

**BIOCHEMICAL STUDIES ON A LITTLE KNOWN MARINE GASTROPOD
HEMIFUSUS PUGILINUS BORN (VOLEMIDAE)**

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ABSTRACT

The Chemical composition of little known marine gastropod *Hemifusus pugilinus* belonging to the family Volemidae was investigated. The protein, carbohydrate, fat, water content, percentage of shell weight and Trace metals like Fe, Cu, Mn, and Zn of oven dried tissues were estimated, for various length groups of males and females. The percentage shell weight varied from 61 to 68.5 in males and 59.4 to 69.7 in females. The percentage meat weight has the range of 20.9 to 24.3 and 19.7 to 25 in males and females respectively. The percentage water content accounted for 41.4 to 66.6 in males and 52.3 to 61.1 in females. The protein was found to be more than 33.1 to 55.9% in males and 33.8 to 49.78% in females. The range of carbohydrate and fat in males and females are 4.7 to 12.1 and 15-23.6% and 3.2 to 9.5 and 17 to 21.8% respectively. The trace metals level of males in the order of Fe, Cu, Zn and Mn is 521-687 41-61, 74-103, and 33-48, $\mu\text{gm/gm}$ and that of females is 409-542 32-54, 109-113, and 27-36 $\mu\text{gm/gm}$ dry tissue.

INTRODUCTION

THE MOLLUSCS are delicious and rich in protein and are next in importance to fishes and prawns. Their nutritive value can be readily assessed by estimating the levels of protein, carbohydrate and fat in their body tissues. As the bivalves mostly constitute the shell fishery several works were dealt with bivalves rather than gastropods (Mobius, 1877; Meigs, 1915; Durve and Paul, 1961; Ansari *et al.*, 1981; Deshbande and Nagabhushanam, 1983). There remains no considerable studies with gastropods with regards to their nutritive value. The species *Hemifusus pugilinus* is edible in Hon shu Islands (Kira, 1962). In India there is no evidence to support this species as edible. The Major portion of the catches are for the shells which are used for ornamental purposes and in lime making. Hence, a brief study was carried out with the biochemical aspects of *Hemifusus pugilinus* which is commonly known as mullan changu. The amount of protein, carbohydrate and fat,

the percentage shell weight, of meat weight, of dry weight, and percentage of water content were determined.

The marine molluscs have been used as biological indicators to monitor marine pollution on a global scale (Jones, 1972; Stureson, 1976; Mathew and Menon, 1983 a). The amount of Heavy metals like Fe, Cu, Zn and Mn present in body tissues of various length groups of males and females were recorded and the results presented.

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MATERIAL AND METHODS

Only two species of the genus *Hemifusus*, viz. *Hemifusus pugilinus* and *H. cochlidium* are recorded from Indian waters. (Satyamoorthy, 1952). The present study was designed on the species *H. pugilinus* which is abundantly available along the Porto Novo Coast and its fishery potential is higher (Ananda

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Kumar, 1986). The animals were procured from the commercial catch immediately after landing and brought to the Laboratory. After recording the total weight of the animal with a monopan balance, the shell was broken and the weighed meat was oven dried at 70°C, and kept in a dessicator for estimating the water content, protein, carbohydrate, fat and trace metals. The animals thus collected during the period of Nov. 1984 - Oct. 1985 were segregated according to sex and length groups. For proximate composition studies, eight length groups *viz.*, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95 mm were used and for trace metal studies only four length groups 55-65, 65-75, 75-85, 85-95 mm from both males and females were used.

Shell weight

The total shell weight along with the operculum was calculated by deducting the meat weight from the total wet weight of the animal.

Meat weight

After the removal of shell and operculum with utmost care, not to loose the tissue, the animal was blotted with blotting paper and then weighed to 10 milligram level, and was noted as meat weight of the animal.

Water content

The percentage water content of the animals were estimated gravimetrically. The weighed meat of the animal was dried in a hot air oven at 70°C for 48 hours and reweighed. The difference in the weight was taken as the water content of the meat.

Protein

For total protein estimation, about 20 mg of oven dried tissue was homogenised with 1 ml of distilled water in a hand homogeniser

and the total protein was estimated in spectromic 20 by following the biurette method (Raymont *et al.*, 1964).

Carbohydrate

The Carbohydrate content of the tissues from various length groups of males and females were estimated following the phenol sulphuric method of Dubois *et al.* (1956). About 5 mg of oven dried tissue was taken for analysis.

Fat

For the extraction of lipids, chloroform methanol mixture (3:1) was used. (Foch *et al.*, 1956). 200 mg of oven dried tissue from each length group of males and females were used and the lipid content was estimated gravimetrically.

Calorific content

Calorific content from the tissues (K cal/gm dry wt) was calculated by using calorific equivalents of 5.65 for proteins 9.45 for lipids and 4 for carbohydrate. (Brady, 1943).

Total nitrogen

This was obtained by dividing the protein value by 6.25 (Ansel, 1974 a)

Trace metals

Trace metals like Fe, Cu, Zn and Mn of the whole body tissues from various length groups of males and females were estimated by wet digestion method (FAO, 1975). Samples weighing 0.5 to 1.0 gm dry weight were digested in a mixture of nitric acid - perchloric acid until it is almost dry and colourless. The final volume was made up to 50 ml with double distilled water. Concentration of the trace metals in the sample was estimated by aspirating the dilutions in Atomic Absorbtion Spectro-

photometer. Blanks and standards were also treated in the same manner as done for the samples.

