

The chemical properties of the African match box crab, *Pachygrapsus transversus* (Gibbes, 1850) of lower river Niger at Anambra State, Nigeria

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Abstract: The proximate composition and the contents of some important minerals in the box crab, *Pachygrapsus transversus* were studied in fresh and dried specimens. Numerical Values determined for moisture, ash and carbohydrates in the fresh individuals were higher than those measured in the dried samples. Similarly, protein and fat values in the dried specimen were higher than those determined in the fresh samples. Generally, the values 13.94%, 13.94% and 1.32% determined as moisture, ash and carbohydrate in dried samples were lower than those obtained in the fresh components. The concentration of sodium and calcium were 591.00mg/100g and 213.50mg/100g in fresh *Pachygrapsus transversus* while the values of iron, zinc and phosphate in the dried samples were higher. The nutritional implication of these differences in the proximate composition and mineral content of the *Pachygrapsus transversus* (dried and fresh) were discussed.

Keywords: Crab, Chemical Properties, Fresh, Dried, Lower Niger River

1. Introduction

Interest in the consumption and study of crab date back over 200 million years: Dixon, 2003; FAO, 2006. It has remained one of the oldest species on earth and literally a living fossil: Morrison, 2002. Crabs make up 20% of all marine crustaceans caught, farmed and consumed worldwide, with an estimated 11.2 million tones of it being consumed worldwide, annually: Donaldson & Cullenberg, 1999; Cohen, 2006. Its biology, reproduction, behaviour and cultural importance have been extensively reported: Voss, 1980; Abele *et al*, 2008; Donaldson & Cullenburg, 1999; Andrea, 2006; Hemmi *et al.*, 2008; Sammy, 2009. Crabs are known to contain variety of nutrients which are nutritionally healthy for human consumption. Crab helps in the supply of protein. Its lipid content is basically in the form of triglycerides or triacylglycerols. Crabs are also rich in vitamins A, C, B₆, thiamine, riboflavin, niacin, panthothenic acid with small amounts of folate and vitamin

B₁₂, small quantities of calcium, iron, copper, zinc, phosphorous and potassium: Valverde, 2000; Oduro *et al*, 2001; Murphy, 2003; Udo & Arazu, 2012. Studies on crab have also shown that about one-third of an adult edible crab consists of meat which are prepared, sauced and served in different forms in different parts of the world. Incidentally, Nigeria remains backward in meeting up with her protein and mineral requirements: Rowland, 1996; Ozean & Akyurt, 2006. They are common during onset of rainy season and are found chiefly in marine or freshwater, land and in holes along river bank: Ackman *et al*, 1989. *Pachygrapsus transversus* has a wide geographical range including the West Africa, Nigeria, Niger Delta, mangrove swamps, estuaries, lagoons in freshwater, rivers, streams, caves: Christiansen, 1969; Amadi, 1990; FAO, 2006. Although this species is not commonly seen, it has remained the crab of choice for most crab consumers

within and outside the community where it was obtained. The literature about this species has been sparse. Hence, this research is aimed at ascertaining the nutritive value of fresh and dried specimens of *Pachygrapsus transversus* (African match box crab) obtained from this locality.

2. Materials and Methods

2.1. Sample Collection

The adult specimens (*Pachygrapsus transversus*) were collected from artisanal fishermen. Most of these peasant fishermen live close to the swampy shore-banks of these River Niger tributaries, Oraifite town in Ekwusigo Local Government Area of Anambra State, Nigeria.

2.2. Processing of Sample

The fresh specimens were weighed ground to paste and stored under refrigeration. While the specimens for the dried evaluation were heated to dryness in electrically heated oven at 100°C for one hour to obtain the dried individual.

