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Preliminary studies on Water and Protein distribution pattern in *Paratelphusa masoniana* (Henderson) (female), a local Freshwater Crab from Jammu region of J&K state, India

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Abstract

In the present study, protein percentage and water content in the body meat, claw meat and trash of Paratelphusa masoniana (Henderson), a freshwater crab inhabiting some streams of Jammu region of J&K, were analysed as the local communities are eating it without having any knowledge of its nutritional status. Total protein percentage was maximum in body meat followed by claw meat and trash being 62.16±0.30%, 57.39±0.35% and 29.05±0.66% respectively. Estimations on monthly basis revealed the protein values to be maximum during non-spawning period. The lowest water content in the body meat (78.13±1.45%), claw meat (77.73±1.44%) and trash (56.75±1.12%) were also recorded during non spawning periods. The protein content recorded an inverse relation to water content in all the three body tissues. The aim of the present study was thus to evaluate the protein and water content in different tissues of P. masoniana and relating them to seasonal variation in addition to its health benefits to the consumers as it is a rich source of protein.

Keywords: Body meat, claw meat, moisture, *Paratelphusa,* protein and trash.

Introduction

A crab is characterised by a flattened, broad body covered by a shell or carapace. Crabs belong to the order: Decapoda, class: Crustacea, phylum: Arthropoda. True crabs are the most successful decapods with about 4500 species[1]. Crabs are found throughout the world, chiefly in marine waters, but they also inhabit fresh water and land, where they dig or inhabit burrows. 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 recent assessment[2]. The importance of crabs as a source of protein rich food for the growing population of India especially in the coastal sector, and also as an excellent raw for seafood products for export purpose is increasingly recognized in the country in the recent years. In our state, the limited utilization of shellfishes (crab) is particularly due to conservative food habits and lack of knowledge about the nutritive value of crabs. Knowledge of the biochemistry and metabolism of the processes that occur during maturation are essential for a complete understanding of crustacean reproduction.

Protein is essential for the sustenance of life and accordingly exists in the largest quantity of all the nutrients as a component of the human body[3]. An increasing demand for good quality animal protein for the exploding population has led to an effective and combating increasing exploitation of the aquatic resources. The acceptability and easy digestibility of fin and shellfish proteins make it very valuable in meeting protein malnutrition, especially in children. The protein of fish (fin and shellfish) has a high biological value with its growth promoting capacity. Keeping in view the essential role of proteins, an attempt has been made to study the variation in the quantity of protein and moisture content in different body tissues of *P. masoniana*. The data thus generated, may lead to the better understanding of the relative importance of the protein and moisture content during reproductive cycle and during different seasons of a year.

Material and Methods

Crabs were collected from their natural habitat (Gho-Manhasan stream), at a distance of about 12 kms from University of Jammu, (32˚67/ Lat N; 74˚ 79/ Long E) and were immediately dissected for body meat, claw meat and trash. During the present course of study, only adult female crabs (of carapace width 5-6cm) were selected and the juveniles were again released into their natural habitat. The analysis was performed for a period of one year (July 2010 - June 2011). The organic constituents of each component were determined by standard methods such as total proteins[4], moisture[5]. The results were expressed on dry weight basis. The data was analyzed to test the level of significance with the help of Microsoft Excel 2003 and SPSS (12.0 Version, Chicago, USA). The level of significance was tested by one way ANOVA, Duncan Post Multiple comparison.

Results and Discussion

The seasonal variation in the moisture and protein content in female crabs has been shown in table 1.

Protein: The annual average protein content in the body meat of *P. masoniana* throughout the year was 54.38±4.08% with minimum (46.05±0.82%) and maximum (62.15±0.30%) values being recorded in the months of December and March respectively.

In claw meat as well, minimum (46.0±0.64%) and maximum (57.39±0.54%) values were recorded in the months of December and March respectively with annual average being 51.97±3.62%.

In trash, minimum (19.54±0.50%) and maximum (29.05±0.66%) values were however recorded in the months of November and April respectively with annual average being 25.78±3.04%.

