COMPARISON BETWEEN THE PROXIMATE AND MINERAL COMPOSITIONS OF FERAL AND CULTURED GECARCINID CRAB

Moruf, R.O[1*]., Durojaiye, A.F. [2] and Taiwo, M.A. [3]

[1]Department of Fisheries and Aquaculture, Bayero University, Kano, Kano State-Nigeria
[2]Department of Forestry, Wildlife and Fisheries, Olabisi Onabanjo University, Ogun State, Nigeria
[3]Department of Food Science and Technology, Federal University Dutsin-Ma, Katsina State-Nigeria
***Correspondence:** tunjimoruf@gmail.com

ABSTRACT

The proximate and mineral compositions in the muscle of feral and cultured gecarcinid crab, *Cardiosoma armatum* (Herklots, 1851), were determined to identify their nutritional differences. With the exception of a significantly higher crude fat content in the cultured crabs ($P < 0.05$), there were no significant differences in the moisture, crude protein, total ash or carbohydrate contents of both types of crabs ($P > 0.05$). Feral crab groups showed significant higher content of calcium, sodium and potassium, but significantly lower magnesium and phosphorus contents. In feral crab group, only the total ash content showed a positive correlation with all the investigated minerals with respective values of 0.977, 0.999, 0.976, 0.997 and 0.999 for calcium, magnesium, sodium, potassium and phosphorus. Whereas, crude protein, crude fiber in addition to total ash content showed positive correlation with magnesium sodium and potassium in the cultured crabs. The feral crabs are superior to cultured crabs in terms of valuable minerals like calcium, sodium and potassium contents.

Keywords*:* Crab, Crustacean, Culture, Nutritional Quality, Lagos Lagoon.

INTRODUCTION

Crab is one of the cheapest shellfish resources that can serve as an alternative source of animal protein especially among coastal dwellers. Crab culture can compensate for the increased demand for animal protein and can avoid deforestation for pasture use. The gecarcinids are decapod crabs that show significant behavioral, morphological, physiological and or biochemical adaptations permitting extended activities out of water (Oluwole *et al.*, 2020). These crabs are a large group of invertebrates and, due to the high palatability of their meat, they are the focus of commercial crab fisheries.

The gecarcinid species, *Cardiosoma armatum* cohabits with other brachyurans in the mangrove swamp of Abule-Agege Creek of Lagos where they are harvested by locals for domestic markets (Lawal-Are *et al.*, 2019). Typically, there is a large difference in nutrient contents between wild and farmed aquatic animals consumed by humans, owing to environmental and dietary factors (He *et al.*, 2017). Several studies have reported these differences in wild and farmed crabs (Alava *et al.*, 2007; Kong *et al.*, 2012: Wu *et al.*, 2020). To the best of our knowledge, the comparison between farmed and wild-caught crabs has never been reported in Nigeria. This study aimed to compare the tissue composition of conventional nutrients of feral crabs with those of plastic-cultured *C. armatum*, in order to provide crab consumers with useful nutritional information.

MATERIALS AND METHODS

Sample collection

Two groups of crab samples (Adults and crablets) were obtained in June 2019 from Abule-Agege Mangrove Swamp (Latitude of 6°26"N and 6°39"N and Longitude of 3°29"E and 3°50"E) in Lagos State, Nigeria. The adult samples (80±0.05 g) were taken as feral and prepared for laboratory analysis. The crablets (48±0.02 g) were cultured for 3 months at the Department of Marine Sciences, University of Lagos.

Experimental Set up

The crablets were selected and randomly stocked into eight small plastic tank (length × width × depth = 8 m × 8 m × 1.5 m) at 4 crabs per tank and allowed to acclimatize for a week before the commencement of the experiment. The crabs were fed with trash fish (*Sardinella aurita*) once daily, the amount of which was approximately 2.2 % of the total weight of crablets held in the plastic. A water depth of 20 cm was maintained with 50 % water in each plastic, exchanged every 3 days over the period of the experiment. The cultured crabs, now weighing 82±0.01 g were then dissected to extract their muscle tissues. Each sample was freeze-dried, separately homogenized, and stored at −20 °C for further analysis.

