples were subjected to proximate analysis using methods recommended by the Association of Analytical Chemists (AOAC) and with the aid of spectrophotometer for the determination of the mineral content of the crabs. The results showed that in the exoskeleton samples, crude protein was the highest in the male with value of 39.84±0.25% while in the flesh samples, carbohydrate was the highest in the male with 41.59±0.27% and in the whole body sample, and carbohydrate was the highest in the female whole body with 54.89±0.52%. Nine minerals were analyzed. *Sudanonautes africanus* was found to be rich in Sodium, Potassium, Calcium, Magnesium, and Phosphorus. *Information* on the nutrient composition of *S. africanus* is needed to encourage the processing, utilization and marketing of this commonest species of West Africa. Nutritive values recorded in this *S. africanus* suggest that the species could be employed as an alternative dietary supplement of protein and minerals.

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INTRODUCTION

Crabs which are the basic components of the ecosystem are the most advanced members of the phylum Arthropoda. The freshwater crabs of Nigeria are true crabs which can be distinguished from false crabs by not having 5th pair of the pereiopods totally or partly concealed beneath the carapace, the antennae were always placed between the inner margin of orbit and fused Pterygostomial region with endotome (Ingle, 1983). True crabs belong to the Suborder Brachyura of order Decapoda under Class Crustacea. It shows the greatest size range of all arthropods such as observed in lobsters, prawns, crayfishes, shrimps, hermit crab and true crabs (Yoloye, 1988).

Crabs are widely distributed in the tropical and temperate regions of the world. Literature information is scarce on the food values of most edible crabs in West Africa despite the richness of these gastropods. Most people rate the fish higher in preference to crabs which are considered inferior and food for the low income earners. Over 100 species of crabs are known Worldwide with two species - *Sudanonautes africanus* and *Cardisoma armatum* readily known to exist with economic value in West Africa; the mudcrabs (*Sudanonautes africanus*) found in estuaries and mangrove. *S. africanus* inhabits cracks and holes when fully matured and as small individuals are found under rocks in the littoral zone. They are highly exploited but only their fleshes are consumed (Ojewole and Udom, 2005, Jimmy and Arazu, 2012). Animal protein is very vital in the diet because of the various functions it performs. Fish, beef, pork and poultry products are some of the good sources of animal protein which are used for the growth and repair of body tissues (Ramalingam, 2001). In developing countries, the high cost of these highly valued animal proteins (i.e. fish, beef, and poultry) has made it impossible for the less privilege to eat them. However, lesser valued animal such as crabs may be used to cater for the protein needs of the less privileged people (Omotoso, 2005).

Nutritive values of different crab species have been previously investigated in various parts of the world (Gates and Parker, 1992, Lee et.al, 1993, Perry, et.al.2001, Skonberg and Perkins, 2002, Omotoso, 2005, Adeyeye et.al., 2010).
Very limited data are available on the biochemical composition of freshwater crabs in Nigeria especially the *Sudanonautes* species (Adeyeye, 2008 and Adeyeye, *et.al.* 2010). Crabs are known to be good sources of Omega 3-polyunsaturated fatty acids and other valuable essential foods such as protein, carbohydrate, ash, and energy (Broughton *et.al.*, 1997). Crabs are reported to be prominent sources for the provision of essential macro and micro elements such as potassium, phosphorus, calcium, magnesium, copper, iron, manganese, and zinc. Crabs are known to possess fewer calories than beef, pork and poultry (Carter and Chung, 1999, Adeyeye *et.al.* 2010, Adeyeye, 2008). According to Carter and Chung, (1999); a 100gm portion of crabs is reported to contain 0.7gm saturated fat and 76 calories while 100gm of beef contained 66.9gm and 225 calories. This study provides information on the food nutrients in crabs collected from Ifaki- Ekiti, Ekiti State, Nigeria. It is expected that the results of this study will provide awareness concerning the nutritional value of *S. africanaus* and the need to use the species as food for human, food supplement and suitable alternative for fishmeal in animal production.
MATERIALS AND METHODS

SOURCE OF MATERIALS

*Sudanonautes africanus* samples were collected from the bank of river Oniyo, Ifaki –Ekiti, Ekiti State, Nigeria toward the end of raining season in the year 2012. The samples were transported to the laboratory immediately for analyses. In the laboratory, the samples were washed thoroughly with tap water to exclude contaminants. They were later separated into sexes. Three pieces of complete and matured fresh crabs of each sex were selected from total collections of 30 crabs. Two whole crabs (of each sex) were grouped into three main parts (Exoskeleton, flesh, whole body). The internal organs were discarded; the other separated parts were oven dried at 105°C. The crabs were separated into parts namely carapace and cheliped exoskeleton and muscle from the thoracic sterna and cheliped referred to as flesh and the whole body constitute the cheliped with muscle and exoskeleton, carapace, thoracic sternum and the other four pairs of walking legs. All were oven dried. The whole body, exoskeleton and flesh samples were blended.