Moisture: In the body meat, minimum (78.13±1.45%) and maximum (84.23±1.60%) values were recorded in the months of March and July respectively with annual average being 80.98±1.79 %.

In the claw meat, minimum (77.73 ±1.44%) and maximum (83.58±1.55%) values were also recorded in the months of March and July respectively with annual average being 79.66±1.58%.

In trash however, minimum (76.78±1.84%) and maximum (80.18 ±1.69%) values were however recorded in the months of April and August respectively with annual average being 63.28±3.57%.

From the study of the seasonal variation in the protein and moisture content of *P. masoniana*, it appears that there are two distinct periods of variation i.e: i. From July to August (Monsoon) i.e. Ist spawning period and December to January (Winter) i.e. IInd spawning period when the gonads are in advance stage of maturity and there is mobilization of protein from muscle to the gonads for their development. ii. From August to October (Post-monsoon) and February to April (Spring) which correspond to the Ist and IInd Non- spawning period. During this period, *P. masoniana* is nutritionally more rich as protein in the muscle is high. Thus, these two periods are characterized by the variation in the chemical composition. Biochemical composition of majority of organisms are known to vary with season, size, sex, stages of maturity and availability of food, temperature etc[6]. Protein in crabs were found to be influenced by the extent of water content apart from other parameters like fats[7].

The protein content in all the body tissues i.e., body meat, claw meat, and trash of female crabs remain characteristically low during winter (December and January) and monsoon (July and August) which coincides with their spawning season (i.e., May to July and December to February) when the gonads are in advanced stage of maturity. 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. It has also recorded that during both wintering and spawning periods, food intake is significantly reduced and fish must rely, in part, on stored energy resources to survive both events[8].

There is however, an increase in the protein content during spring (February to April) and post monsoon (August to October) which coincides with their non-spawning period. High levels of protein during post monsoon (54.29%, 55.85%) and spring season (62.16%, 60.50%) can be attributed to planktonic abundance on one hand and deposition of proteins to meet the protein requirement of next breeding season on other hand. Planktonic bloom and maxima of zooplankton in Jan–March has also been observed[9]. Our observations also get strengthened by the previous recordings made in the same stream where benthic species like (chironomous larvae sps., *Tubifex* sps., *Chaetogaster* and *Tipula* sps.) were abundant during summers and monsoon while dipteran population exhibited a decline in monsoon[10-12]. Maximum algal content also has recorded in March (19.065%) i.e., spring[13]. Therefore, high protein content in muscles may be attributed to readily and abundant food supply as one of the factor. The variation in the protein is therefore influenced by feeding and breeding capabilities. The protein cycle thus appears to have a strong correlation with feeding and spawning. It has also been recorded that the protein maxima and minima correspond to the development/spawning and biological regression/resting phases, respectively[14].

The protein content ranged from 46.05% to 64.5% (dry wt.) in the muscles of *P.masoniana* which is at par with other crustaceans viz. 70.09 to 75.46% in *Squilla*[15]; 65.25% in *M. dobsoni*[16]; 44.62 to 80.87% in *P. indicus*[17]; 58.17% to 64.15% in *M. malcolmsonii*[6]. A comparative status of the species under investigation with other marine decapods is presented in table-2. Our results are in accordance with the findings of other workers [18, 19, 20] who have reported that protein content in *Portunus pelagicus* Linnaeus, *Charybdis smithi and Scylla tranquebarica* lies in the range of 54 to 75%, 59.8 to 71.1% and 65.48 to 72.24% respectively.

When compared with males, females had lower annual average protein content being 59.52±2.31% and 54.38±4.08% respectively and this is probably due to the fact that in females, muscle protein gets mobilized for the gonadal development. The same trend was observed in shrimp, *Penaeus merguiensis* and in fresh water prawn, *M. idea* [21] and in Palamonid prawn, *M. idella idella*[7]. Further, among females, non- berried females showed higher values than berried females. This is mainly due to the intake of protein for the development of eggs in berried females. Similar trend has been shown in non-berried females who have higher values than berried females[7].