RESULTS

The percentage of shell weight, meat weight, dry weight and water content of tissues in various length groups of males and females are given in Table 1.

of *Hemifusus pugilinus* was studied and it can be discussed in comparison with other gastropods. The heavy shell contributes much to the animal's wet live weight and the average percentage shell weight is 65.84 in the case of males and 63.84 in females. This value is higher than any other gastropod's shell weight so far reported. It is just 7.4 percent in *Megathura crenulata* and is 37 percent in *Haliotis cracherodii* (Booolotian *et al.*, 1962). In the

TABLE 1. Percentage of shell weight, meat weight, dry weight and water content in various length groups of *H. pugilinus*

Size groups (mm)	shell weight		meat weight		dry weight		water content	
	Male	Female	Male	Female	Male	Female	Male	Female
55-60	67.53	59.40	21.50	21.00	36.50	37.70	59.76	53.11
60-65	64.12	63.60	22.19	21.18	37.90	37.19	62.74	62.76
65-70	66.37	65.06	24.30	22.13	37.60	38.30	62.98	62.00
70-75	65.60	65.50	22.70	23.10	37.33	36.80	52.22	52.32
75-80	61.00	69.70	24.14	19.70	39.57	36.78	63.13	59.02
80-85	66.22	66.37	22.80	21.40	40.90	33.25	66.69	61.18
85-90	67.40	63.66	21.30	23.90	43.16	37.30	62.69	56.80
90-95	68.53	57.80	20.90	25.00	54.06	40.55	41.41	65.59
\bar{X}	65.84	63.89	22.48	22.18	40.88	37.23	58.95	59.09

The Table 2 illustrates the protein, carbohydrate and fat content of oven dried tissues of various length groups of males and females.

The Table 3 shows the accumulated heavy metals in various length groups (56-66, 66-76, 76-86 and 86-96 mm) of males and females.

DISCUSSION

As the species *Hemifusus pugilinus* was stated to be edible (Kira, 1962) the nutritive value

case of moon snail *polinices lewisii* it is 61.6 percent (Geise, 1969). Higher percentage shell weight may account for the high hydraulic pressure in the habitat and lesser amount in females may be due to their reproductive efforts in which they have to spend shell materials in egg production and hence much shell materials may be secreted by the animals. As *H. pugilinus* shows higher percentage of shell weight it shows lesser percentage of meat weight than that of *M. crenulata* (92.6%) and

TABLE 2. *Protein, carbohydrate, lipid (% dry wt), calories (K cal/gm dry wt) and total nitrogen in various length groups of H. pugilinus*

Length groups (mm)	Protein		Carbohydrate		Lipid		Calories		Total Nitrogen	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
55-60	41.18	49.18	12.13	7.73	21.00	21.33	4.12	3.52	6.59	7.87
60-65	33.19	41.48	11.30	5.46	16.17	17.17	3.64	2.67	5.31	6.64
65-70	44.84	44.87	8.46	5.66	16.67	17.00	3.34	2.83	7.17	7.18
70-75	46.09	41.79	9.06	9.53	23.67	21.50	3.71	2.84	7.37	6.69
75-80	47.32	44.87	8.06	5.90	15.00	17.83	3.41	2.93	7.57	7.18
80-85	55.93	33.80	9.02	3.26	19.80	17.33	3.78	2.00	8.95	5.40
85-90	49.17	49.78	7.60	7.60	18.50	21.80	3.45	3.50	6.88	7.96
90-95	34.02	36.26	4.70	8.13	13.90	18.50	2.64	3.16	7.21	5.80
X	45.09	42.75	8.79	6.66	16.35	19.06	3.51	2.93	7.13	6.84

TABLE 3. *Amount of heavy metals (Fe, Cu, Zn and Mn in $\mu\text{g/gm}$) in various length groups of males and females of H. pugilinus*

Length groups (mm)	Fe		Cu		Zn		Mn	
	Male	Female	Male	Female	Male	Female	Male	Female
56-66	552	425	41	46	74	113	37	36
66-76	573	409	39	32	109	105	40	35
76-86	521	476	57	35	91	109	33	27
86-96	687	542	61	54	103	113	48	37
\bar{X}	583	463	49.5	41.75	94.25	110	39.5	33.7

H. cracherodii (63%) (Booolotian, 1962). The higher percentage of water content (61.62% in males and 59.59% in females) may be attributed to their deep water habitat (Geise, 1969). Further the length groups with higher lipid level show lesser water content and this relationship was established already (Webber, 1927). Regarding the protein value

H. pugilinus shows lesser value than that of previous reports on *Cellana radiata* (Suryanarayan and Nair, 1976), *Cellana rota* (Patil and Mane, 1982), and *Cerithium rubus* (Krishna Kumari, 1985). The higher protein value in males may be due their less energy expenses for reproduction. Concerning the percentage carbohydrate value *H. pugilinus* shows much higher values than the previous reports except for *C. rubus* which shows almost equal value. The same is the case also for lipids. Generally the fluctuations in the value of carbohydrate, protein and lipid may be either due to ecological factors including the availability of nutrients or due to the animal's reproductive behaviour.

Considering the heavy metal concentration except for Zn all the three heavy metals show high-

er accumulation in males. The accumulated heavy metal values for *H. pugilinus* are lesser than that of *C. rubus* (Krishna Kumari, 1985), which may account for the difference in the degree of pollution between the two environments or the animal's higher accumulating ability. The little difference in heavy-metal concentration of males and females confirm the results of Latouche and Mix (1982) in Bay mussels.

Having in mind the statement of Kira (1962) it can be inferred that *H. pugilinus* is good for consumption as it approximates with previous reports on the nutritive value of some edible gastropods. Further the carbohydrate value is much higher than the previous reports and the heavy metal concentration is much less.

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