The Biochemical Analysis of the Carcass of Two West African Caridean Shrimps: *Macrobrachium Vollenhovenii* (Herklot's, 1857) And *Macrobrachium Macrobrachion* (Herklot's, 1951) of the Great Kwa River, Nigeria

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Abstract: ***The proximate and mineral composition of the carcass of Macrobrachium vollenhovenii (Herklot's 1857) and Macrobrachium macrobrachion (Herklot's 1851) of the Great Kwa, Nigeria were investigated. The content of magnesium, phosphate and zinc were significantly different in the species (P > 0.01).However, the values of other minerals were similar in both species (P>0.01), giving values that ranged from 0.01mg/100gm in potassium, lead and copper to 0.25mg/100gm in calcium. The proximate composition of the carcass of both species was similar (P> 0.05) except values of moisture that were 38. 40 ± 0.32% and 41.1±0.10 % in M.vollenhovenii and M.macrobrachion respectively. The caloric energy value of 232.5 ± 0.82 Kj determined in M.vollenhovenii was higher than that measured in M.macrobrachion. Values obtained for minerals were lower than WHO values on toxic levels of minerals in aquatic species; data on the proximate composition compared favorably with values reported for similar organisms' .The implication of these data are discussed extensively.***

Keywords: Food value, carcass, *Macrobrachium* species, Nigeria

1. Introduction

Aquaculture practice has been affected due to lack of sufficient supply of feedstuff ingredients e.g. fish meal that is scarce and expensive and in high demand [11]. It is known that fish find it difficult to utilized the large quantity of exoskeleton (Chitin) and ash available as protein in fish head and similar other skeletal structures[2,12]. This suggest the need for the use of other sources of organism with low chitin and ash content such as the crabs, shrimps and other crustaceans, as feed ingredient in animal food production [10,9].

According to reports, about 1.6 x 10^4 MT of shrimp carcass waste are produced yearly in Nigeria and close to 2.8 x 10^{-5} MT from shrimps companies around the world. A good amount of carcass (exoskeleton) of various types of shrimps and other waste are deposited carelessly from many fish processing plants without proper improvement of technology for making use of the wastes resulting in waste disposal problems[11,12]. If this waste collected from shrimps could be use in fish feed production it will not only minimize the cost of fish production, it will also help in keeping the environment clean [10,11,19].

The availability of dependable source of shrimp waste (carcass) in large amount and the suspected high level of protein in them have stimulated the awareness for this study. In addition, the desire to identify an alternative and cheap source for fishmeal in animal feeds production is a booster to this study. Therefore, this study provides data on the major / trace element contents(Ca ,Fe, P, K, Na, Pb, Zn, Cu Mn and Mg) and proximate food value of the carcass (exuviate, limb and head) of *Macrobrachium vollenhovenii* and *M. macrobrachion* of the Great Kwa River, Nigeria.

2. Materials and Methods

Fresh specimens of *Macrobrachium vollenhovenii* and *M. macrobrachion* were bought from Nsidung beach market, Calabar. Nsidung beach is located between latitude $4^0$5'and 5^0 00¹ North and longitude $8^0$22¹ and $8^0$24¹East These organisms were transported in frozen blocks to the laboratory in the University of Calabar, Calabar, Nigeria for the analysis.

About 5 pieces of the same sizes of each species were used for the study. The carcass (exuviate with the limbs, and other uneaten parts) were first separated and stored in an oven in the laboratory while the flesh was discarded. These dried samples were powdered and stored for analysis.

The mineral contents of the carcass were determined by the procedures recommended by[3] which involved the digestion of the powdered carcass in appropriate substance. The concentrations of these minerals were read directly from a spectrophotometer at the appropriate wavelengths. The proximate components of the samples were also determined by methods described by [3]; crude protein by Micro-Kjeldahl method, fat by Soxhlet extraction, moisture by drying of samples for 24hrs. at 105^{o}C .The differences between the wet and dried samples was the value for moisture, while ash was determined by furnace ashing at 600^{o}C for 12hrs and nitrogen free extract(NFE) also by difference.

T-statistic was used to compare data to determine the significant differences between the values measured from the carcass of both species [15]. The mineral content values were matched with WHO data on tolerable levels of minerals in aquatic species to confirm the toxic levels of these minerals in these species in the Great Kwa River, Nigeria.

3. Results

There were significant differences in the proximate composition of the carcass of *M.vollenhovenii* and *M.macrobrachion* (P>0.01) .Table 1 also showed that the crude fiber content of both species are similar (P>0.01).*M.vollenhovenii* seem to be richer in fat, carbohydrate and calories while the moisture, protein and ash content in *M.macrobrachion* are higher(Table 1). T-statistic showed that the proximate composition of the shell of both species were significantly different (P.<0.01).

Table 1: The proximate composition of the carcass of *M.vollenhovenii* and *M.macrobrachion of* the Great Kwa River, Nigeria

Sample	Moisture	Protein	Fat	Ash	Crude fiber	Carbohydrate	Energy/ KJ
M.vollenhovenii (shell)	38.40 ± 0.32	9.15 ± 0.02	1.36 ± 0.15	7.10 ± 0.10	0.00 ± 0.00	43.57 ± 0.75	232.50 ± 0.82
M.macrobrachion (shell)	41.1 ± 0.10	10.04 ±0.03	1.03 ±0.15	7.66 ±0.15	0.01 ± 0.00	40.14 ± 0.19	210 .84 ± 0.07

Table 2 show that the mineral contents in *M.vollenhovenii* is not different from that in M.*macrobrachion (*P>0.01*)* However, the minute differences in concentration of magnesium, sodium, zinc and copper between *M.vollenhoveni*i and *M.macrobrachion* were obvious.

