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ANIMAL HUSBANDRY & VETERINARY SCIENCE | RESEARCH ARTICLE

Comparative study on the nutritional composition of the pink shrimp (*Penaeus notialis*) and tiger shrimp (*Penaeus monodon*) from Lagos lagoon, Southwest Nigeria

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Abstract: Shrimps are very good source of protein; they contain small amount of fat and calories and are relished in many homes across the world. This study attempts to compare the proximate compositions and mineral contents of fresh *Penaeus monodon* and *Penaeus notialis* using standard analytical methods. Results of proximate composition revealed that percentage mean values for carbohydrate, crude protein, fat, crude fiber, ash and moisture levels in *P. monodon* were 13.15 ± 0.18, 9.21 ± 0.03, 4.67 ± 0.05, 1.21 ± 0.12, 3.53 ± 0.06 and 68.24 ± 0.11 respectively while values for *P. notialis* were 9.77 ± 0.04, 6.09 ± 0.05, 2.68 ± 0.06, 2.88 ± 0.06, 4.89 ± 0.03 and 73.71 ± 0.18 respectively. Both shrimp species were high in all the micro and macro minerals analyzed. However, values for calcium and zinc were significantly higher ($p < 0.05$) in *P. monodon*. It was concluded that although both shrimps are of different species and the nutrient levels in *P. monodon* were higher in some cases, nutritional differences between these two species in most cases are however not statistically different ($p > 0.05$).

Subjects: Agriculture & Environmental Sciences; Aquaculture; Marine & Aquatic Science

Keywords: shrimp; proximate composition; mineral content; Lagos lagoon

1. Introduction

Shrimps have become one of the major sources of animal protein to the low income earners. Its meat is high in protein, low in saturated fat and calories, and have a good flavor, and apart from supplying good quality proteins and vitamins A and D, it also contains several dietary minerals such as Fe, Ca, etc. which are beneficial to man and animals (Ravichandran, Rameshkumar, & Rosario Prince, 2009). Shrimps are also a rich source of vitamin B12, selenium, ω-3 highly unsaturated fatty acids (HUFA) and astaxanthin (Venugopal, 2009) which has been shown to provide antioxidant support to both the nervous system and musculoskeletal system. In addition, some animal studies have shown decreased risk of colon cancer to be associated with astaxanthin intake, as well as decreased risk of certain diabetes-related

ABOUT THE AUTHORS

Edah Bernard and Adeyemi Yewande Bolatito are both research scientists at the Department of Biotechnology/Fish Nutrition Unit of the Nigerian Institute for Oceanography and Marine Research, Lagos, Nigeria. Their passion for a better knowledge of these two *Penaeus* shrimp species in Nigeria spurred them to carry out this research as the collection of accurate date on species nutritional and mineral composition will in no small measure ensure their proper management.

PUBLIC INTEREST STATEMENT

This research was design to show how the comparative approach can increase understanding of the nutritional compositions of the two *Penaeus* shrimp species. We chose these two species because *Penaeus notialis* is the dominant native *Penaeus* species while *Penaeus monodon* is the dominant invasive *Penaeus* species in Nigeria.

problems (The George Mateljan Foundation, 2015). Nigeria is among the tropical countries endowed with rich shrimp resources. Dublin-Green and Tobor (1992), reported that the coastal waters of Nigeria are characterized by abundance of significant living resources including shrimps, predominantly members of the family *Penaeidae*. Economically, the importance of shrimp production in Nigeria and most especially along the coastal communities includes the provision of employment, source of food, source of income, source of tool to rural development and source of raw materials to manufactures. However, literature reports are scarce on the comparative nutritional chemical composition of the indigenous shrimp species (*P. notialis*) and the exotic species (*P. monodon*) in the southwestern part of Nigeria. Thus, the objective of this study is an attempt to compare the nutritional quality of these shrimp species.

2. Materials and methods

2.1. Sample collection and preparation

Samples of the pink shrimp (*P. notialis*) and tiger shrimp (*P. monodon*) were collected from local fishermen at Makoko Jetty along the Lagos lagoon environment, Southwest of Nigeria (6°29′-N and 3°23′-E). Samples were washed with de-ionized water to remove any adhering contamination and drained under folds of filter paper. Samples were then immediately preserved using iced packed cooler and transferred immediately to the Biochemistry laboratory of the College of Medicine, Lagos State University teaching Hospital. The drained samples were further wrapped in aluminum foil paper and frozen at a temperature of −4°C for 48 h before analysis.

