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Proximate Composition of the Giant River Prawn, *Macrobrachium vollenhovenii* from River Osun, Southwestern Nigeria

Asiru RA* and Fafioye OO

Department of Zoology, Facaulty of Science, Olabisi Onabanjo University, Nigeria

Abstract

Proximate compositions of African giant River prawn *Macrobrachium vollenhovenii* in River Osun, Nigeria were studied. Twenty samples each were selected at two landing sites Atan and Asejire Lake. Ten samples from each site were fried, while the remaining 10 were dried to determine the effect of frying on the proximate composition. Protein, ash fat, crude fibre and moisture contents in dried samples from Atan and Asejire Lakes are 45.85, 13.70, 12.40, 0.01, 92.27 and 46.55, 15.01, 11.20, 0.01 and 92.59 units respectively. Protein, ash fat, crude fibre and moisture contents in fried samples from Atan and Asejire Lake are 45.69, 13.84, 14.58, 0.01, 92.15 and 46.15, 14.98, 13.69, 0.01 and 92.36 units respectively. The mean proximate composition of *M. vollenhovenii* in River Osun are 46.06 ± 0.38, 14.38 ± 0.71, 12.98 ± 1.48, 0.01 ± 0.00 and 92.34 ± 0.19 unit representing protein, ash fat, crude fibre and moisture in that order. Data were analysed using SPSS (21.0). No significant difference was found in proximate composition from the two sampling areas. This prawn contains great amount of which can be used as substitute for fish, meat, plant protein and animal protein in human food and animal feed formulation for animals.

Keywords: *Macrobrachium vollenhovenii*; Proximate composition; Protein; Lipids; Ash; Fat

Introduction

Prawn play important roles in the food chain and are important food sources for larger animals from fish to whales. They are distributed throughout the tropics and subtropics on all continents except Europe [1]. The freshwater prawn, *Macrobrachium vollenhovenii* supports artisanal fisheries in many developing countries especially in Africa [2]. Shell fish contains potent source of nutrients required for the maintenance of growth of human body. The proximate analysis is a scheme for routine description of animal feedstuffs devised in 1865 by Henneberg and Stohmann of the Weende Experiment Station in Germany. The proximate composition of the prawns, crustaceans and other aquatic organisms has found to be varied due to the seasonal factors, climatic factors, geographic factors, habitat, developmental stage, sex, sexual maturation [3,4]. Its biochemical composition may be affected by several factors as the species, environmental factors, size, age, natural diet and feed composition [5]. The Prawn has high levels of omega-3 fatty acids and low levels of mercury [6]. Due to low price and efficient availability, the prawns and shrimps have good source of animal protein for low income earners. The proximate composition of fatty acid profile, cholesterol and total carotenoid contents of prawns change seasonally [7-9]. The proximate body composition including protein moisture, fat, and ash are good indicators of physiological condition of an organism. The greater the protein and lipid content represents higher the energy density [10]. However, quantities of these constituents vary considerably within and between species, size, sexual condition, feeding season and physical activity [3,11]. There is paucity in the studies on proximate composition of the giant River prawn which has high amount of proteins, lipids and unique taste with high demands in national and international markets, so this determine the proximate compositions of *M. vollenhovenii* sampled from River Osun (Figure 1).

Materials and Methods

Description of the study area

The Osun River is a River that flows southwards through central Yorubaland in southwestern Nigeria from Ekiti state (Lat. 8°20'N and Lon. 5°16'E) and meanders through three different States (Osun, Oyo, Ogun respectively) before Lagos State where it empties into the Lagos Lagoon and the Atlantic Gulf of Guinea (Lat. 6.56°N and Lon. 4.06°E) (https://en.wikipedia.org/wiki/Osun_river) (Figure 2). It has length of about 166 miles and plays host to different diversity of fauna and flora including prawn. It is surrounded by green vegetation (trees and shrubs) along it course. Samples were collected at two different landing sites; Asejire in Oyo state and Atan in Ogun State The two sites were selected based on their easy access, relative availability of fishers and their prominence to their immediate community as fishing terminus.

Figure 1: *Macrobrachium vollenhovenii*.

