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Proximate Composition of Edible Palaemonid Prawn *Macrobrachium idae* (Heller, 1862)

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Abstract: In the present study, proximate composition (protein, carbohydrate, lipid, ash and moisture) and fatty acids were studied in different size groups and sexes of *Macrobrachium idae.* In general, the protein content was higher in younger ones than in adults. The total values of saturated fatty acids were maximum in females (21.84%) than in males (12.82%). Among various saturated fatty acids recorded, the amount of oleic acid in both sexes was more. As in saturated fatty acids the total amount of monounsaturated fatty acid also shows maximum in males rather than females. The total amount of polyunsaturated fatty acids of *M. idae* is minimum than monounsaturated fatty acids and saturated fatty acids. The present study clearly indicated that the nutritive value of *M. idae* is very well comparable to the edible species of decapod crustaceans already studied (shrimps, prawns and lobsters). Considering the above results from the nutritional point of view, *M. idae* can be very well used as food and perhaps as a candidate species in future for culture.

Key words: *Macrobrachium idae*, protein, carbohydrate, lipid, moisture and fatty acid

INTRODUCTION

Freshwater prawns are important in the capture and culture fisheries scene and are extensively distributed in freshwater and estuaries of the world mostly in tropical and subtropical belts. Many species are of regional or local fishery important, however only half a dozen species of genus *Macrobrachium* are of major economic value in India. Prawn represents a very important fishery resource and is strongly exploited by local communities (Cabrera-Jiménez *et al*., 1977). In India, millions of people suffering from malnutrition. Protein deficiency may be minimized for some extent by making available cheaper fish meal items which are available to local communities. Prawn has become the major source of animal protein to the low income earners due to its low price and availability (Adeyeye, 1996). Eventhough M. idae is eaten by local population (Dinakaran and Soundarapandian, 2008) but nobody studied the nutritional status of this species. So study on the nutritional status of this species is very much needed. In this connection studies on biochemical aspects of different size groups and sexes in prawns are very much awaited to know the nutritional status of prawns which leads to the introduction of new species for aquaculture.

MATERIALS AND METHODS

The prawn, *M. idae* was collected from freshwater areas of Ponanthittu (Lat.11º28'50.50ºN; Long. 79º45'28.23ºE) which is located 2 km south to Parangipettai and the water source finally connected with Vellar estuary. The study was conducted from October to December 2008. Totally 180 specimens (size ranging from 30–110 mm in length) were collected and transported to the laboratory in live condition and washed with distilled water to remove dust and algal particles and eventually ice killed. Then they were separated in to three groups *viz*. male, female and berried. Further grades were made according to the size and each group was placed into eight size groups at 10mm intervals. After grading, the exoskeleton was pealed out and homogenized with pestle and mortar. The grounded samples were then freeze dried and powdered and stored in refrigerator for further analysis.

The protein, carbohydrate and lipid contents were estimated by adopting the standard methods of Raymont *et al.* (1964), Dubois *et al.* (1956) and Folch *et al.* (1957) respectively. The difference in weight between wet and dried tissue represented the weight of water in the body tissue, which is expressed as percentage. Ash was estimated by incinerating the pre- weighed test material (1gm dry weight in a mettle turn ace at 560º C for a period of 5 hours). The residue was weighed and the percentage was calculated. The fatty and methyl esters of the sample was injected the gas chromatography (GC-6890) capillary column coated with 5% phenyl silicone at a temperature from 170º C to 300º C for 23.33 minutes. Flame ionization time of the different fatty acid samples were identified. Triplicate was maintained for each experiment.

Statistical analysis: To know the statistical significance one way ANOVA was carried out between sexes and size groups.

RESULTS

The proximate composition of different sexes and size groups of *M. idae* are presented in Table1.

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Table: 1: Biochemical composition in the muscle tissues of *M. idae* (Values expressed in % on dry weight basis except moisture).