Table 2: Major mineral component of *M.vollenhovenii* and *M.macrobrachion* of the Great Kwa River, Nigeria A=*M.vollenhovenii (*carcass) & B= *M.macrobrachion(*carcass*)*

Sample	*Ca*	*Mg*	*Mn*	*Fe*	*K*	*Pb*	*Po₄*	*Cu*	*Zn*	*Na*
A	0.23 ± 0.02	0.03 ± 0.01	0.04 ± 0.02	0.04 ± 0.02	0.01 ± 0.01	0.01 ± 0.01	0.50 ± 0.04	0.006 ± 0.01	0.20 ± 0.02	0.78 ± 0.04
B	0.25 ± 0.03	0.01 ± 0.01	0.03 ± 0.01	0.04 ± 0.02	0.02 ± 0.02	0.01 ± 0.00	0.11 ± 0.03	0.01 ± 0.01	0.01 ± 0.02	0.39 ± 0.03

4. Discussion

In this study, the proximate composition of the carcass of *M. vollenhovenii* and *M. macrobrachion* were similar though with low values especially when they compared with available published data from other organisms in the same taxonomic group. However, [7] presented values for moisture and carbohydrate in *Peneaus notabilis* that were about 3 and 40 times lower respectively than that obtained in the specimen of this study. Their data on the protein, fiber and fat contents in the same species were 2 to 4 times higher than our values in *M.vollenhovenii* and *M.macrobrachion* (Table 1). Similar studies on the shell of snail also showed low protein content of 7.17 ± 8.17%[7] compared to 9.15 ± 0.02% and 10.04±0.03% obtained in this study (Table 1). Explanations for the drastic deviation of our results to that reported by [7] cannot be immediately confirmed; however, we could link this to physiological reasons probably associated with the habitat of the organisms so compared, one is marine the other a freshwater species.

Data on the proximate composition of carcass/shell of shellfishes are scarce in literature, but we are able to gather data on whole animal or flesh of most edible crustaceans inhabiting the Great Kwa and the Cross River. Data on *Uca tangeri* (whole animal) and *Callinectes amnicola (*flesh and shell) are presented by [19].In that study, the proximate composition of *U.tangeri* was similar to that of the flesh of *C.amnicola* while data obtained for the exoskeleton of *C.amnicola* were similar to the data provided in this report for the carcass of *M.vollenhovenii* and *M.macrobrachion* respectively. The proximate food value of the shell of *M.vollenhovenii, Palaemon sp.* and *P.clarkii* reported by [6] seem to higher than those reported in this study and as reported for *Peneaus indicus* by [16] .For example ,values for protein ,crude fat, and carbohydrate in these species ranged from 21.31%-22.50%,5.72%-8.32% and 45.45% - 50.14% respectively while those obtained for protein in this study as presented in Table1 are different . The protein in the shell of *Callinectes amnicola* is 5.23%, carbohydrate 60.12% and fat 0.01% while moisture is 33.60%[19]. The results obtained from the shell of the two *Macrobrachium* species of this report is similar to data presented by [19] on *C.amnicola* and as reported by [2] and [4] on the shell of snails 7.17 ± 8.17% . It also seem that protein ,fat, and moisture contents in shells of crustaceans are generally lower and contributes less to the overall nutrient contents of the whole animal.

Higher values of moisture in nutrients were measured in the flesh of shellfishes; but the calories in those shells were higher [14, 18, 20]. In table I of this study the energy content of both species were high as compared to the data reported by [8] on *P. notabilis,* [19] on *C.amnicola* and *Uca. tangeri* and [6] on *M..vollenhovenii*, *Palaemon species* and *Penaeus clarkii* .The level of crude fat measured in the species of this study fits into the category of organism with low fat content [1]

The mineral components of *M. vollenhovenii* and *M. macrobrachion* (Table II) are not high, but these low values for all the elements were not significantly different from each other. These values too were below the [7] permissible level of element in aquatic organisms. It is stated that higher values of these elements in species above [7] standard are hazardous to health[5].Therefore and based on their nutritional and health value the carcass of *M.vollenhovenii* and *M.macrobrachion* can be useful as food additives in human meals as well as a suitable and veritable source of animal food ingredient.

5. Conclusion

A causal comparison of the quality of minerals and their concentration in the carcass of these two important species of *Macrobrachium* species of the Great Kwa River show that their contents are far off toxic levels. This clearly shows that *M, vollenhovenii* and *M. macrobrachion* are safe for use either directly as food or as additives in animal feed production.

6. Future Scope

The extension of this effort will be the assessment of the amino and fatty acid qualities of these species, which hopefully will strengthen our knowledge on the true food quality status of these animals.

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Authors Profile

Dr. Paul J. Udo is the lead and corresponding author of this article .Has several nutritional papers on aquatic species indigenous to West Africa. He is an international scholar with several publications. Dr Udo is an aquaculturist of long standing with special interest in shrimp farming, especially on the rearing of freshwater/brackish water species indigenous to West Africa,. He is now diverted into fish nutrition with efforts tilting towards the choice of local species and their suitability as sources for fishmeal

Patience B. Opeh is presently undergoing training as Master of Science degree student. She is researching into the industrial culture of *Macrobrachium macrobrachion* species. This organism for research is a fresh water caridean shrimp of economic value in West Africa.