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Note

Proximate composition of the surf clam *Mactra violacea* (Gmelin 1791)

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ABSTRACT

The surf clam *Mactra violacea* (Bivalvia: Mactridae) is a fairly large marine clam with high meat content. These clams are found in the surf zone of exposed sandy beaches. The proximate composition of *M. violacea* was studied. Moisture, crude protein, crude fat, acid insolubles and ash were estimated. The protein content of *M. violacea* was estimated as 11.9 %, fat 1 %, ash 3.2 % and moisture 80 %. The surf clam is a good source of protein and minerals and has low fat content. The nutritive value is high and comparable to other shellfishes.

Keywords: *Mactra violacea*, Proximate composition, Surf clam

Clams are one of the important varieties of shellfish and perhaps the most versatile seafood in the world. These edible bivalves are filter feeders; thereby have high conversion efficiency and consequently high levels of biochemical constituents. Clams are high in protein and the nutritive value of several species of clams has been estimated (Lakshmanan and Nambisan, 1981; Wenne and Styczyska-Jurewicz, 1987; George and Gopakumar, 1995; Dincer, 2006). Shellfish meat, particularly clam meat have been recommended in several dietary regimes for their high protein content, low calorific values, low fat/ cholesterol profile and lower proportions of saturated fat, the presence of good lipids, significant amounts of omega-3-fatty acids, dietary essential amino acids, vitamin B_{12} and several important minerals such as iron, zinc and copper (Krzynowek *et al.*, 1989; Dong, 2001; Trung tam Tin hoc- Bo Thuy San, 2007). Various factors affecting the proximate composition in shellfishes such as spawning season (Durve, 1964), fecundity (Durve, 1964; Litaay and De Silva, 2003), depth of culture area (Ngo *et al.,* 2006) have also been investigated (Qasim *et al.,* 1977; Nagabhushanam and Mane, 1978; Rivonker and Parulekar, 1995).

The surf clam *M. violacea* (Bivalvia: Mactridae) is a fairly large marine clam (>100 mm) with high meat content. These clams are found in the surf zone of exposed sandy beaches and occur in densities that will support significant fisheries. These unexploited species have attracted scientific and commercial interest and are the focus of several investigations (Cranfield *et al.,* 1992) This study presents the biochemical composition and thus the nutritive value of the surf clam.

The surf clam, *M. violacea,* were collected by diving and picking from the surf zone along the Thalassery beach (11.75° N, 75.49° E) in Kannur district, North Kerala, during 2005. Clams could not be collected in June and during September to December due to rough sea conditions. The clams were brought to the laboratory in live condition. After thorough washing, the shell was opened and the meat extracted, male and females identified and weighed after removing the excess moisture. Total weight and wet flesh weight were recorded to the nearest 0.1 g. The extracted meat was stored at 4 °C until further analyses. Moisture, crude protein, crude fat, acid insolubles and ash were estimated separately for males and females, according to the AOAC (1990) procedure. The results are presented as mean ± SD. The percentage edibility of the meat was estimated as percentage of wet flesh weight to total weight of the clam (Durve, 1964).

SPSS 7.5 for Windows program was used to search for significant differences between mean values for sexes and monthly variations in moisture, crude protein, crude fat, acid insolubles and ash. Differences between means were analyzed by one-way analysis of variance (ANOVA). Differences were considered to be significant when $p<0.05$. Cross correlations between the biochemical constituents was also examined by Pearson's Correlation test.

Moisture, crude protein, crude fat, ash and acid insoluble contents of *M. violacea* are shown in Table 1. The mean moisture content in *M. violacea* was higher in females (80.6 %) than in males (79.7 %). The mean crude protein in males and females was almost same at 11.8 % and 11.9 %. The mean crude fat was slightly higher in males

Table 1. Proximate composition (%) of surf clam *M. violacea*

Months	Moisture		Crude protein		Crude fat		Ash		Acid insolubles	
	M	F	M	F	M	F	M	F	M	F
Jan 05	80.8	—	10.2	—	1.4	—	4.4	—	1.3	—
Feb	77.7	80.4	11.7	11.4	1.2	0.9	3.0	3.1	0.3	0.32
Mar	—	80.3	—	11.3	—	0.9	—	3.9	—	1.1
Apr	76.8	78.5	13.6	12.4	1.9	1.4	2.9	3.3	0.4	0.6
May	—	80.2	—	12.5	—	0.9	—	3.4	—	1.2
Jul	82.0	82.4	11.7	11.8	0.5	0.4	3.5	3.9	1.0	1.3
Aug	81.2	82.0	11.9	11.8	0.7	0.7	1.5	2.0	0.0	0.02
Mean	79.7	80.6	11.8	11.9	1.1	0.9	3.1	3.3	0.6	0.8
±SD	2.3	1.4	1.2	0.5	0.6	0.3	1.1	0.7	0.5	0.5

M = Male, F= Female

at 1.1 % as against 0.9 % in females. The mean ash content was higher in females at 3.3 % when compared to 3.1 % in males. The mean acid insolubles were also slightly higher in case of females at 0.8 % than in males 0.6 %. However, differences between means of each of the biochemical constituents were not statistically significant ($p>0.05$) between sexes. Monthly/seasonal variations were also not statistically significant ($p>0.05$) for any of the biochemical constituents.

