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RESEARCH ARTICLE

BIOCHEMICAL COMPOSITION AND CALORIC CONTENT OF PARATELPHUSA MASONIANA (HENDERSON), A LOCAL FRESHWATER CRAB, FROM JAMMU WATERS

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ABSTRACT

During the course of present study, various nutritional aspects viz. protein, glycogen, lipid, moisture and ash of the body meat of a local freshwater crab, *Paratelphusa masoniana* has been investigated in both male and female crabs and marked seasonal variations were observed during an year long investigation. Lipid and water contents were inversely related, maximum lipid levels being recorded during the pre-spawning months and minimum during post-spawning. The relationship between lipid and protein was a direct one. Pre-spawning period witnessed high energy values and muscle glycogen witnessing a direct correlation with feeding and spawning activity. Nutritive value of *P. masoniana* is well comparable to other edible species of decapod crustaceans like prawns and shrimps thereby ensuring its potential as an edible and potential culture candidate species.

INTRODUCTION

Freshwater crabs (Potamidae, Potamonautidae, Gecarcinucidae, Parathelphusidae, Pseudothelphusidae, Trichodactylidae) are a group of more than 1,280 species that comprise the largest group within the brachyurans according to the latest assessment (Ng *et al*., 2008).

The crabs rank after shrimps and lobsters for their esteemed seafood delicacy and also the value of fishery they support (Savad and Rahavan, 2001). The nutritional quality of the crab proteins compare very favourable with that of muscle meat of mutton, chicken, duck, and fish (Newcombe, 1944; Derosier, 1963; Zaitsev *et al.,* 1969). Studies on *Paratelphusa masoniana*, a local freshwater crab in Jammu water bodies has recently attracted the attention of workers keeping in view the fact that it is readily available, completes its lifecycle in freshwater only and can be maintained in captivity. So far, a very limited number of reports are on record with regard to this species. Whatever little work has been reported that too pertains to its eco-biology and population structure. Preliminary studies witness the species to be a potential culture candidate as evinced by its high protein content. Further the scope or role of a species in aquaculture practice is primarily determined by its nutritional status, especially the protein value. Present study therefore, represents a maiden endaeavour been to investigate and establish reference range for biochemical estimation of proteins, lipid and glycogen during the reproductive cycle of *P. masoniana*.

MATERIALS AND METHODS

Crabs were collected from their natural habitat, at Gho-Manhasan stream, at a distance of about 12 kms from University of Jammu. Only adult crabs (of 5-6 cm carapace width) were selected and the analysis was performed over a period of one year, beginning in July 2010 and concluding in June 2011. Soon after catching, crabs were brought to the laboratory and male and female crabs were segregated. The crabs were then dissected for body meat. The organic constituents of each component were determined by standard methods such as Total proteins (Lowry *et al*., 1951); Glycogen (Vander vies procedure, 1954); Lipid (Folch *et al*., 1956); Moisture (Standard method of AOAC, 1999). The results were expressed on dry weight basis. Caloric content was calculated by multiplying the concentration of various components with conversion factors 4.15, 9.4, 5.65 for carbohydrate, lipid and protein respectively (Philips, 1969). The caloric values were expressed as calories per gram (cal gm^{-1} DWB).

RESULTS

Lipid and water percentages in male and female crabs are shown in fig 1. The percentage of water varied from 77.41±1.59% (March) to 80.67±1.76% (December) in males and 78.13±1.45% (March) to 84.23±1.60% (July) in females. The percentage of water was high during July (monsoon) and December (winter) which correspond to Ist and IInd spawning period respectively. The percentage of lipid in the body meat varied between 4.08±0.31% (December) to 6.52±0.41% (August) in male crabs. In female crabs, it however, varied from 3.99±0.32% (July) to 5.85±0.46% (September). Seasonal variations in the protein content in the body meat of male and female crabs are shown in fig 2. It can be seen that the protein percentage varied from 55.12±0.30% (in October) to 64.5±0.11% (in April) in male crabs. In female crabs however, it fluctuated from 46.05±0.82% (in December) to 62.15±0.30% (in March). The glycogen variations studied in both the sexes are presented in fig. 3. Muscle glycogen varied from 0.97±0.28% (in December) to2.73±0.57% (in March) in

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Table 1 Seasonal variation in various biochemical compositions (dry weight basis) in *P.masoniana* (male)