Table-1
Showing seasonal variation in the protein and moisture content of *P. masoniana* (female)

Month	Body meat		Claw meat		Trash	
	Moisture	Protein	Moisture	Protein	Moisture	Protein
July	84.23±1.60^{a}	48.51±0.12^{g}	83.58±1.55^{a}	47.95±0.56^{h}	68.53±1.22^{a}	28.17±0.35^{b}
August	81.30±1.53^{bcd}	50.98±0.71^{f}	80.80±1.54^{b}	49.50±0.51^{fg}	56.75±1.12^{d}	22.39±0.28^{f}
September	81.90±1.61^{abc}	54.29±0.32^{e}	79.20±1.19^{bcd}	50.50±0.23^{e}	58.70±1.27^{cd}	24.55±0.46^{e}
October	81.29±1.57^{bcd}	55.85±0.48^{d}	78.78±1.39^{bcd}	53.91±0.57^{d}	59.43±1.10^{c}	21.71±0.50^{f}
November	81.76±1.48^{abcd}	53.98±0.47^{e}	79.56±1.46^{bcd}	50.22±0.62^{ef}	60.00±1.15^{c}	19.54±0.50^{g}
December	82.56±1.40^{ab}	46.05±0.82^{h}	80.30±1.52^{bcd}	46.64±0.64^{i}	66.00±1.28^{b}	27.91±0.64^{b}
January	82.20±1.65^{abc}	54.75±0.47^{e}	80.69±1.45^{bc}	50.93±0.44^{e}	65.19±1.30^{b}	26.58±0.47^{c}
February	79.61±1.55^{cdef}	56.03±0.24^{d}	78.08±1.36^{cd}	54.35±0.27^{cd}	65.23±1.19^{b}	25.63±0.38^{d}
March	78.13±1.45^{f}	62.16±0.30^{a}	77.73±1.44^{d}	57.39±0.35^{a}	65.15±1.23^{b}	28.98±0.19^{a}
April	78.53±1.40^{ef}	60.50±0.50^{b}	78.35±1.50^{bcd}	56.01±0.75^{b}	64.03±1.29^{b}	29.05±0.66^{a}
May	79.28±1.61^{def}	57.54±0.42^{c}	79.04±1.37^{bcd}	54.95±0.61^{c}	64.17±1.21^{b}	27.91±0.52^{b}
June	80.98±1.57^{bcde}	50.77±0.41^{f}	79.76±1.54^{bcd}	49.07±0.89^{g}	65.23±1.19^{b}	26.98±0.56^{c}
Annual Average	**80.98±1.79**	**54.38±4.08**	**79.66±1.58**	**51.97±3.62**	**63.28±3.57**	**25.78±3.04**

Table-2
Comparative account of Proximate biochemical composition of different decapod crustaceans (crabs) (on dry weight basis)

Shell fishes	***Portunus pelagicus***	***Charybdis smithi***	***Scylla traquebarica***	***Podopthalmus vigil***	***Scylla serata***	***Paratelphusa masoniana***
Authors Parameters	Akbar *et al.*(1988)	Balasubramanian and Suseelan (2001)	Thirunavukkarasu (2005)	Radhakrishnan and Natarajan (1979)	Prasad and Neelakantan (1989)	Present authors
Protein	54-75%	59.8-71.1%	65.48-80.29%	15.75-20.16%	18.54-20.11%	54.38%
Moisture	66.06%	85.5-89.6%	73.2.-81.8%	69.54-74.46%	77.7-78.76%	80.98%

There is significant variation in the moisture content throughout the period of investigation. Comparatively high values of water content were recorded during July (monsoon) and December (winters) which may be due to the breeding period of the animal. High water content have also been recorded during breeding season[22,23]. It can be presumed that *Paratelphusa masoniana* developed gonads at this time of the year.

