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A comparative analysis of the proximate composition of wild and cultured prawn (*Macrobrachium rosenbergii*) and shrimp (*Penaeus monodon*)

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Abstract

The purpose of this research was to compare the proximate composition of wild and cultured shrimp (*Penaeus monodon*) and prawn (*Macrobrachium rosenbergii*). The moisture, protein, lipid, ash and carbohydrate were analyzed. The mean value of moisture, protein, lipid, ash, and carbohydrate were found as 71.44±1.43%, 25.86±2.31%, 1.70±0.11%, 0.81±0.09% and 0.17±0.05% respectively in wild prawn and 69.82±3.55%, 26.26±0.76%, 2.69±0.08%, 0.86±0.15%, and 0.55±0.02% respectively in cultured prawn. In wild and cultured shrimp the mean value of moisture, protein, lipid, ash and carbohydrate were found 72.35±2.54%, 20.32±0.87%, 5.53±0.43%, 0.87±0.06% and 0.91±0.03% respectively in wild shrimp and 63.27±4.97%, 28.24±1.76%, 7.02±0.21%, 0.75±0.11%, and 0.78±0.11% respectively in cultured shrimp. The proximate compositions were significantly ($p \leq 0.05$) different in shrimp and prawn. It showed the cultured shrimp contain superior nutrients than cultured prawn. Meanwhile, the wild prawn showed better nutrients than wild shrimp. Hence, present study suggests that cultured shrimp and prawn can be used as a healthy choice of food for human consumptions and good source of animal protein like other fish.

Keywords: Wild; Cultured; Prawn; Shrimp; Proximate Composition.

1. Introduction

The nutritional properties of fish and shellfish are valuable foodstuffs for human health [1]. Fish and shellfish as a whole has a lot of food potential and can therefore provide relief from malnutrition, especially in the country like Bangladesh. It provides superior quality protein to that of meat, milk and eggs [2, 3]. In addition to that flesh fish and shellfish are tasty and highly digestible. Over and above it minimizes the risk of heart diseases and increases life expectancy [4]. The chemical parameters of wild fish and shellfish are strongly influenced by the environmental conditions, which determine the nutrients availability, while in cultured the feeding with artificial diets prepares a wide range of nutrients and determines the flesh composition [5, 6]. Cultured shrimp and prawn is provided with nutrient rich foods in addition to natural productivity in the pond. Wild shrimp and prawn on the other hand has to depend totally on natural food for its sustenance. These variations have direct bearing on body composition, health status and growth of shellfish. Body composition is therefore, a true reflector of its feeding habits and type of food availability. However, the flesh protein content is less influenced by external feeding since mainly dependent on intrinsic factors such as the species, variety, and size [7]. It is widely believed that the wild fish and shellfish acceptability is better than that of cultured fish, generally an important accomplishment is that consumers expect cultured fish to be equivalent or superior to the wild fish [8].

The *Penaeus monodon* and *Macrobrachium rosenbergii* are available in our country having high market value. However, consumers do not know the exact nutritive value of these species that play a significant role in our body. In addition, several studies have outlined various differences in nutritional composition between cultured and wild fish and shellfish, where not cultured are deemed of lesser quality [9, 10]. However, this is not unequivocally the case and some research has outlined contrasting and/or comparable qualities in cultured and wild fish and shellfish [11, 12]. Therefore, the primary objectives of these studies were to identify nutritional elements of differentiation, which characterize wild and cultured prawn and shrimp

and to convey an appropriate and authenticated message to the consumer about the nutritional quality of these species.

2. Materials and Methods

2.1 Collection of shrimp and prawn samples

A good number of wild shrimp were collected from Chairman ghat, Subornocho, Noakhali and prawn were collected from Alexgender, Laxmipur. The cultured shrimp and prawn were collected from different hatchery of Shatkira, Khulna. Then the samples were kept in an insulated cool box with ice and immediately transported to the laboratory of Institute of Food Science and Technology (IFST), BCSIR, Dhaka for analysis. Then the samples were separated and labeled and stored at -20°C until laboratory analysis.

2.2 Sample preparation for laboratory analysis

The shrimp and prawn species were cut into small pieces with a sharp knife and homogenized for analytical evaluation.

2.3 Determination of Proximate composition

The proximate composition of fish samples were analyzed in triplicate following standard procedures AOAC (2000) [13]: moisture content by drying in an oven at 105°C for 24 h; crude protein content (N x 6.25) by the Kjeldahl method using an Auto Kjeldahl System (Kjeltec TM 2300 Foss Tecator AB, Hoganas, Sweden), lipid by ether extraction (Soxtec System HT6, Tecator AB, Hoganas, Sweden), ash by incineration in a muffle furnace at 600°C for 6 h. Carbohydrate content was calculated based on difference calculation.

2.4 Data analysis

The data which obtained from this experiment were analyzed by MS EXCEL 2010 and XL-stat version 16 for DMRT to understand the differences of the variables.

3. Results and Discussion

3.1 Moisture content

The moisture content of wild shrimp and prawn were 72.35% and 71.44% respectively (Table 1). On the other hand, the moisture content of cultured shrimp and prawn were 63.29% and 69.82% respectively (Fig. 1). In the present study, the contents of moisture were found to be slightly higher in wild prawns than cultured while, higher in the wild shrimp than cultured. It could be as a result of age, diet and environmental factors in fish and shellfish habitat [14]. The moisture content in wild prawn was 78.08% than the cultured one, which was 76.09% [15]. The percentage of moisture between shrimp and prawn were 77.35% and 77.96% during ice storage [16]. The moisture content was 68.24% and 73.71% in *Penaeus monodon* and *Penaeus notialis* respectively [17]. Moisture content in body tissue of adult *Macrobrachium rosenbergii* were 76.40% and 75.50% from two different natural culture sites [18]. The moisture content in the present study was recorded as 72.35%, 71.44%, 69.82%, 63.29% in wild shrimp, wild prawn, cultured prawn and cultured shrimp which coincide with it (Table 1).