Laboratory analysis

The analyses of moisture, protein, fat, ash and carbohydrate contents were determined as described by AOAC (2006). For the mineral determination, the samples were digested in HNO_3/HCl while some metal parameters namely Ca, P, Mg, Na and K were measured by a Varian Spectra Atomic absorption spectrophotometer (AAS), Buck Scientific 210 GVP model following the procedure reported by Santoso *et al.* (2006).

Statistical analysis

With the aid of SPSS statistical software version 22, mean and standard error were derived by subjecting data to descriptive analysis. T-test was used to compared between the two treatments while Pearson Correlation Coefficient was used to find the relation between the variables at significant level of $P \leq 0.05$.

RESULTS AND DISCUSSION

Proximate composition of feral and cultured gecarcinid crab

The proximate composition of feral and cultured gecarcinid crab are presented in Figure 1. With the exception of a significantly higher crude fat content in the cultured crabs ($P < 0.05$), there were no significant differences in the moisture, crude protein, total ash or carbohydrate contents of both types of crabs ($P > 0.05$). The higher crude fat content indicates that the cultured crabs have higher nutritional energy value than the feral crabs. Apart from this, all other proximate composition of the feral and cultured crabs were similar. This result is consistent with that of He *et al.* (2017) and Wu *et al.* (2020), because in both studies, the highest crude lipid was found in the muscles of farmed crabs.

.

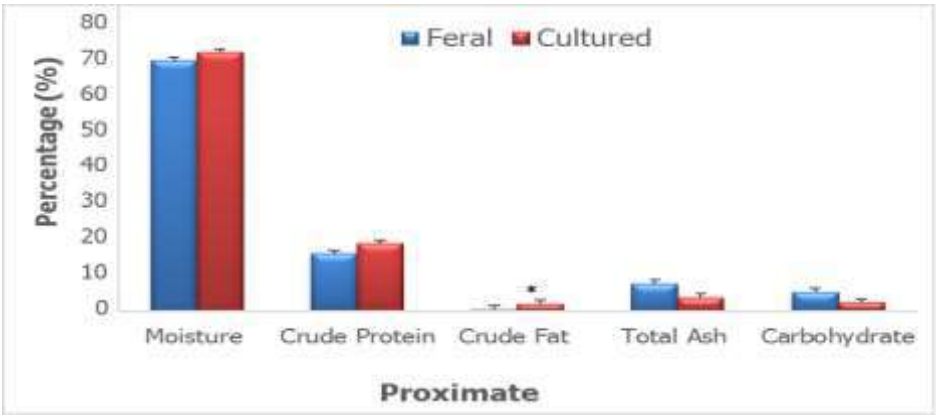

Figure 1. Proximate composition of feral and cultured gecarcinid crab, *Cardiosoma armatum*

Mineral content of feral and cultured gecarcinid crab

Figure 2 showed the mineral content of the edible tissues in feral and cultured crabs. In general, contents of calcium, sodium and potassium were significantly higher in feral crabs, while the contents of magnesium and phosphorus were significantly higher in cultured crabs ($P < 0.05$). The results

showed that the edible tissues in both types of crabs were rich in minerals as obtained by Moruf *et al.* (2019) for the Lagoon Crab (*Callinectes amnicola*) from Lagos Lagoon in Nigeria. Mineral content, especially that of Calcium higher in the feral crabs may be attributed to the natural diets available in the wild, which contain more benthic organisms that are rich in minerals (Wu *et al.*, 2020).