High moisture content has been reported during spawning which decreased to lowest thereafter in wild abalone muscle[24]. Similar trend has been shown in *Mugil cephalus* where high values of moisture content could be due to decline in food intake during the monsoon months [25]. It has been observed that the fluctuation of the water content is mainly affected by the reproductive cycle and it was also stated that after the spawning period, high amount of water content was noticed during monsoon months and it may be due to the low salinity prevailing in the habitat[26]. Similar trend has been reported in somatic tissues of Atlantic bonito wherein water content increased with gonadal maturation (Stage III, IV and V i.e. 72.77%, 76.63%, 77.40%) and decreased after spawning (Stage VI 73.90%) being about lowest in immature bonitos[27]

The values for moisture content so obtained in *P. masoniana* are well within the range reported for other species of finfishes and shellfishes viz., *Tor putitora*–77.98% and *Labeo rohita*–78.37%, *Mystus seenghala* - 75.52%, *Channa punctatus*–76.43%[28] , *Carcinus maenus*–79.07% to 82.3+0.5% [29], *S. tranquebarica*–73.5 to 81.8% in body meat, 73.5 to 80.16% in claw meat, 73.23 to 79.6% in leg meat[20], *M.dayanum*–79.14% and *M.kistensis*–80.84%[30].

The values noted for protein and moisture content were found to have significant differences among various months of the year showing gradual increasing and decreasing trends in the present study. It has been recorded that there is an increase in the moisture content which is accompanied by decrease in protein tissues. It has been observed that protein and moisture showed highly significant differences during different months of the year (figure-1). Protein and moisture content showed negative correlation (r=-0.84311).

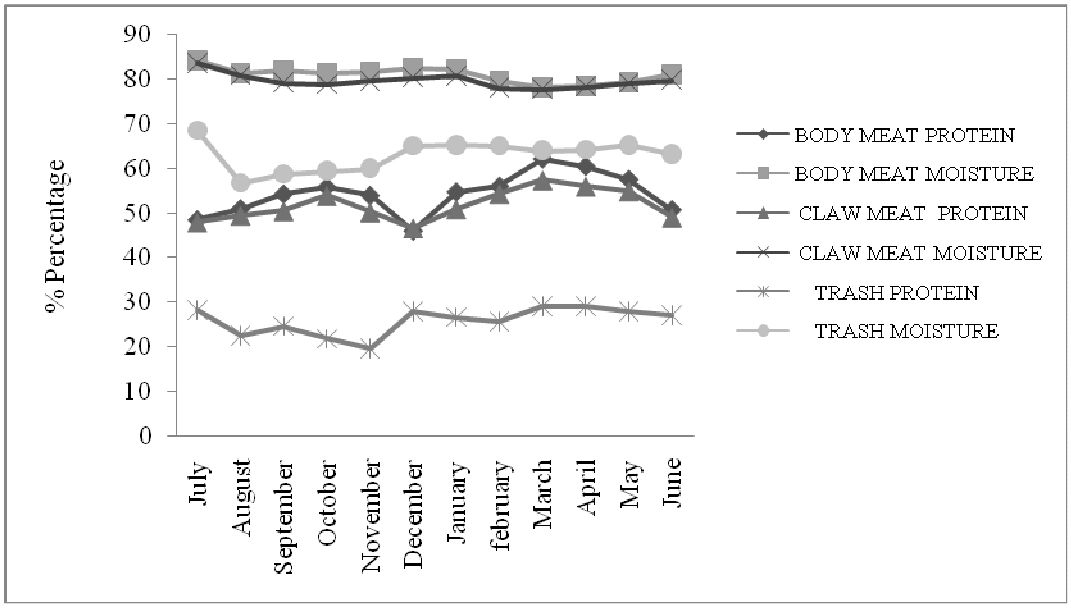

Figure-1
Showing seasonal variation in the protein and moisture content of body meat, claw meat and trash of *Paratelphusa masoniana* (Henderson) (female)

This inverse relation might be due to low temperature, low feeding rate, high energy demands to maintain body temperature and to cope up with food scarcity during winter. Similar results were earlier propounded by many authors[31-38].