PROXIMATE ANALYSIS

The proximate compositions of the samples were determined using the methods recommended by the Association of Analytical Chemists (AOAC, 2000). Protein content was analyzed by the use of Micro-Kjeldahl apparatus and moisture by the difference in weight between wet weight of the sample and weight of the sample after drying. Fat was determined by Soxhlet extraction while the ash content was calculated after samples were ignited at 550°C. The carbohydrate content was estimated by subtracting the sum of the weight of protein, fibre, and ash from the total dry matter. All determinations were done in duplicates. Student t-test was applied to compare the results obtained from males and females of *S. africanus* statistically.
MINERAL ANALYSIS

The mineral compositions of the samples were determined by the Spectrophotometry using different wavelengths as follows: for iron at wavelength 420nm, calcium at 48nm, sodium at 380nm, nitrate 320nm, while phosphates, magnesium and copper were read at 420nm, 568nm and 62nm respectively. These results were expressed in mg/100gm of specimen respectively.
RESULTS AND DISCUSSION

The results of proximate analyses of male and female exoskeleton, flesh and the whole body of *S. africanus* are shown in table 1. The crude protein averaged 14.91± 0.52 in the female exoskeleton to 39.84±0.25 in the male exoskeleton. The values of the protein in the male were greatly higher than that of the female in all the samples. The crude protein of the male exoskeleton, flesh and whole body are similar to value reported for *Sudananateus africanus africanus* by Adeyeye *et al.* (2010) but higher than the value of 18.81±0.09-19.555±0.001 reported for *Callinectes sapidus* by Aygul *et al.* (2006), 33.3±1.20 and 14.80-17.35 reported on *Cardisoma armatum* and *Paratelphusa eduntula* by Omotoso (2005) and Nabanita (2012) respectively. The variations in the values of protein among these species of crabs may relate to species specificity. The high content of crude protein in *Sudanonates africanus* support earlier findings that crab meat can supply sufficient protein and energy in diet and that crab protein is essential for growth, development and body defense as reported by Adeyeye (2010), Gates and Parker, (1992). Researches revealed that crabs are useful in the transportation of gas, building of organ components and in water and metabolic regulation of organisms (Ackman and Mcleod, 1989).

The crude fat content was higher in male exoskeleton (4.24±0.02) than those obtained on flesh and wholebody of both male and female samples. The distribution of fat in the exoskeleton, flesh and whole body was similar to the results obtained by Adeyeye *et al.* (2010) on *S. africanus africanus*. It is also similar to the observation in the shell and flesh of *Penaeus notabilis* (Adeyeye, *et al.* (2008). Crabs are reported to show low calories than beef,pork and the poultry (Broughton *et al.*,1997). The fat content record for exoskeleton, flesh and whole body in both male and female were low compared to the values obtained on crab *Cardisoma armatum* (5.35±0.01) by Omotoso (2005) and waxworms, *Galleria mellonella* by Pennino *et al.* (1991), but greater than the 0.002±0.001% and 1.020±0.002% recorded on *Callinectes amnicola*, by Moronkola *et al.* (2011). Fats are known to be essential in the diets as they increase the palatability of foods by absorbing and retaining their flavors. Fats are also important in the structural and biological functioning of the cells. It helps in the transportation of nutritionally

The ash content of *Sudanonautes africanus* is an indication of the mineral concentration in the organism. The ash concentration ranged between 4.55±0.01% in the male exoskeleton to 14.92±0.03% in the male whole body. The values reported here are similar to the values (4.60 in male exoskeleton to 14.92% in whole body) reported by Adeyeye *et al.* (2010) on *Sudananautes africanus africanus*. The result of this study on ash content is greatly lower than the values of 42.23± 0.02% and 1.40±0.178%-50.87± 10.01% reported on *Cardisoma armatum* and *Callinectes amnicola* and *Uca tangeri* by Omotoso (2005) and Jimmy and Arazu (2012) respectively. The ash content determines mineral concentration of the species. The species may not be able to supply all the needed minerals in the body of man.

The fibre contents of the female flesh averaged 2.31±0.01% while it was 11.09±0.01% in the female exoskeleton. Fibre is known for the absorption of water as well as in the provision of assistance to food miller during transit in the alimentary system (Krzynowek et al., 1982).