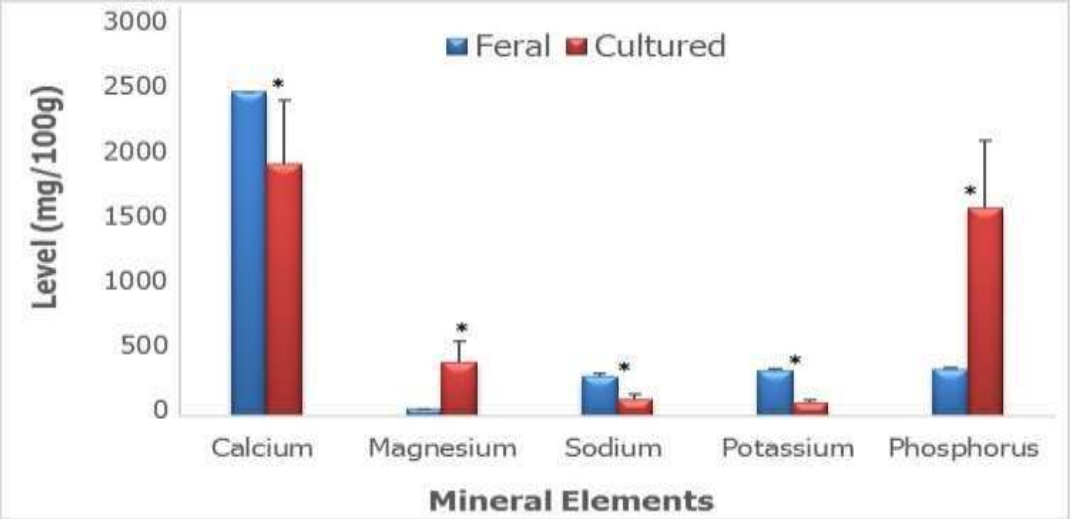

Figure 2. Mineral contents of feral and cultured gecarcinid crab, *Cardiosoma armatum*

Correlation between proximate and mineral compositions of feral and cultured gecarcinid crab

The correlation coefficient between the proximate and mineral compositions of feral and cultured gecarcinid crabs are shown in Table 1 and Table 2 respectively. In the feral samples, only the total ash content showed a positive correlation with all the investigated minerals with respective values of 0.977, 0.999, 0.976, 0.997 and 0.999 for calcium, magnesium, sodium, potassium and phosphorus. In Table 2, crude protein, crude fiber in addition to total ash content showed positive correlation with magnesium sodium and potassium in the cultured crab group. The result is comparable to the work of Lawal-Are *et al* (2018) that reported significant direct relationship among proximate/mineral compositions of whole and fillet of the Guinean Mantis Shrimp, *Squilla aculeata calmani* from Southwest Nigeria. Positive correlation indicates that the two variable moves in the same direction with the same magnitude while negative correlation indicates that the two variable moves in different directions.

CONCLUSION

Apart from crude fat, all other proximate composition of the feral and cultured crabs were similar. However, the feral crabs are superior to cultured crabs in terms of valuable minerals like calcium, sodium and potassium. Future research should focus on optimizing culture conditions in order to improve the nutrient composition of *Cardiosoma armatum*.

Table 1. Correlation coefficient between the proximate and mineral compositions of feral gecarcinid crab

	Moisture	*Crude Protein*	*Crude Fat*	*Total Ash*	*Carbo hydrate*	*Calcium*	*Magnesium*	*Sodium*	*Potassium*	*Phosphorus*
Moisture	1									
Crude Protein	0.999	1								
Crude Fat	0.750	0.721	1							
Total Ash	0.953	0.940	0.914	1						
Carbohydrate	0.997	0.993	0.800	0.974	1					
Calcium	-0.996	-0.991	-0.807	0.977	-0.999	1				
Magnesium	-0.961	-0.948	-0.904	0.999	-0.980	0.982	1			
Sodium	-0.996	-0.992	-0.804	0.976	-0.999	0.999	0.981	1		
Potassium	-0.974	-0.963	-0.881	0.997	-0.989	0.991	0.999	0.990	1	
Phosphorus	-0.957	-0.9431	-0.910	0.999	-0.977	0.979	0.999	0.978	0.998	1

Table 2. Correlation coefficient between proximate and mineral compositions of cultured gecarcinid crab