2.2. Determination of proximate composition

Fresh samples of *P. monodon* and *P. notialis* were grounded using an electric grinding machine after crushing with mortar and pestle. The grounded portions were weighed individually and used for chemical analysis. The estimation of protein, carbohydrate and lipids were carried out by Bligh and Dyer (1959), Lowry, Rosebrough, Farr, and Randall (1951) and Morris (1948) respectively. Moisture content was estimated by hot air oven method while minerals contents were analyzed by A.O.A.C. (1990).

2.3. Statistical analysis

Biological data resulting from the experiment were analyzed for significant differences between groups by the two sample *t*-test using the SPSS (statistical Package Computer, Software 2004 version Chicago, Illinois, USA). Differences were regarded as significant at $p < 0.05$ (Zar, 1998).

3. Results and discussion

The proximate composition of fresh samples of *P. monodon* and *P. notialis* is presented in Table 1. According to Ockerman (1992), proximate composition varies with species and is influenced by season, water temperature and spawning cycle. In this study, the moisture content of *P. monodon and P. notialis* were 68.24 ± 0.11 and 73.71 ± 0.18% respectively ($p < 0.05$). The crude protein percentage recorded for *P. monodon* (9.21%) and *P. notialis* (6.09%) were not significantly different ($p > 0.05$). This is similar to the findings of Bhavani and Karuppasamy (2014). The high amount of protein content recorded for both shrimp species in this study may be attributed to their high protein dietary intake which included algae, diatoms, crustaceans, mollusks and partly digested fishes (Osibona, 2005). Similarly,

Table 1. Proximate composition of *P. monodon* and *P. notialis* (%)

Item	*P. monodon*	*P. notialis*	*p*-value (two tailed)
Carbohydrate	13.15 ± 0.18	9.77 ± 0.04	0.093
Crude protein	9.21 ± 0.03	6.09 ± 0.05	0.128
Crude fat	4.67 ± 0.05	2.68 ± 0.06	0.169
Moisture	68.24 ± 0.11	73.71 ± 0.18	0.025
Ash	3.53 ± 0.06	4.89 ± 0.03	0.102
Crude fiber	1.21 ± 0.12	2.88 ± 0.06	0.248

Note: Results are the mean value of triplicates ± standard error.

carbohydrate content in *P. monodon* and *P. notialis* were 13.15 and 9.77% respectively, and differences were not significant ($p > 0.05$). Varadharajan and Soundarapandian (2014) reported that in crustaceans, lipids are not only the main organic reserve and source of metabolic energy but also indispensable in maintaining cellular integrity. In this study, the lipid contents in both species were similar ($p > 0.05$), reaching in *P. monodon* a value of 4.67% while a value of 2.68% was recorded for *P. notialis*. The ash contents values were 3.53 and 4.89% for *P. monodon* and *P. notialis*, respectively ($p > 0.05$). *P. monodon* had similar ($p > 0.05$) crude fiber content (1.21%) than that recorded for *P. notialis* (2.88%).

Marine foods are very rich sources of both macro and micro mineral components (Kumaran et al., 2012). Figures 1–9 show the mineral composition of *P. monodon* and *P. notialis*. Among the nine nutrient elements investigated the most abundant was phosphorous (P) followed by magnesium (Mg), calcium (Ca) and sodium (Na). The phosphorous content for *P. notialis* was 242.3 mg/100 g and

Figure 1. Sodium content of *P. monodon* and *P. notialis* ($p > 0.05$).

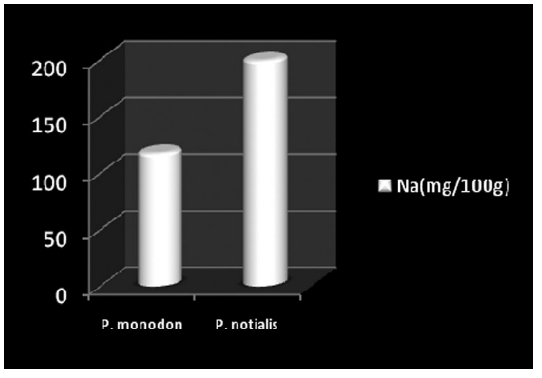


Figure 2. Calcium content of *P. monodon* and *P. notialis* ($p < 0.05$).