Conclusion

P.masoniana has crude protein (25.78±3.04% to 54.38±4.08%) which is at par with other marine decapods. It was observed that it is more nutritious during non-spawning months, when the protein is high and water content is low. It could be safely presumed that *P.masoniana* is a good source of protein and recommended as an ideal food item.

References

1. Yoloye V.L., *Invertebrate zoology*. IIorin University Press, IIorin, Nigeria, 192-230 **(1988)**
2. Ng PLK, Guinot D., and Davie P., Systema Brachyuorum: Part I. An annotated checklist of extant Brachyuran crab, of the world, *Raales Bulletin of Zoology.,* **(17),** 1-286 **(2008)**
3. Okuzumi M. and Fujii T., Nutritional and functional properties of squid and cuttlefish, National cooperative Association of Squid Processors, California, 223 **(2000)**
4. Lowry O.H., Rosebrough N.I., Farr A.L. and Randell R.J., Protein measurement with folin –phenol reagent, *J. Biol. Chem*., **193,** 265-275 **(1951)**
5. AOAC, Official methods of the Association of official Analytical chemists, 1298 **(1999)**
6. Soundarapandian P. and Ananthan G., Effect of Unilateral eyestalk ablation on the biochemical composition of commercially important Juveniles of *Macrobrachium malcolmosoni*, *Int. J. Zool. Res.,* **4(2),** 106-112 **(2008)**
7. Dinakaran G.K. and Soundarapandian P., Biochemical status of edible Palaemonid Prawn, *Macrobrachium idella* (Hilgendorf, 1898), *Advance Journal of Food Science and Technology*, **1(1)**, 19-26 **(2009)**
8. Pederson J. and Hislop J.R.G., Seasonal variation in the energy density of fishes in North Sea, *J. Fish Biol.*, **59**, 380-389 **(2001)**
9. Jan N., Ecology of Janipur pond (Jammu) with special reference to zooplankton dynamics, M. Phil. Dissertation. University of Jammu **(2005)**
10. Parveez S., A preliminary study on Macrobenthic Fauna of Gho-Manhasan stream, MSc. Dissertation, University of Jammu **(2005)**
11. Nelofer N., Limnology of a high attitude sarkoot pond (Kishtwar), M.Phil. Dissertation, University of Jammu, **(2003)**
12. Sawhney N., Limnology of Ban–Ganga stream with special reference to some consumers inhabiting the stream, M.Phil. Dissertation, University of Jammu **(2004)**
13. Sharma P., A preliminary study on Feeding Ecology of *Macrobrachium dayanum, M.Sc.* Dissertation, University of Jammu, Jammu **(2005)**
14. Lee S.Y., Growth and reproduction of the green mussel *Perna viridis* (L.) (Bivalvia: Mytiliacea) in contrasting

environments in Hong Kong, *Asian. Marine Biol*., **3**, 111-127 **(1986)**

15. Garg D.K., Nair L. and Prabhu P.V., Protein from Javla prawn (*Acetes spp*) and Squilla (orat squilla nepa), *Fish. Technol*., **14(1)**, 53-56 **(1977)**

16. Nair A.L. and Prabhu P.V., Protein concentrates from tiny prawns, *J. Mar. Biol. Ass. India.*, **32(1-2)**, 198-200 **(1990)**

17. Sambhu C. and Jayaprakash V., Effect of hormones on growth, food conversion and proximate composition of the white prawn, *Penaeus indicus* (Milne Edwards), *Indian J. Mar. Sci.*, **23**, 232-235 **(1994)**

18. Akbar Z., Qasin R and Siddiqui P.J.A., Seasonal variations in biochemical composition of edible crab, (*Portunus pelagicus* linneaus), *Journal of Islamic Academic of Sciences,* **1(2)**, 127-133 **(1988)**

19. Balasubramanian C.P. and Suseelam C., Biochemical Composition of the deep water crab, *Charybdis smithii*, *Indian. J. Fish,* **48(3)**, 333-335 **(2001)**

20. Thirunavakkarasu N., Biology, nutritional evaluation and utilization of mud crab, *Scylla tranquebarica (Fabricus, 1798),* Ph.D. Thesis, Annamalai University, India, 126 **(2005)**