A significant positive correlation was observed in the ash and acid insoluble contents ($r = 0.895$, $p<0.01$). Positive correlation was observed between moisture and ash ($r = 0.018$, $p<0.01$) and moisture and acid insoluble contents ($r = 0.270$, $p<0.01$) while a negative correlation exists between moisture and crude protein ($r = -0.176$, $p<0.01$) and moisture and crude fat ($r = -0.159$, $p<0.01$). Negative correlation exists between crude protein and crude fat ($r = -0.209$, $p<0.01$) and crude protein and ash ($r = -0.437$, $p<0.01$) and crude protein and acid insoluble contents ($r = -0.352$, $p<0.01$). Negative correlation was also observed between crude fat and ash ($r = -0.114$, $p<0.01$) while a positive correlation exists between crude fat and acid insolubles ($r = 0.114$, $p<0.01$).

The monthly variation in the meat content is shown in Fig. 1. The mean meat content was 23.2 % and ranged between 15.2 and 26.7 %. The meat content was high during January to March declined during April-May and again increased during July-August. This also reflected the changes in the meat content in relation to the gonadal condition. The meat content was very low during April-May when the clams are in spent condition and elevated during January to March and again in August when the clams are maturing.

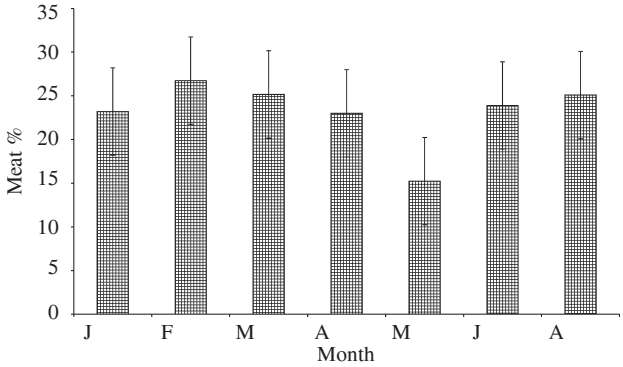

Fig. 1. Monthly variations in meat % in *M. violacea*

The evaluation of the proximate composition of *M. violacea* clearly indicates that the surf clam has higher biochemical composition comparable to those reported for several other shellfish species in India (Table 2). The protein

Table 2. Proximate composition (%) of selected commercially important molluscs

Species	Moisture	Crude protein	Crude fat	Ash	Reference
Meretrix casta	77.5	13.74	2.00	1.50	Lakshmanan and Nambisan, 1981
Villorita cyprinoides	82.05	9.3	1.5	2.5	Chinnamma George, 1985
Perna viridis	78.27	12.8	2.24	2.72	Chinnamma George, 1985
Crassostrea madrasensis	80.05	12.26	—	2.9	Chinnamma George, 1985
Anadara granosa	81.3	11.7	1.1	2.4	Trung tam Tin hoc-Bo Thuy San, 2007
A. subcrenulata	83.8	8.8	0.4	4.0	Trung tam Tin hoc-Bo Thuy San , 2007
Paphia undulata	8.3	10.3	0.5	2.4	Trung tam Tin hoc-Bo Thuy San, 2007
Meretrix lusoria	83.1	11.2	1.1	2.6	Trung tam Tin hoc-Bo Thuy San, 2007
Perna viridis	85.4	9.3	0.9	2.4	Trung tam Tin hoc-Bo Thuy San, 2007
Ruditapes decussatus	83.98	9.56	0.98	3.3	Dincer, 2006
R. philippinarum	85.91	8.71	0.78	3.1	Dincer, 2006
Mactra violacea	80.0	11.85	1.0	3.20	Present study

content is fairly high, almost similar to other clam species such as *Anadara granosa*, *Villorita cyprinoides* and *Meretrix casta* and the green mussel *Perna viridis*. The fat content is low while ash is high indicating that it is high in several of the essential trace elements. The proximate composition is also comparable to many other bivalve species (Table 2). The protein and ash content is higher than those reported for several clam species (Wenne and Styczyska-Jurewicz, 1987; Dincer, 2006; Trung tam Tin hoc-Bo Thuy San, 2007). A direct relationship exists between ash and acid insolubles which is probably due to the marine niche occupied by *M. violacea*. An inverse relationship exists between all other constituents. However, a direct relationship is reported in the backwater species, *M. casta* and *V. cyprinoides (*Lakshmanan and Nambisan, 1981).

The mean meat content in *M. violacea* also was very high at 23 %. The meat content varies with spawning season. It was very low during April-May when the clams are in spent condition and high during January to March and again in August when the gonads are maturing. Similar pattern has been reported in most other bivalves, mussels, oysters and in abalones (Wenne and Styczyska-Jurewicz, 1987; Krzynowek *et al.*, 1989; George and Gopakumar, 1995; Dincer, 2006). However, such drastic changes in the proximate composition levels were not observed in *M. violacea* although it has been reported in the abalone (Litaay and De Silva, 2003), edible oyster (Ngo *et al.*, 2006) and green mussel *P. viridis* (Qasim *et al.,* 1977; Nagabhushanam and Mane, 1978; Rivonker and Parulekar, 1995).

M. violacea is thus a potential source of good protein, high quality fat and minerals. *M. violacea* meat could well be a source of alternative to high fat / cholesterol meat such as chicken, beef or other red meat. *M. violacea* is at present not commercially exploited, although it is consumed by the local population. During monsoon, these clams are upwelled and beached in large quantities along Malabar coast. The local people collect these clams for domestic consumption. During other times, these clams are dredged in large numbers in the ring seines operated along the shore. In view of their high nutritive value, attempts may be made to encourage targeted exploitation of these protein rich shellfish.

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