S.No.	Sample	Lenght (mm)	Protein (%)	Carbohydrate (%)	Lipid (%)	Ash (%)	Moisture
1	Male		60.82±0.12	2.12±0.22	4.48±0.22	4.76±0.16	79.68±0.23
	Female	31-40	59.14±0.22	2.08±0.08	4.12±0.16	4.88±0.10	78.54±0.18
	Berried (F)		58.44±0.54	1.88±0.12	3.88±0.32	4.94±0.08	77.88±0.22
2	Male		61.44±0.43	1.89±0.23	4.12±0.08	5.25±0.11	80.42±0.32
	Female	41-50	60.64±0.20	2.02±0.10	3.98±0.26	5.16±0.18	79.34±0.24
	Berried (F)		58.86±0.32	1.82±0.20	3.64±0.14	5.94±0.38	76.82±0.18
3	Male		59.54±0.24	2.26±0.12	5.06±0.06	5.75±0.12	79.34±0.26
	Female	51-60	58.86±0.42	2.32±0.14	5.34±0.12	5.64±0.22	77.46±0.16
	Berried(F)		57.44±0.38	2.10±0.21	3.56±0.14	5.82±0.18	79.14±0.30
4	Male		58.44±0.46	1.98±0.24	5.12±0.24	5.92±0.19	77.43±0.28
	Female		58.88±0.22	1.76±0.11	4.12±0.32	6.34±0.14	76.36±0.24
	Berried(F)	61-70	57.32±0.30	2.10±0.21	4.02±0.22	6.68±0.15	79.82±0.26
5	,Male		58.86±0.32	2.33±0.16	4.68±0.30	6.32±0.22	80.06±0.32
	Female	71-80	58.54±0.26	2.08±0.30	4.96±0.14	6.04±0.16	77.05±0.26
	Berried(F)		57.42±0.12	2.14±0.21	4.22±0.16	6.35±0.18	80.02±0.22
6	Male		58.24±0.14	2.16±0.14	3.98±0.23	6.68±0.13	79.42±0.12
	Female	81-90	57.24±0.40	2.28±0.22	4.86±0.16	6.56±0.16	79.25±0.21
	Berried(F)		56.94±0.46	1.96±0.21	3.36±0.21	6.76±0.11	81.04±0.16
7	,Male		59.86±0.23	2.44±0.12	4.42±0.18	6.54±0.22	80.26±0.21
	Female	91-100	-----	------	------	------	------
	Berried(F)		-----	------	------	------	------
8	Male		60.44±0.12	2.64±0.22	4.20±0.08	6.74±0.16	80.54±0.20
	Female	101-110	-----	------	------	------	------
	Berried(F)		-----	------	------	------	-------

Protein: The protein content was maximum in males (61.44%) in the size groups of 41–50mm. While minimum was (58.24%) recorded in 81–90mm size groups. The protein content in berried females was ranged from 56.94 to 58.86% in the size groups of 81–90mm and 41–50mm respectively. The females showed highest protein content (60.64%) in the size groups of 41–50mm and lowest protein value (57.24%) was in the size groups of 81–90mm.

Carbohydrate: In males, the carbohydrate values varied between 1.89% in 41–50mm and 2.64% in 101–110mm size groups. In berried females it ranged from 1.82% in 41–50mm to 2.14 in 71–80mm size groups. Like wise in females, it fluctuated between 1.76% in 61–70mm and 2.32% in 51–60mm size groups.

Lipid: The lipid content was maximum in males (5.12%) in the size groups of 61–70mm. While minimum lipid was recorded (3.98%) in 81–90 mm size groups. The lipid content in berried females was ranged from 3.36 to 4.22 % in 81–90mm and 71–80mm size groups respectively. In females showed highest lipid content of 5.34% in 51.60m size groups and lowest lipid values (3.98 %) was in 41–50mm size groups.