***Corresponding author:** Asiru RA, Department of Zoology, Facaulty of Science, Olabisi Onabanjo University, Nigeria, Tel: 2348050400015; E-mail: ragakare@gmail.com

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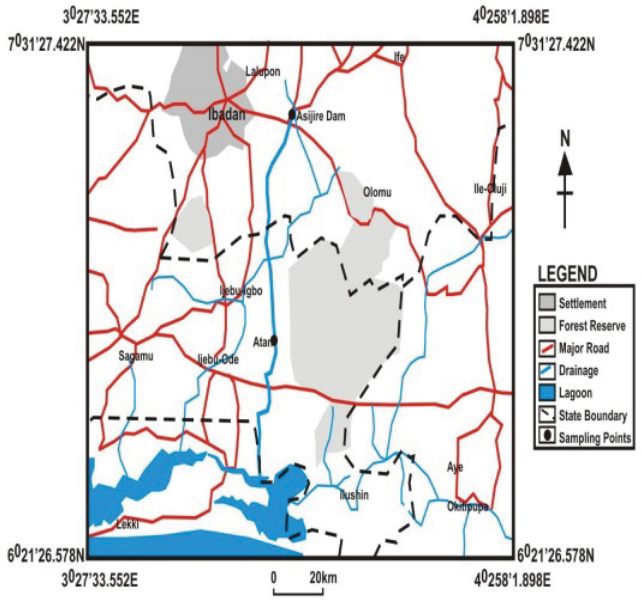

Figure 2: Map of south-western Nigeria indicating the study areas.

Sample collection

Mixed sizes of healthy samples of *M. vollenhovenii* were collected from the two landing sites with the help of artisanal fishermen (Figure 1). The fishermen used combination of gill nets and non-return valve cage to trap the prawns. The specimens were immediately preserved in ice packed cooler and transferred to the laboratory, where they were thoroughly washed off impurity before researching on them.

Proximate composition

Ash content estimation was done following the procedures of AOAC, (2000) Percentage (%) of Ash = (Weight of Ash / Weight of sample) × 100. The protein content was determined using Association of Analytical Chemist (2000) method which follows the processes of Kjeldahl method.

$$\%N = \frac{x \text{ moles}}{1000 \text{ cm}^3} \times \frac{(v_s - v_b) \text{ cm}^3}{m \text{ g}} \times \frac{14 \text{ g}}{\text{moles}} \times 100$$

Where *v*s and *v*b are the titration volumes of the sample and blank, and 14 g is the molecular weight of nitrogen N.

Once the nitrogen content has been determined it is converted to a protein content using the appropriate conversion factor: Percentage (%) of Proteins = (c-b) × 14 × d × 6.25/a × 1000 × 100 (a = sample weight in (g), b = volume of NaOH required for back titration and neutralize with 25 ml of 0.1N H_2SO_4 (for sample), c = volume of NaOH required for back titration and neutralize with 25 ml of 0.1N H_2SO_4 (for blank), d = normality of NaOH used for titration process, 6.25 = conversion factor of Nitrogen to protein and 14 = atomic weight of Nitrogen). Estimation of liquid content was done following the procedures of Bligh and Dyer (1959). Percentage (%) of Lipids = (Weight of the extract / Weight of sample) × 100

Percentage (%) of Moisture = (weight loss / original weight of sample taken) ×100

$= (W_1 - W_2) \times 100$

W_1

Where

W_1=weight (g) of sample before drying

W_2=weight (g) of sample after drying

Result and Discussions

The result of the proximate analysis of *M. vollenhovenii* shows that the protein content in the samples was high with respect to other nutrient composition (Table 1). It contains almost half of its biochemical composition which conforms to Soundarapandian et al. [12] who stated that protein is the most prominent biochemical component of crustaceans. The protein content of *M. vollenhovenii* (45.69-46.55) corroborates with reports of Reddy and Reddy 2014 who reported 74.24% in *Microbrachium rosembergii* and Ehigiator and Nwangwu [13] who reported 53.38% level of the whole prawn and 53.85% edible portion but slightly lower than reports of Ehigiator and Oterai [14] who reported 68.77-71.37%, Ngoan et al. of 65.4-83.3%, Dinakaran et al. for *M. idae* 57.32-61.44%, Ehigiator and Nwagwu [13] of 67.68-68.46% for *T. fuscatus* and Devanathan et al. [15] for *Babylonia spirata* (a gastropod). However, this result is higher than that reported for *Caridina Africana* 18.98% [16], for *M. vollenhovenii*, (16.99%), *M. Macrobrachion* (17.30%); *Penaeus notialis* (20.57%) and *Bachrus niger* (18.52%). The high protein content in *M. vollenhovenii* can be attributed to its omnivorous feeding habit Bello-Olusoji and also may be due to stress conditions caused by toxicity of heavy metals on protein metabolism or due to enhanced proteolytic activity as a consequence of increased metabolic demands following exposure to toxic pollutants in the freshwater environment Kharat et al. It might also be attributed to the nature of food available at a particular time. High protein content may be valuable for food formulation as protein replacement for other expensive animal protein source in feed production [13].