21. Sriraman K., Biological and biochemical studies on the prawns of Portonova coast (Crustacea: Decapoda : Macrura), Ph.D. Thesis, Annamalai University, India **(1978)**

22. Pillay K.K. and Nair N.B., The reproductive cycle of three decapods crustaceans from the south west coast of India, *Curr. Sci*., **40**, 161-162 **(1970)**

23. Farragut R.N. and Thompson M.H., Proximate composition of the pacific coast Dungeness crab, (*Cancer magister*), *U.S. Fish wild Serv Fish Ind Res.*, **3(3)**, 1-4 **(1965)**

24. Watanable H., Yamanaka H. and Yamakawa H., Seasonal variation of extractive components in the muscle of disk abalone, *Nippon Suisan Gakkaishi.,* **58**, 21-925 **(1992)**

25. Das H.P., Seasonal variation in the chemical composition and calorific content of *Mugil cephalus* Linnaeus from the Goa waters. *Mahasagar, Bull.Natn.Inst Oceanogr*., **11(3&4),** 177-184 **(1978)**

26. Tagore J., Studies on Thaisid *Thais biserialis* (Blainvile, 1832) and *Thais bufo* (Lamark) (Gastropoda: Prosobranchia: Thaisidae) of Tranquebar rocky shore southeast coast of India, Ph.D. Thesis, Annamalai University, India, 179 **(1990)**

27. Zaboukas N., Miliou H. Megalofonou P. and Moraitou–Apostolopoulou M., Biochemical composition of the Atlantic bonito *Sarda Sarda* from the Aegean Sea (Eastern Mediterranean Sea) in different stages of sexual maturity, *Journal of fish Biology*, **69**, 347-362 **(2006)**

28. Jafri A.K. and Khawaja D.K., In: Biology of Finfish and Shell fish by S.L. Chondar, *SCSC publishers* (India), 1-514 **(1964)**

29. Naczk M., Williams J., Brennan K., Liyanapathirana C. and Shahidi F., Compositional characteristics of green crab (*Carcinus maenas*), *Food Chemistry*, **88(3)**, 429-434 **(2004)**

30. Langer S., Bakhtiyar Y. and Manhas M., Studies on the biochemical composition of *Macrobrachium dayanum* and *Macrobrachum kitensis*, *Uttar Pradesh Journal of Zoology*, **28(2)**, 211-214 **(2007)**

31. El Saby M.K., Dietetic value of certain Egyptian food fishes, Rapp. P.V. Reun. *Cons. Int. Explor. Mer*., **8**, 127-143 **(1934)**

32. Brandes C.H. and Dietrich R., A review of the problem of fat and water content in the edible part of the herring, *Fette Seifin*., **55**, 533-541 **(1953)**

33. Gerking S.D., Influence of rate of feeding on body composition and protein metabolism of blue gill sunfish, *Physiol. Zool*., **28**, 267-282 **(1955)**

34. Brown M.E., The Physiology of fishes. Academic press, New York., 447 **(1957)**

35. Suppes C., Tiemeier O.W. and Deyoe C.W., Seasonal variations of fat, protein, and moisture in channel catfish, *Trans. Kans. Acad Sci.,* **70**, 349-358 **(1967)**

36. Denton J.E. and Yousef M.K.., Body Composition and organ weights of rainbow trout, *Salmo gairdneri*, *J. Fish Biol*., **8,** 489-499 **(1976)**

37. Jonsson B. and Jonsson N., Lipid energy reserves influence life history decision of Atlantic Salmon (*Salmo Salar*) and brown trout (*Salmo trutta*) in freshwater, *Ecol. Fresh water fish.,* **14**, 296-307 **(2005)**

38. Nargis A., Seasonal variation in the chemical composition of Body flesh of Koi Fish *Anabas testudineus* (Bloch) (Anabantidae: Perciformes), *Bangladesh, J. Sci., Ind. Res.*, **41(3-4)**, 219-226 **(2006)**