Ash: Ash content showed an increasing trend from young ones to adult in both males and females. The maximum ash content was recorded in males (6.74%) in the size groups of 101–110mm, while the minimum ash content was (4.76%) recorded in 31–40 mm size groups. The ash content in berried females was ranged from 4.94 to 6.76% in 31–40mm and 81–90 mm size groups respectively. In females, showed highest level of ash content (6.56%) in the size groups of 81–90 mm and lowest ash values (4.88%) was in 31–40mm size groups.

Moisture: The moisture content in males was ranged from 77.43 to 80.54% in 61–70mm and 101–110 mm size groups respectively. Berried females exhibit a minimum water content of 76.82% in 41–50 mm and maximum values of 81.04% in the size groups of 81–90 mm. The females showed higher water content of 79.34% in 41–50 mm size groups and lower content of 76.36% in the size groups of 61–70 mm. The results of one way analysis of variance showed that protein, carbohydrate, lipid, ash and moisture did not varied significantly between males, females and berried (Table 2). However, protein, lipid and moisture varied significantly between different size groups except carbohydrate and ash (Table 3).

Fatty acids: For fatty acid analysis only medium sized males (70–90mm) and females (70–80mm) were taken into consideration. The total amount of saturated fatty acids present in males was 19.28% and females it was 41.33%. Among total 6 individual saturated fatty acids reported, the palmitic acid was maximum in both females (25.67%) and males (12.13%). However Lauric acid was reported minimum and present only in females (Table 4).

The total amount of monounsaturated fatty acids were minimum in males (12.82%) whereas in females it was about 21.84% Oleic acid was found to be maximum then any other monounsaturated fatty acid in both males and females. But it was dominated in females (17.41%) rather in males (9.41%) (Table 5). The total amount of polyunsaturated fatty acid was recorded maximum in females (7.46%) than in males (3.79%) (Table 6). The total amount of Anteiso branched and Iso-branched fatty acids were maximum in males and minimum in females (Table 7 and 8).

DISCUSSION

Biochemical composition of organisms are know to vary with season, size of animal, stages of maturity and

Table 2: One way ANOVA for the biochemical composition between different sexes

		Sum of Squares	df	Mean Square	F	Sig.
Protein	Between Groups	1372.134	2	686.067	1.410	NS
	Within Groups	10218.152	21	486.579		
	Total	11590.286	23			
Carbohydrate	Between Groups	2.585	2	1.293	2.047	NS
	Within Groups	13.261	21	.631		
	Total	15.846	23			
Lipid	Between Groups	11.519	2	5.760	2.160	NS
	Within Groups	55.998	21	2.667		
	Total	67.517	23			
Ash	Between Groups	15.090	2	7.545	1.393	NS
	Within Groups	108.347	20	5.417		
	Total	123.437	22			
Moisture	Between Groups	2293.349	2	1146.675	1.299	NS
	Within Groups	18542.313	21	882.967		
	Total	20835.662	23			

Table 3: One way ANOVA for the biochemical composition between different size groups

		Sum of Squares	df	Mean Square	F	Sig.
Protein	Between Groups	6753.283	7	964.755	3.191	P<.05
	Within Groups	4837.003	16	302.313		
	Total	11590.286	23			
Carbohydrate	Between Groups	7.006	7	1.001	1.811	Ns
	Within Groups	8.841	16	.553		
	Total	15.846	23			
Lipid	Between Groups	38.440	7	5.491	3.022	P<.05
	Within Groups	29.076	16	1.817		
	Total	67.517	23			
Ash	Between Groups	64.073	7	9.153	2.313	NS
	Within Groups	59.364	15	3.958		
	Total	123.437	22			
Moisture	Between Groups	12191.950	7	1741.707	3.224	P<.05
	Within Groups	8643.712	16	540.232		
	Total	20835.662	23			

Table 4: Saturated fatty acids in females and males (%) of *M. idae*

Fatty Acids	Name	Female70-80 (mm)	Male 70-90 (mm)
C12:0	Lauric acid	0.71	-
C14:0	Myristic	3.40	2.39
C15:0	Pentadecyclic	1.51	1.10
C16:0	Palmitic	25.67	12.13
C17:0	Margaric	2.21	1.10
C18:0	Stearic	7.83	2.56
Total		41.33	19.28