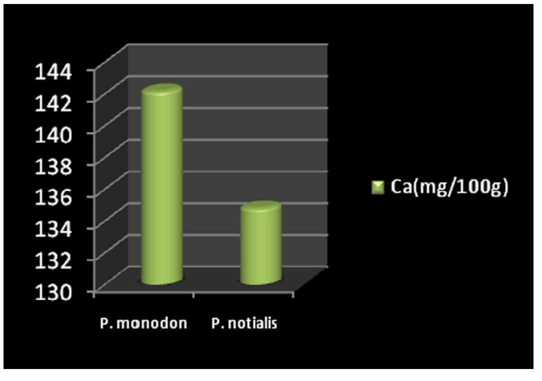


Figure 3. Zinc content of *P. monodon* and *P. notialis* ($p < 0.05$).

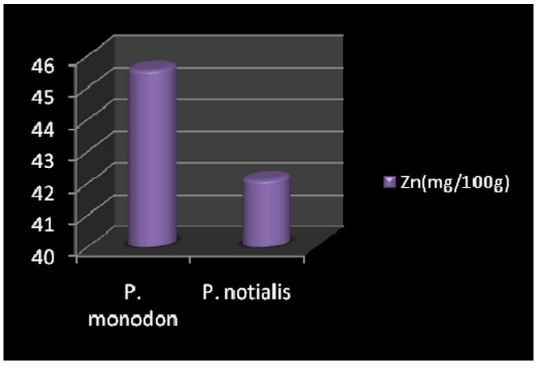


Figure 4. Potassium content of *P. monodon* and *P. notialis* ($p > 0.05$).

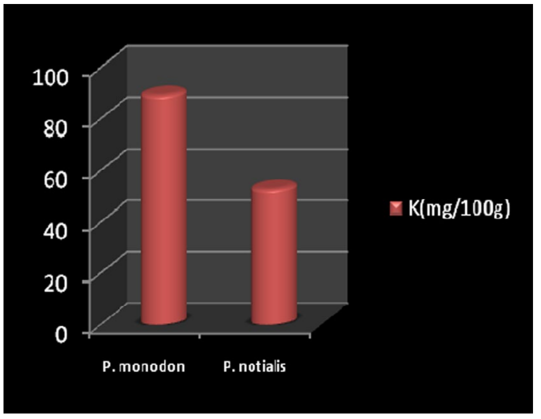


Figure 5. Magnesium content of *P. monodon* and *P. notialis* ($p > 0.05$).

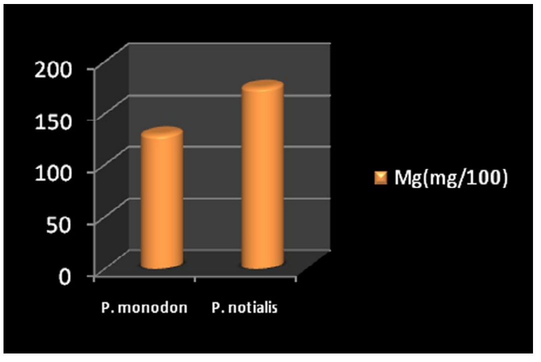


Figure 6. Cupper content of *P. monodon* and *P. notialis* ($p > 0.05$).

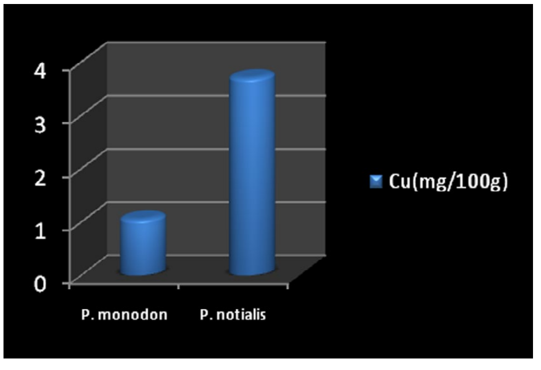


Figure 7. Iron content of *P. monodon* and *P. notialis* ($p > 0.05$).

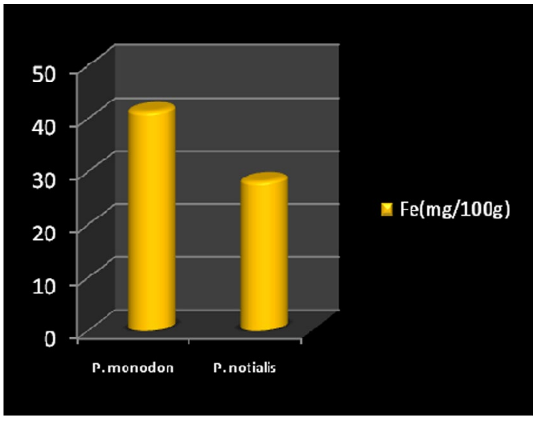


Figure 8. Phosphorous content of *P. monodon* and *P. notialis* ($p < 0.05$).