The moisture content of *S. africanus* ranged between 8.21±0.01% in the female exoskeleton and 11.14±0.02% in the male exoskeleton. This may be an advantage as regard the shelf-life of the crab’s meat

Carbohydrate averaged 33.85± 0.25% in the male exoskeleton while it averaged 57.89±0.28% in the female flesh. The implication of the value of carbohydrate on the flesh of the female is that the crab flesh consist the traces of glucose, fructose, sucrose and other mono and disaccharides (Okuzumi and Fujii, 2000).

The mineral composition of *S. africanus* is shown in the table 2. Total numbers of nine minerals were analyzed. For exoskeleton and flesh samples, Na, K, Ca, and Mg were more concentrated in the female than the male. In the whole body sample, Na, K, Ca, Mg, Zn and Fe were more concentrated in the male than the female. Also, in the table, Fe, P were concentrated in the male exoskeleton, flesh
and whole body samples. Mn was more concentrated in the female exoskeleton and whole body samples.

Phosphorus (P) recorded the highest value of 265.21/100g in the female whole body sample while female flesh had the least value (158.20/100g. Phosphorus was distantly followed by potassium with the highest value in female flesh (38.73/100g). Na, K, Mg, Fe and Mn were predominant elements in the flesh of both male and female. Cu was not detected. The concentration of minerals of male and female crab samples can be influenced by a number of factors such as seasonal and biological differences such as size, age, sex, and sexual maturity, but; the samples for this research work are adult crabs. Also, food sources and environmental factors such as water parameter also influence the concentration of minerals in male and female crab samples.

*S. africanus* is rich in trace elements thus it would be desirable for healthy functioning of the body and as good supplements in food of those with deficiencies. It could as well be used as additives in animal feed production and a possible replacement to fishmeal.
REFERENCES


Line 282-284 (KINDLY REMOVE THIS REFERENCE)


Table 1: Proximate Composition (g/100g) of the exoskeleton, flesh and whole body of male and female freshwater crabs (dry weight)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Exoskeleton</th>
<th>Flesh</th>
<th>Whole body</th>
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<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
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<tr>
<td>Crude Protein</td>
<td>39.84±0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.91±0.52&lt;sup&gt;b&lt;/sup&gt;</td>
<td>32.68±0.25&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>Crude Fat</td>
<td>4.24±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.36±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.29±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>Total ash</td>
<td>4.55±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.22±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.42±0.14&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Crude fibre</td>
<td>6.39±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.09±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.06±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>Moisture</td>
<td>17.14±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.21±0.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.98±0.03&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Carbohydrate</td>
<td>33.85±0.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>57.24±0.54&lt;sup&gt;a&lt;/sup&gt;</td>
<td>41.59±0.27&lt;sup&gt;b&lt;/sup&gt;</td>
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</table>

Note: Mean values in the same row but with different superscript were significant different (P ≤ 0.05)

ME (Male Exoskeleton), FE (Female Exoskeleton), MF (Male Flesh), FF (Female Flesh)

M(WB) (Male Wholebody), F(WB) (Female Wholebody)

<sup>a</sup> and <sup>b</sup> (Statistical difference at 0.05 level of Probability)
Table 2: Mineral composition (mg/100g) of the exoskeleton, flesh and whole body of male and female freshwater crabs

<table>
<thead>
<tr>
<th>Parameter</th>
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<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
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<td></td>
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<tr>
<td>Na</td>
<td>18.10</td>
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<td>K</td>
<td>20.33</td>
<td>22.52</td>
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<td>Ca</td>
<td>22.15</td>
<td>23.56</td>
<td>23.52</td>
<td>28.68</td>
<td>34.11</td>
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<td>Mg</td>
<td>21.65</td>
<td>22.35</td>
<td>30.20</td>
<td>29.52</td>
<td>28.52</td>
<td>23.45</td>
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<td>Zn</td>
<td>5.31</td>
<td>5.22</td>
<td>8.14</td>
<td>8.02</td>
<td>9.87</td>
<td>7.83</td>
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<tr>
<td>Fe</td>
<td>8.36</td>
<td>5.69</td>
<td>12.30</td>
<td>8.12</td>
<td>9.76</td>
<td>8.03</td>
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<td></td>
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<tr>
<td>Cu</td>
<td>ND</td>
<td>ND</td>
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<td>ND</td>
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<td></td>
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<tr>
<td>Mn</td>
<td>0.49</td>
<td>0.62</td>
<td>1.22</td>
<td>0.74</td>
<td>0.41</td>
<td>0.82</td>
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<td>P</td>
<td>237.03</td>
<td>182.00</td>
<td>170.11</td>
<td>158.20</td>
<td>250.12</td>
<td>265.21</td>
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ND = Not detected