Table 5: Monounsaturated fatty acids in females and males (%) of *M. idae*

Fatty Acids	Name	Female 70-80 (mm)	Male 70-90 (mm)
C15:1w5c		-	0.80
C17:1w8c		0.70	0.66
C18:1w9c	Oleic	17.41	9.41
C18:1w7c	Octadecenoic	3.73	1.95
Total		21.84	12.82

Table 6: Polyunsaturated fatty acids in females and males (%) of *M. idae*.

Fatty Acids	Name	Female 70-80 (mm)	Male 70-90 (mm)
C20:4w6c	Arachidonic	7.46	3.79
Total		7.46	3.79

Table 7: Branched fatty acids in females and males (%) of *M.idae*

Fatty Acids	Female70-80(mm)	Male70-90(mm)
C11:0Anteiso	0.71	4.93
C12:0Anteiso	1.27	6.93
C13:0Anteiso	1.35	5.77
C14:0Anteiso	1.32	4.53
C15:0Anteiso	1.11	4.03
C16:0Anteiso	1.08	3.07
C17:0Anteiso	0.68	2.95
C18:0Anteiso	9.66	5.81
C15:1AnteisoA	1.17	0.86
C15:1AnteisoB	-	1.15
Total	18.35	40.03

Table 8: Branched fatty acids in females and males (%) of *M. idae*.

Fatty Acids	Female70-80(mm)	Male70-90(mm)
C14:0 ISO	---	1.32
C17:0 ISO	0.37	---
C16:1 ISO H	---	0.42
C18:1 ISO H	0.74	----
C19:1 ISO I	2.69	1.09
C13:0 ISO 3OH	---	1.10
C16:0 ISO 3OH	---	3.72
C15:0 ISO 2OH	6.18	2.84
C11:0 2OH	---	4.64
C16:0 N Alcohol	0.56	1.45
Total	10.54	16.58

availability of food, temperature etc. Protein is the most prominent biochemical components of crustaceans from eggs to adult and is strikingly dominant in younger phases. The quantity of protein in shrimps is largely influenced by the extent of fat and water content (Geiger and Bergstrom, 1962). In the present study, males were found to have more protein than females. The fall in protein content, which is very well pronounced in females suggested that the protein in the muscle may be mobilized for the gonadal development. The same trend was

observed by Sriraman (1978) in shrimp, *Penaeus merguiensis* and in freshwater prawn *M. idae*. In contrary, females of *P.indicus* and *Metapenaeus monoceros* were increasingly proteinacious than males. Garg *et al*. (1977) reported that the protein content in *Squilla* was varied from 70.09 to 75.46% and in Jawla prawn from 61.93 to 72.64%. Nair and Prabhu (1990) showed that protein content in *M.dobsoni* was 65.25% and in *Acetes sp*. was 66.98%. According to Sambhu and Jayaprakash (1994) the protein level in *P.indicus* was varied from 44.62 to 80.87%. The high protein content in the lowest size groups may be attributed to increased protein synthesis during the active growth phase as it has been observed elsewhere in shrimps and mantis shrimps (Achuthan Kutty and Parulekar, 1984; Ajit kumar, 1990; Tanuja, 1996). *M.idae* showed greater variation in protein with regard to size group, protein content was higher in younger organisms than in adults. In the present study *M.idae* also showed higher protein content in younger ones than in adults as per the study of Sriraman (1978). Among females, non-berried females showed higher value than berried females. This is mainly due to the intake of protein for the development of eggs in berried females. Protein fluctuation was non significant between sexes, whereas significant among all size groups.

