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Research Article



Evaluation of proximate composition from selected species of shrimps collected from Gorai Creek (West Coast) of India

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Abstract

The aim of this study is to find the proximate composition in different tissues of shrimp species collected from Gorai Creek. We emphasized the possible role of this proximate composition on humankind. In this study, the emphasis has been given to the pattern of bioaccumulation and their orders of occurrence have been studied using standard methods. From this study, it is concluded that the shrimp species have low levels of ash content. This might be because of a good source presence of minerals like calcium, potassium, zinc, iron, and magnesium. In the studied shrimps, we found elevated levels of moisture content that may be due to decreased levels of lipids in the shrimp species. From our findings, no remarkable fluctuating trends were recorded in carbohydrate. This might be because of lowering the energy level. In this study, the levels of protein and carbohydrates were found low. Protein is one of the essential nutrients for the formation of body posture by maintaining the body tissues for normal growth and body functioning, which showed the low nutritional value and physiological significance. This might be because the varying seasonal conditions and presence of food may differ in the reproductive cycle, which subsequently affects the tissue biochemistry, particularly fat metabolism.

Keywords: Gorai Creek, Shrimp, Proximate Composition, Bioaccumulation, Tissues.

Introduction

Maintaining the health of human beings, required nutrients as a source of food including carbohydrates, proteins, fats, minerals, vitamins and water to enable the body functions effectively. Many researchers have proven that fishes provide protein, fat and vitamins which greatly benefit human health (Job et al., 2015). According to FAO, 2003, for protein intake in the sub-Saharan continent, fish provides 22% of the protein. The essential amino acids found in fish are high quality and are present in ideal proportion. The presence of Proteins in fishes is easily digestible because it contains low levels of fiber, which help the body to utilize the protein in maximum quantity. The body of fish contains unsaturated fatty acids which do not pose a danger to the heart and it helps to reduce the levels of triglycerides and also assist in reducing

constipation and other attendant problems in human consumers (Pamploner-Roger, 2006).

The bioaccumulation of protein, amino acids, lipids, fatty acids, carbohydrate, vitamins and minerals in shrimps increased the nutritive value of the prawns and shrimps. The edible crustaceans, including shrimps, prawns, cry fish and lobsters, are a highly nutritious and good source of protein and amino acids and contribute 20% in the world's estimated seafood data. The proximate composition in fishes have been describe by (Gokoglu et al., 2004; Fawole et al 2007; Turkan et al., 2008). However, the data on proximate composition in shrimps are very scanty. Therefore there is a need to explore the proximate composition of shrimps species collected from Gorai Creek. Therefore efforts have been revealed to determine the proximate composition in selected shrimps species collected from Gorai Creek, Mumbai.

Methods and Materials

Sample Collection

The Shrimps samples were collected from 200 meters away from the Gorai creek of Mumbai from April, 2018 to December 2021. The samples were washed in seawater and packed in propylene bags, and stored at -20°C in deep freeze in the Department of Zoology, S. S & L. S. Patkar College, Goregaon (West) Mumbai, until further analysis.

Identification of Samples

The primary identification of the samples was done by referring FAO manual guidelines and the final identification of experimental shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, *Acetes indicus* were done at ICAR-Mumbai Research Centre at Versova, Mumbai-400061 of CMFRI (ICAR), Dept of Agriculture, Research and Education, Ministry of Agriculture, Govt. of India vide no 7-9/2020.

Estimation of Proximate composition

The analysis of proximate composition of five species namely *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, *Acetes indicus* by estimating moisture content, protein estimation, carbohydrates and lipids estimation, and ash. The species of shrimps were collected from the fresh catch and were

processed for analysis. The different tissues were minced for analysis of proximate composition such as moisture content, protein estimation, carbohydrates and lipids estimation, and ash. The estimation of protein was carried out following the method of Lowry et al. (1951). Estimation of total carbohydrate was done by Rose (1955). Total lipid extraction was done with a chloroform-methanol mixture following the method of Barnes and Black-Stock (1973) and estimated by the method of Folch et al. (1957). The pre weighed wet tissues were dried under 100°C for the moisture content and the dried tissues were subjected to 600°C under a Muffle Furnas to find the ash content in shrimps.

Results and Discussion

Ash Content

In crustaceans particularly in *M. idea* ash content is one of the least studied biochemical constituents. (Sriraman and Reddy 1977) studied that the ash contents increases with the increase in growth and size of the juveniles of *P. monodon*. They found gradual increase in ash composition in muscles regardless of sex. Similar results were reported by Kutty and Parulekar (1976) in *P. stylifera* and *M. affinis* and (Ajithkumar, 1990) in *M. idella*. The ash composition in *M. dobsoni* was 15.79% and in Jawla prawn (*Acetes sp*) was 17.11 % (Nair and Prabhu 1990). In response to proximate composition of the fresh and the various processed samples of prawn (*Penaeus notialis*,) the mean values of the proximate composition of ash in fresh sample 13.32%; sundry sample 16.09% in boiled sample 15.21% and in smoked sample is 5.65% (Bello, 2013).