	Moisture	*Crude Protein*	*Crude Fat*	*Crude Fiber*	*Total Ash*	*Carbo hydrate*	*Calcium*	*Magnesium*	*Sodium*	*Potassium*	*Phosphorus*
Moisture	1										
Crude Protein	-0.070	1									
Crude Fat	0.275	0.003	1								
Crude Fiber	-0.970	0.144	-0.489	1							
Total Ash	-0.965	-0.186	-0.333	0.931	1						
Carbohydrate	-0.837	-0.487	-0.242	0.769	0.947	1					
Calcium	-0.923	-0.305	-0.365	0.891	0.992	0.975	1				
Magnesium	-0.405	0.859	-0.457	0.544	0.203	-0.117	0.106	1			
Sodium	-0.863	0.484	-0.493	0.933	0.742	0.490	0.668	0.806618	1		
Potassium	-0.659	0.674	-0.563	0.783	0.503	0.207	0.419	0.946459	0.949	1	
Phosphorus	0.831	-0.434	0.614	-0.923	-0.733	-0.490	-0.672	-0.80448	-0.989	-0.953	1

REFERENCES

Alava, V.R., Quinitio, E.T., De, P.J.B., Priolo, F.M.P., Orozco, Z.G.A. and Wille, M. (2007). Lipids and fatty acids in wild and pond-reared mud crab *Scylla serrata* (Forsskal) during ovarian maturation and spawning. *Aquaculture Research*, 38: 1468–1477.

AOAC (2006). Official Methods of Analysis, 18th ed., Association of Official Analytical Chemists, Washington, DC, USA.

He, J., Xuan, F., Shi, H., Xie, J., Wang, W., Wang, G., *et al*. (2017). Comparison of nutritional quality of three edible tissues of the wild-caught and pond-reared swimming crab (*Portunus trituberculatus*) females. *LWT-Food Science and Technology*, 75: 624–630.

Kong, L., Cai, C., Ye, Y., Chen, D., Wu, P., Li, E., *et al*. (2012). Comparison of non-volatile compounds and sensory characteristics of Chinese mitten crabs (*Eriocheir sinensis*) reared in lakes and ponds: Potential environmental factors. *Aquaculture*, 364 -365(1): 96–102.

Lawal-Are, A.O., Moruf, R.O. and Afolayan, O.A. (2018). Proximate composition, mineral profile and cholesterol level in whole and fillet of the Guinean Mantis Shrimp, *Squilla aculeata calmani* (Holthuis, 1959) (Crustacea: Stomatopoda). *Albanian Journal of Agricultural Sciences*, 17(3): 160-165.

Lawal-Are, A. O., Moruf, R. O., Akubueze, K. L. and Adewole, O. (2019). Morphometric characteristics of two walking crabs, *Cardiosoma armatum* (Gecarcinidae) and *Goniopsis pelii* (Graspidae) from a tropical mangrove swamp in Lagos, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*, 15 (1): 83-88.

Moruf, R.O., Saba, A.O., Chukwu-Osazuwa, J. and Elegbede, I.O. (2019). Seasonal variation in macro-micronutrient compositions of the flesh and shell of the Portunid Crab, *Callinectes amnicola* (De Rochebrune, 1883) from the coastal waters of Southwest Nigeria. *Agricultura*, 102 (1-2): 200-209.

Oluwole, G., Moruf, R.O. and Lawal-Are, A.O. (2020). Meat quality of Land Crab, *Cardiosoma armatum* (Herklots, 1851) fattened with trash fish and formulated diet. *Journal of Scientific Research*, 12 (3): 371-377.

Santoso, J., Yoshie-Stark, Y. and Suzuki, T. (2006). Comparative content of minerals and dietary fibers in several tropical seaweeds. *Bull. Aquatic Products Technol*., 9 (1): 1−11.

Wua, H., Gea, M., Chena, H., Jianga, S., Lina, L. and Lua, J. (2020). Comparison between the nutritional qualities of wild-caught and rice-field male Chinese mitten crabs (*Eriocheir sinensis*). *LWT-Food Science and Technology*, 117: 108663.