Carbohydrates constitute a meager percentage of the total biochemical make up in *M. idae* muscle when compared to protein and ash contents. Carbohydrate content exhibited an inverse relationship with protein content. Similar findings were recorded by Sriraman (1978), Nair and Prabhu (1990), Reddy and Shanbhogue (1994), Sambhu and Jayaprakash (1994) and Ravichandran (2000). The raise in carbohydrate content was gradual among the size groups and the peak value was observed in the bigger size group, which may be due to more synthesis and accumulation of carbohydrates in the higher size groups than in younger ones. Various factors like gonad development in addition to starvation, feeding, rest, exercise and other physiological states changes the carbohydrate level. Presently the higher values encountered in larger organisms might be due to storage and senility in them. No distinguished trend in carbohydrate fluctuation was noticed among the size groups of many shrimps studied by Achuthan Kutty and Paruhekar (1984) and Ajit Kumar (1990). In the present study, males generally showed higher carbohydrate values than females and among females, non-berried females showed higher carbohydrates, which is agreement with Ajith Kumar (1990). However the variations of carbohydrate between sexes and size groups are not statistically significant.

In general, lipid act as major food reserves along with protein and subjected to periodic fluctuations influenced by environmental variables like temperature (Johnstene, 1917). The inverse relationship between lipids and protein was earlier reported by George and Patel (1956), Pillay and Nair (1973), Sriraman (1978), Radhakrishnan (1979), Nair and Prabhu (1990) and Ravichandran (2000). Pillay and Nair (1973) marked an inverse relationship between lipids and moisture content. But this does not affect the lipid composition of muscle tissue to any great extent. Shaikhmahmud and Magar (1957) obtained higher lipid content in mature females of *Parapanaeopsis stylifera* when compared to immature ones. Gopakumar and Nair (1975) did not find any variation in the lipid content of muscle tissue of five species of penaeid shrimps studied. Achuthan Kutty and Parulekar (1984) also did not find any consistency to suggest that maturity condition influnces the lipid composition of muscle tissue. In the present study also there is no regularity in fat values among the size groups in males and females. Berried females showed lesser lipid values than non-berried females and the non-berried females showed higher fat values than males. The lipid content was nonsignificant among the sex groups and significant among the size groups.

Ash is one of the least studied biochemical constituents of crustaceans in general and *M. idae* in particular. Sriraman and Reddy (1977) observed slight increase in ash content with increase in the size of juveniles of *P.monodon*. In the present study also signals a marginal and gradual raise in the ash composition of muscle regardless of sex. Similar marginal increases in ash during growth were also reported by Achuthan Kutty and Parulekar (1984) in *P.stylifera* and *M.affinis* and Ajithkumar (1990) in *M. idella*. Nair and Prabhu (1990) reported that ash composition in *M. dobsoni* was 15.79% and in Jawla prawn (*Acetes sp)* was17.11%. In the present study reflected that increased ash content was noticed in increasing size groups, regardless of sex. The differences of ash content among males, berried and non-berried females are also noticed and this difference is statistically nonsignificant.

In the present study, the total values of saturated fatty acids are maximum in females (21.84%) than in males (12.82%). Among various saturated fatty acids recorded, the amount of oleic acid in both sexes was more. But when compared with males (9.41%) the females had more (17.41%). Murugesan (2007) also reported maximum amount of palmitic acid (20.09%) in *C.lucifera*.

As in saturated fatty acids the total amount of monounsaturated fatty acids in females were maximum rather than males. Among mono-unsaturated fatty acids studied, palmitic acids was higher in females (25.67%) than in males (12.13%).Comparatively the total amount of polyunsaturated fatty acids of *M. idae* is minimum then monounsaturated and saturated fatty acids. In the present study the fatty acids having carbon atoms above 20 could not be identified by the instrument. So the rest of the fatty acids in the *M. idae* was not detected. Further detailed study on fatty acid profile using advanced and versatile instrument is suggested. From the present observation, it could be conformed that *M. idae* is not inferior in terms of nutritive value of already studied decapod crustaceans. So *M. idae* is advised to introduce in aquaculture practices.

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