	Moisture	Lipids %	Calg^{-1}DWB	Glycogen %	Calg^{-1}DWB	Protein %	Calg^{-1}DWB	
July	79.08	5.40	50.76	1.22	5.06	59.98	338.89	394.71
Aug	78.65	6.52	61.29	2.44	10.13	58.75	331.94	403.36
Sep	79.12	5.68	53.39	2.53	10.50	57.56	352.21	389.10
Oct	78.51	5.48	51.51	1.93	8.00	55.12	311.42	370.93
Nov	77.41	4.42	41.55	1.31	5.44	59.92	338.55	385.54
Dec	80.67	4.08	38.35	0.97	4.03	62.00	350.30	392.68
Jan	79.67	4.41	41.45	1.22	5.06	58.50	330.53	377.04
Feb	78.49	4.98	46.81	1.85	7.68	58.00	327.70	382.19
Mar	77.41	5.18	48.69	2.73	11.33	59.00	333.35	393.37
April	75.01	5.69	53.49	1.89	7.84	64.50	364.43	425.76
May	76.96	5.03	47.28	2.03	8.42	60.89	344.03	399.73
June	78.26	4.98	46.81	2.01	8.34	59.90	338.49	393.64

Table 2 Seasonal variation in various biochemical compositions (dry weight basis) in *P.masoniana* (female)

Month	Moisture	Lipids %	Calg^{-1}DWB	Glycogen %	Calg^{-1}DWB	Protein %	Calg^{-1}DWB	Total caloric value (Calg^{-1})
July	84.23	3.99	37.51	1.10	4.57	48.51	274.08	316.16
Aug	81.30	5.45	51.23	1.71	7.10	50.98	288.03	346.36
Sep	81.90	5.85	54.99	2.04	8.47	54.29	306.74	370.20
Oct	81.29	5.33	50.10	3.62	15.02	55.85	315.55	331.59
Nov	81.76	4.41	41.45	1.41	5.85	53.98	304.99	352.29
Dec	82.56	4.08	38.35	0.98	4.07	46.05	260.18	302.60
Jan	82.20	4.22	39.67	1.53	6.35	54.75	309.33	355.35
Feb	79.61	4.76	44.74	1.95	8.13	56.03	316.57	369.44
Mar	78.13	5.49	51.61	3.32	13.78	62.16	351.20	416.59
April	78.53	5.03	47.28	3.28	13.61	60.50	341.82	402.71
May	79.28	4.84	45.50	2.81	11.66	57.54	325.10	382.26
June	80.98	4.44	41.73	2.76	11.45	50.77	288.03	341.21

males and from 0.98±0.13% (December) to 3.62±0.73% (in October) in female crabs. The seasonal variation in various biochemical contents in both male and female crabs has been shown in Table 1 and 2 respectively.

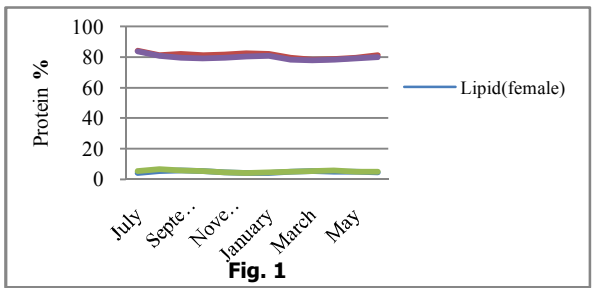

Fig. 1

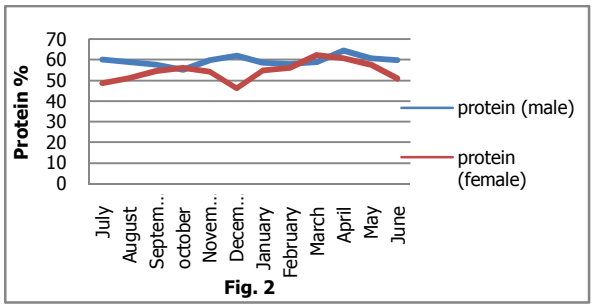

Fig. 2

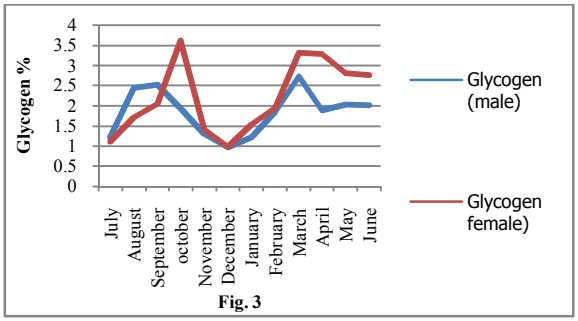

Fig. 3

DISCUSSION

Lipid- water cycle

Water as a component, contributes maximally to the chemical composition in the muscle tissues of all organisms including fin fishes and shell fishes investigated so far. Lipids act as major food reserve along with protein and are subjected to periodic fluctuations influenced by environmental variables like temperature (Johnstene, 1917). Lipids are highly efficient as sources of energy and they contain more than twice the energy of carbohydrates and proteins (Okuzumi and Fujii, 2000)