2.3. Proximate Analysis

These were determined on the fresh and dried samples of *Pachygrapsus transversus*. Each group were analyzed three times using the methods in AOAC, 1990. The analysis was made in Chukeze Analytical Laboratory Services, Ltd. Awka, Anambra State, Nigeria. The sample was variously digested and homogenized accordingly prior to the determination of the extracted components. Protein was determined for the fresh and dried specimens using micro-Kjedahl distillation method; carbohydrate was estimated as the Nitrogen-Free Extract (NFE) while the fat, ash and moisture determinations in the fresh and dried specimens were analysed using Association of Official Analytical Chemists (AOAC, 1990) methods. Similarly, the fresh and dried (3 samples each) specimens were variously evaluated for some minerals. The extracts were digested, and readings noted using the Atomic Absorption Spectrophotometer set at appropriate wavelengths. The minerals analysed were iron, zinc, calcium and phosphate. The results were expressed in mg/100gm of specimen, respectively.

2.4. Results and Discussion

The result of the proximate and mineral composition of *Pachygrapsus transversus* are displayed in Tables 1 and 2 respectively. The result revealed a higher moisture level in the fresh (56.57%) than the dried (13.94%) specimen of *Pachygrapsus transversus*. In this study, the moisture content in fresh sample is lower than similar values previously reported: $79.0 \pm 0.7\%$ for *Carcinus maenas*; Skonberg & Perkins, 2002, 97.1 ± 0.4 to $82.30 \pm 0.5\%$ for European green crab, Naczek *et al*, 2004, $67.37 \pm 0.22\%$ for *Callinectes amnicola*, Moronkola, *et al*, 2011; 76.76 ± 0.49 for *Potamon potamios*, Sengul & Zelina, 2011; $72.31 \pm$

0.96% for *Uca tangeri*, Udo & Arazu, 2012; $70.31 \pm 0.5\%$ for *Callinectes amnicola*, Udo & Arazu 2012.

The economic and health benefits of protein in edible crab have long been emphasized. Its consumption is essential in growth and body defence. It propagates effective transportation of gas and regulation of metabolism in organism (Hopwood, 1975; Ackman & Mcleod, 1989; Jamieson *et al*, 1998).

The protein values in the present study (fresh and dried) are slightly lower when compared to the assertions in some literature. For example, Ojewola and Udom, 2005 reported $28.1 \pm 0.01\%$ protein for crabs, while $33.30 \pm 1.2\%$ was given as the protein content in *Cardisoma armatum*, Omotoso 2005; Elegbede & Fashina, 2013. Values ranging between 13.94% and 24.38% were reported for other species of crabs (Sengul & Zeliha, 2011; Moronkola *et al*, 2011; Udo & Arazu, 2012; Elegbede & Fashina, 2013. Hence, the protein content of the dried specimen of the study reflects the fact that there is a decrease in the muscular protein of dried species (Benjakul and Suttipan, 2009).

The fat content obtained in the fresh and dried specimen (*Pachygrapsus transversus*) of the present study are comparatively lower than that reported on dried *Callinectes armatum* ($5.35 \pm 0.01\%$), Omotoso (2005). The values are close to the report by Sengul & Zeliha (2011), which showed a fat value of ($1.8 \pm 0.02\%$) for female freshwater crab in autumn and $1.05 \pm 0.63\%$ for female crab in summer. This phenomenon of low fat calories is not uncommon since it has been noted in other works: Udo & Arazu, 2012 working on *Uca tangeri* (0.22 ± 0.01) and *Callinectes amnicola* (fresh: $0.45 \pm 0.02\%$) respectively; Moronkola *et al*, 2011, report on *callinectes amnicola* (tissue: $1.02 \pm 0.00\%$). Crabs generally contain lower fat calories than beef, pork and poultry (Broughton *et al*, 1997; Carter & Chung, 1999. The ash content in the fresh specimen was higher than that of the dried sample. This agrees with the report of Eddy *et al*, 2004; FAO, 2005 and Abulude *et al* 2006. They asserted that the mineral levels in the organism could be a direct evaluation of its ash content. The ash content of the fresh and dried samples of this study is 26.06% and 13.94% (Table 1) respectively. These results were respectively 10 times higher than the value reported earlier for *Callinectes amnicola* (1.04%), Moronkola *et al*, 2011; *Uca tangeri*; ($2.2 \pm 0.01\%$), Ojewole and Udom, 2005; *Uca tangeri* and *Callinectes amnicola* ($1.4 \pm 0.01\%$) and ($1.84 \pm 0.007\%$) respectively, Udo & Arazu, 2012. Fiber is known to assist in food matter transit in the alimentary system canal and also probably assist in reduction of constipation in animals: (Lee, 1993). The fresh-analysed specimen had higher crude fiber (0.54% and 0.06%, respectively than the dried specimen. Carbohydrate content was higher in the fresh specimen (5.37%) than in the dried specimen (1.32%). The level of this food items was lower in the dried samples compared to the values reported: Moronkola *et al*, 2011; Udo & Arazu, 2012. High or low carbohydrate levels indicate the yields of glucose,