3.2 Protein content

The protein content of wild shrimp and prawn were 20.32%

and 25.86% respectively (Table 1). In cultured shrimp and prawn protein content were 28.24% and 26.26% respectively (Fig. 1). The considerable high protein content value is an indication that shrimp and prawn are a good source of quality protein [19]. The variation in protein could be due to essential nutrients in the local environment in which the shrimp and prawn lived [20]. The protein contained in *Macrobrachium amazonicum* and *M. rosenbergii* were 21.5% and 18.5% respectively [21]. Protein content in *Penaeus monodon*, *Fenneropenaeus indicus* and *Aristeus virilis* were 11.41%, 7.49% and 17.25% [22]. This research is coincided with our findings.

3.3 Lipid content

The lipid contents of the experimented wild prawn and cultured prawn were 1.70% and 2.69% respectively (Table 1). On the other hand the lipid contents of the experimented wild shrimp and cultured shrimp were 5.53% and 7.02% respectively (Fig. 1). This variation could be influenced by nutritional values of shrimp and prawn. In the present investigation, the Lipid values are generally higher in cultured shrimp compared to cultured prawn and as well as the wild shrimp contain higher lipid than wild prawn. The lipid contents in the male and female prawns were 3.35% and 4.12% respectively [18]. This present research work results more coincide with the findings of Saravana *et al.*, [18]. The biochemical composition of flesh of the Indian white shrimp *Penaeus indicus* contained 7.6% lipid in its flesh [23]. Lipid contents are affected by many other environmental physiological factors like gonad maturation, spawning season, feed intake, and starvation etc. Seasonal differences in the availability of food and changes in the reproduction cycle have considerable effects on the tissue biochemistry of the fish and shellfish, particularly fat [24].

3.4 Ash content

The value of ash of cultured prawn and shrimp were 0.86% and 0.75% respectively (Table 1). The ash contents of the wild prawn and shrimp were 0.81% and 0.87% respectively (Fig. 1). The variation of ash content between wild and cultured prawn as well as wild and cultured shrimp is very low which is coincides with the findings of Reddy *et al.*, [25]. They found 9.09% and 9.71 ash respectively from those cultured and frozen prawn. The current study findings were more or less similar to the reports of Ferdose and Hossain [26] reported that the ash contents in both cultured and frozen prawns were observed as 8.21% and 9.15% respectively. The average values of ash for *Penaeus semisulcatus* were reported as 4.06% [27].

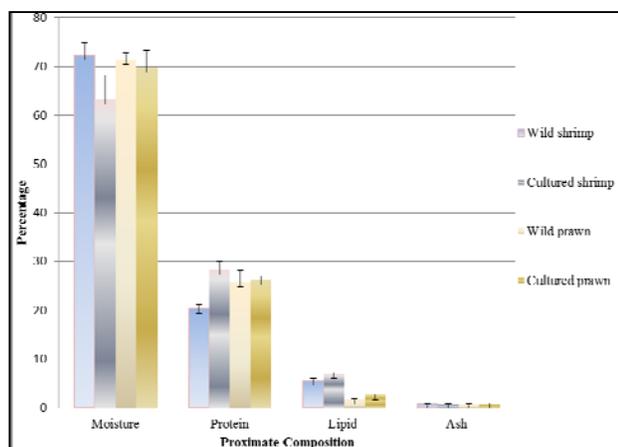
3.5 Carbohydrate content

The carbohydrate content of wild shrimp and prawn were 0.91% and 0.17% respectively (Table 1). On the other hand the carbohydrate content of cultured shrimp and prawn were 0.78% and 0.55% respectively. This research is coincides with the finding Reddy *et al.*, [25]. They reported that cultured and frozen *Macrobrachium rosenbergii* were contained 5.02% and 8.34% respectively.

Table 1: Proximate composition of wild and cultured *Penaeus monodon* and *Macrobrachium rosenbergii*

Species	Moisture (%)	Protein (%)	Lipid (%)	Ash (%)	Carbohydrate (%)
Wild shrimp	72.35±2.54 ^a	20.32±0.87 ^c	5.53±0.43 ^b	0.87±0.06 ^a	0.91±0.03 ^a
Cultured shrimp	63.29±4.97 ^c	28.24±1.76 ^a	7.02±0.21 ^a	0.75±0.11 ^c	0.78±0.11 ^b
Wild prawn	71.44±1.43 ^b	25.86±2.31 ^b	1.70±0.11 ^d	0.81±0.09 ^b	0.17±0.05 ^d
Cultured prawn	69.82±3.55 ^d	26.26±0.76 ^b	2.69±0.08 ^c	0.86±0.15 ^a	0.55±0.02 ^c

Means with the same superscript in the same column are not significantly different ($p \leq 0.05$)

**Fig 1:** Proximate composition of prawn and shrimp

4. Conclusion

The quality properties of both wild and cultured shrimp and prawn were significantly different that could have been influenced by several factors of their habitat. However, our findings revealed that both prawn and shrimp are good sources of proteins and can serve as an alternative source of high quality protein for human consumption. While, our results are novel but further research is needed to find out the variation of other nutritive compounds like amino acid profile, fatty acid profile and minerals value both wild and cultured shrimp and prawn.

5. Acknowledgement

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