The lipid content in the present species is comparatively low as against higher values recorded for finfishes. Higher values of lipid content have been reported in *I. crenata* (5.4 -15.6%) by Mercy Thomas (1985) in *P. vigil* (16.8–31.9%) by Radhakrishnan (1979). Present species therefore stands in a better quality food list for human beings. When compared to other species of shell fishes, *P.masoniana* has higher lipid content viz., *M. rosenbergii*: 3.37, *Scylla tranquebarica: 1.8-2.7%, Scylla serrata*: 0.21% (Gopakumar, 1993 Ed.). The significance of such high lipid level, however, can be specially established only if their complete lipid profiles are determined. In general, the high values for lipid were observed during non-spawning season. The high lipid content observed in spring and post-monsoon could be attributed to active feeding and optimum availability offood, as algal blooms and plankton are reported to acquire maxima during this period (Sharma, 2005). The lipid content however showed a declining trend towards May to July and November to January and an increase during

August to October and February to April. Decline in lipid content during spawning period was possibly due to mobilisation of lipid as energy source to meet the high energy demands, during the act of ovulation and spawning on one hand and due to low feeding intensity and low availability of food items on the other. Similar reports on energy mobilization in fishes during spawning seasons have previously been made by Jafri and Khawaja (1968), Love (1970), Diana (1983), John and Hameed (1995), Vanden Thillart *et al. (*2002), Kilne and Willet (2002), Jonsson and Jonsson (2005), Nargis (2006) and Zaboukas *et al (*2006). In the present study, it has been observed that male crabs have average higher lipid content than female crabs. Our results are in contradiction with the findings of Clarke (1980) wherein lipids were found to be the most variable fraction and males of marine invertebrates were found to have a lesser lipid content.

Protein cycle

High levels of protein during post-monsoon and spring season can be attributed to planktonic abundance on one hand and deposition of proteins to meet the protein requirement of next breeding season on the other hand. On the contrary, a decrease in the protein content during winters and monsoon may consequently arise due to spawning function, reduced feeding intensity, enhanced catabolic process, reduction in the reserve food content and large scale transfer of proteins from muscles to ovaries. Lee (1968) also recorded that the protein minima and maxima correspond to the development/ spawning and biological regression/resting. Similar observations have been recorded in *M. dayanum* by Samyal (2007) and Bakhtiyar (2008). The protein cycle thus appears to have a strong correlation with feeding and spawning.

Like lipid, protein values are inversely proportional to water, suggesting thereby that the depletion in water content is made up by lipid and protein. Results drawn after statistical computation of data suggests a significant negative correlation between protein content and moisture i.e., the increase in the moisture content is accompanied by decrease in the protein content and vice versa. Such a negative correlation has also been observed by Khan *et al* (1977) in *Clibanarius longitarsus*; Diwan and Mohamed (2007) in *Fenneropenaeus indicus*; Vasudevappa (1992) in *Metapenaeus dobsoni* and Mohammad *et al* (2004) in *Scylla serata*.

Glycogen cycle

High values in both the sexes were recorded in spring and post-monsoon which correspond to non-spawning period and thereafter a decreasing trend with the advancement of spawning season was noticed. Low levels in the glycogen content were observed during winters (December- January) and Monsoon (July- August) with lowest values (0.97±0.28%, 0.98± 0.13%) in the month of December in both male and female crabs respectively (Fig. 3). The diminution in the glycogen content during Winters and Monsoon thereby exihibit utilization of glycogen as an energy source in addition to fat for the ripening of gonads. It appears that the muscle glycogen is associated with the feeding in addition to the spawning activity. The moderate values of glycogen during post-spawning may be due to high feeding activity during these months (Somavanshi, 1976). An inverse relationship between glycogen content and moisture content is another characteristic observation made during present study i.e., an increase in the glycogen content is accompanied by a corresponding decrease in the moisture content and vice-versa.

Energy value

The caloric values of *P.masoniana* recorded during different months are presented in Fig.4, Table 1 and table 2. It has been observed that there is a decline in the energy contents during the monsoon and winters which correspond to the spawning period when the gonads are in advanced stage of maturity. The decline in the energy content may be attributed to following factors:

a) Low metabolic rate during winter months when besides low metabolism there is also scarcity of choice food.
b) Divergence of energy from muscles towards gonads for their maturation during spawning.

Our results are in accordance with the results of Monteccchia *et al* (1990) who also reported decline in the muscle energy contents with maturation process of gonads in *Meluceius hubbsi*. Similarly Luzzana *et al.* (1996) have also reported a decline in lipid contents of muscles with maturation of ovaries.

CONCLUSION

Present preliminary studies reveal that *P.masoniana* possess high protein and low lipid content and therefore qualify as an ideal item in dietary in general and in specific may prove to be a good candidate for health conscious or those prescribed to have rich protein and low lipid diet in preparation.

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