galactose, fructose and mannose when digested as energy producer in the body; Omotoso, 2005; Moronkola *et al*, 2011. The implication of the low caloric value of the dried sample, 46.57 Kcal in this study when compared to that of fresh, 100.84Kcal is connected to the low energy value of protein and carbohydrate in the dried samples.

Table 1. Proximate Composition of (whole) fresh and dried *Pachygrapsus transversus*

Parameters	Fresh specimen (%)	Dried specimen (%)
Protein	11.03	14.90
Fat	0.97	1.63
Ash content	26.06	13.94
Crude fiber	0.54	0.06
Carbohydrate	5.37	1.32
Moisture	56.57	13.94
Energy (kcal)	100.54	46.57

Mineral Contents: The two samples (fresh and dried), used in this study had relatively high value of minerals viz: phosphates > sodium > calcium > iron > zinc in decreasing order of magnitude (Table 2). The dried sample values of calcium (75.0 %) and the fresh specimen value of zinc (98.2%) were respectively the least measured mineral in the study. The health benefits of these minerals have previously been reported; NRC, 1989; Mercer, 1992; Lee *et al*, 1993; Abulude, 2006.

Table 2. Mineral Composition of fresh and dried *Pachygrapsus transversus*

Parameters	Fresh specimen (mg/100gm)	Dried specimen (mg/100g)
Calcium	213.50	75.00
Iron	138.90	118.60
Zinc	98.20	114.60
Phosphate	630.00	526.00
Sodium	591.00	475.00

The study recorded a high difference between the calcium values of fresh and dried samples (Table 2). The other minerals were slightly higher or lower in both samples (Table 2). The value of calcium in the fresh sample is comparatively lower than that of *Callinectes amnicola* (fresh), Moronkola *et al*, 2011; *Uca tangeri*, Udo & Arazu, 2012 and *Callinectes sapidus* (meat) Kucukgulmez *et al*, 2006. Iron as observed in the fresh and dried samples of *Pachygrapsus transversus* report was similar to earlier report by Udo & Arazu, 2012 on *Callinectes amnicola* and *Uca tangeri*. In a similar manner, the zinc and sodium varied; Moronkola *et al*, 2011, while values observed in other minerals studied for this report were lower in all dried samples than in the fresh.

3. Conclusion

The fresh and dried specimens of *Pachygrapsus transversus* contain substantial amount of nutrients and essential minerals. By inference, the lower concentration of some of these nutrients in the dried sample of the present study seem to show that fresh *Pachygrapsus transversus* is

more nutritive than the dried one. However, the higher protein, fat and mineral values of the dried specimen suggest the need for an improved awareness in proper drying and preservation of this species to enhance its availability in and out of season. Similarly, the location where the species was obtained is not a coastal area. The species may not have been immediately discovered if not for the adventurous drive of the researchers. Hence, this paper advocates the need to bring the awareness of government and relevant agencies to this species. Also, given that it is cheap, the consumption of this crab will improve the nutritional and health status of the immediate community dwellers which in turn can boost the aquaculture and employment base of the state and the country at large. Therefore, *Pachygrapsus transversus* in which ever manner it is presented (dried/fresh) is a nutritious food supplement.

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