The result of the mean ash content recorded from the study is lower than the earlier reports of Ehigiator and Nwangwu, [13]. who reported 25.33% from *M. vollenhovenii* and 22.67% obtained from *M. macrobrahion* and Adebayo-Tayo and Ogunjobi who reported 10.50% in *T. fuscatus*, but higher than reports of Bello Olusoji, of 1.34% and by Fasakin et al. High level of ash has been observed in the exoskeleton of prawns found in Lagos Lagoon [17]. The high ash values of the species are not surprising as crustaceans have shells and these shells contain more ash than any other type of fish [18]. The high ash content is of significance in measuring the mineral content of the species as the amount of ash shows the richness of the food in terms of element composition.

The mean fat was higher compared to reports of Ehigiator and Oterai [14] of 6.87-7.68% from *M. vollenhovenii* and *T. fuscatus,* Bassey et al. [19] for *Pomecia palludosa*, a gastropod and *Ergeria radiata*, a clam which ranged from 6.03-7.60% and that recorded by Balasubramania and Suseelan [20] which ranged from 6.2-7.6%. Lipids are highly efficient as sources of energy and they contain twice the energy of

Location	Mean	CP (%)	ASH (%)	FAT (%)	CF (%)	M
Asejire (Dried)	Mean	46.55	15.01	11.20	.01	92.59
Atan (Dried)	Mean	45.85	13.70	12.40	.01	92.27
Asejire (Fried)	Mean	46.15	14.98	13.69	.01	92.36
Atan (Fried)	Mean	45.69	13.84	14.58	.01	92.15
Total	Mean	46.06 ± .38	14.38 ± .71	12.98 ± 1.48	.01 ± .00	92.34 ±.19

CP: Crude protein; CF: Crude fibre; M: Moisture

Table 1: Proximate composition of *Microbrachium vollenhovenii* of River Osun.

carbohydrates and proteins [21]. As a general rule, they act as major food reserve along with protein and are subject to periodic fluctuations influenced by environmental variables like temperature [22].

The fiber contents of the samples from the two locations are 0.0100% which is considerable lower than 0.40-0.54% reported by Ehigiator and Oterai [14], 0.28-0.32% [23], 0.21-0.34% (MBA, 1980). According to Sriket et al. [5] handling and process of freezing and thawing negatively impacts the firmness of prawn tissue, which results in a loss of integrity of muscle fibers [24-26].

The condition factor of *M. vollenhovenii* in Atan, Asejire and Pooled sample is 2.0185, 1.58 and 1.667. This observations shows that *M. vollenhovenii* in Atan have better living that those in Asejire [27,28]. This might be due to overfishing in Asejire as the researcher observed more fishers in Asejire compared to Atan. It is worthy to note the difference in major fishing gears in the collection areas as fishers in Asejire uses more of gill nets than other fishing gears whereas fishers in Asejire employed the services of basket traps more. Also, number of samples collected in daily bases in Asejire is more which points towards overfishing. Though, *M. vollenhovenii* samples from Asejire are prone to Overfishing and disturbances, they are still in relatively good condition [29].

Conclusion

M. vollenhovenii is a good source of protein and Ash, thereby, it can be used as substitute for fish, meat, plant protein and animal protein for feed formulation for animals and children because they compare favourably with the protein content of other conventional feed-stuff. Specimens from the two sampling areas had low fat and fibre and are considered to be among low fat class group. No significant difference was found in proximate composition from the two sampling areas.

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