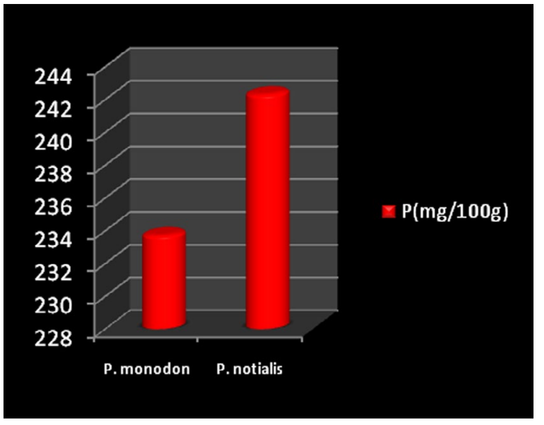
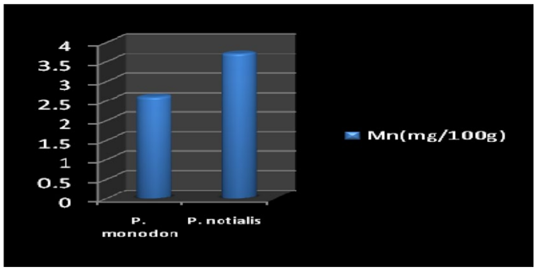


Figure 9. Manganese content of *P. monodon* and *P. notialis* ($p > 0.05$).



that recorded for *P. monodon* was 233.7 mg/100 g. The magnesium content in *P. notialis* was 174.8 mg/100 g while that recorded for *P. monodon* was 128.8 mg/100 g. The calcium content recorded for *P. notialis* was 134.8 mg/100 g while that for *P. monodon* was 142.2 mg/100 g. The sodium content recorded for *P. notialis* was 199.2 mg/100 g while that recorded for *P. monodon* was 117.3 mg/100 g. Values for K, Zn, Cu, Fe and Mn recorded for *P. notialis* and *P. monodon* were 52.45 mg/100 g, 42.1 mg/100 g, 3.7 mg/100 g, 28.05 mg/100 g, 3.7 mg/100 g and 89.1 mg/100 g, 45.55 mg/100 g, 1.05 mg/100 g, 41.25 mg/100 g, 2.6 mg/100 g respectively. The values of various minerals obtained from both shrimp species show a significant difference and samples examined in this study contained appreciable concentrations of Na, K, Ca, Mg, and P, suggesting that these shrimp species are a good source of nutrient minerals. The levels of micro minerals (Zn, Cu, Fe and Mn) analyzed were also within tolerable limits (FAO/WHO, 1989).

The levels of K, Na, Mg, Cu, Fe and Mn in *P. notialis* were higher than in *P. monodon* although differences were not significant ($p > 0.05$). This is similar to the report of Adeyeye (2000) and Adeyeye, Habib, and Awodola (2008). Furthermore, the levels of Ca, Zn and P recorded for both species of shrimps in this study wereare significantly different ($p < 0.05$, showing *P. monodon* higher contents of Ca and Zn than *P. notialis*, while this later species showed high contents of Syama Dayal et al. (2013) reported values for Ca, Mg, P, K, Na, Cu and Mn for *P. monodon* as 107.3 ± 1.96, 58.5 ± 1.38, 303.4 ± 3.22, 259.6 ± 3.25, 176.1 ± 3.04, 9.18 ± 4.62 and 50.5 ± 1.64 mg/100 g respectively which is also similar to the findings of this study.

The variations recorded in the concentration of the different nutritional components of both shrimp species examined in this study could have been as a result of the rate at which these components are available in the water body and the ability of the fish to absorb and convert the essential nutrients from the diet or the water bodies where they live (Adeniyi, Orikwe, Ehiagbonare, & Joshia, 2012; Yeannes & Almandos, 2003). These findings are in line with the reports of Adewoye, Fawole, and Omotosho (2003) and Fawole, Ogundiran, Ayandiran, and Olagunju (2007).

4. Conclusions

In conclusion, *P. notialis* and *P. monodon* examined in this study are good sources of proteins and mineral supply. Although both shrimps are of different species and the mineral levels in *P. monodon* are higher in some cases, differences between these two species are however not statistically different.

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Competing Interests
The authors declare no competing interest.

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