Table 1. Showing range of proximate composition from the shrimp collected from Gorai Creek of Mumbai Suburb of west coast, India

Parapenaeopsis sculptilis												
01	Pre-monsoon				Monsoon				Post-monsoon			
	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body
Ash	0.81 ±0.04	0.46 ±0.01	0.41 ±0.08	0.75 ±0.09	0.79 ±0.03	0.459 ±0.02	0.629 ±0.1	0.67 ±0.07	0.82 ±0.06	0.46 ±0.014	0.63 ±0.08	0.74 ±0.11
Moisture-content	99.79 ±0.02	99.85 ±0.03	99.44 ±0.10	99.85 ±0.005	99.87 ±0.02	99.61 ±0.29	99.44 ±0.10	99.82 ±0.05	99.85 ±0.03	99.76 ±0.18	99.54 ±0.05	99.89 ±0.06
Carbohydrate	0.08 ±0.03	0.083 ±0.03	0.09 ±0.06	0.08 ±0.04	0.09 ±0.02	0.11 ±0.07	0.13 ±0.06	0.08 ±0.04	0.10 ±0.03	0.096 ±0.03	0.08 ±0.04	0.063 ±0.04
Protein	0.066 ±0.005	0.083 ±0.06	0.26 ±0.13	0.26 ±0.19	0.09 ±0.009	0.07 ±0.03	0.17 ±0.08	0.09 ±0.04	0.08 ±0.02	0.07 ±0.03	0.15 ±0.05	0.13 ±0.06
Lipid	0.11 ±0.02	0.076 ±0.05	0.11 ±0.02	0.10 ±0.04	0.11 ±0.02	0.086 ±0.04	0.15 ±0.07	0.11 ±0.02	.086 ±0.046	0.07 ±0.02	0.10 ±0.04	0.11 ±0.05

Table 2. Showing range of proximate composition from the shrimp collected from Gorai creek of Mumbai Suburb of west coast, India

Parapenaeopsis hardwickii												
02	Pre-monsoon				Monsoon				Post-monsoon			
	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body
Ash	0.35 ±0.04	0.44 ±0.06	0.42 ±0.09	0.74 ±0.08	0.40 ±0.08	0.45 ±0.07	0.57±0.05	0.65 ±0.05	0.43 ±0.06	0.43 ±0.08	0.64 ±0.07	0.63 ±0.07
Moisture-Content	99.8 ±0.05	99.77 ±0.08	99.49±0.13	99.76 ±0.08	99.80 ±0.05	99.82 ±0.04	99.43±0.09	99.72 ±0.04	99.76 ±0.13	99.78 ±0.14	99.57±0.05	99.75±0.09
Carbohydrate	0.09 ±0.04	0.076 ±0.03	0.19 ±0.12	0.07 ±0.05	0.10 ±0.04	0.09 ±0.04	0.17 ±0.02	0.08 ±0.05	0.11 ±0.06	0.10 ±0.07	0.09 ±0.08	0.08±0.03
Protein	0.26 ±0.17	0.37 ±0.27	0.29±0.12	0.25 ±0.17	0.23 ±0.21	0.2 ±0.15	0.13±0.10	0.12 ±0.01	0.18 ±0.11	0.20 ±0.14	0.18 ±0.12	0.15±0.08
Lipid	0.11 ±0.02	0.12 ±0.07	0.11±0.05	0.07 ±0.04	0.12 ±0.06	0.12 ±0.06	0.15±0.05	0.1 ±0.03	0.12 ±0.06	0.14 ±0.08	0.10±0.07	0.11±0.04

Table 3. Showing range of proximate composition from the shrimp collected from Gorai creek of Mumbai Suburb of west coast, India

Solenocera crassicornis												
03	Pre-monsoon				Monsoon				Post-monsoon			
	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body
Ash	0.36 ±0.06	0.35 ±0.04	0.34 ±0.05	0.37 ±0.07	0.35 ±0.04	0.38 ±0.03	0.39 ±0.04	0.35 ±0.04	0.37 ±0.07	0.38 ±0.06	0.45 ±0.05	0.38 ±0.04
Moisture-content	99.69 ±0.05	99.68 ±0.06	99.34±0.05	99.66 ±0.05	99.65 ±0.03	99.65 ±0.05	99.36 ±0.05	99.69 ±0.06	99.65 ±0.04	99.62 ±0.09	99.38±0.04	99.69 ±0.05
Carbohydrate	0.12 ±0.02	0.11 ±0.01	0.09 ±0.01	0.1 ±0.009	0.16 ±0.03	0.11 ±0.02	0.10 ±0.01	0.11 ±0.02	0.19 ±0.06	0.12 ±0.02	0.11 ±0.01	0.11 ±0.01
Protein	0.20 ±0.07	0.14 ±0.04	0.19 ±0.02	0.11 ±0.01	0.12 ±0.01	0.12 ±0.01	0.12 ±0.02	0.10 ±0.01	0.13 ±0.04	0.14 ±0.04	0.18 ±0.05	0.11 ±0.02
Lipid	0.13 ±0.03	0.14 ±0.05	0.09 ±0.03	0.1 ±0.009	0.11 ±0.01	0.13 ±0.03	0.13 ±0.05	0.13 ±0.02	0.11 ±0.01	0.14 ±0.04	0.14 ±0.04	0.1 ±0.009

Table 4. Showing range of proximate composition from the shrimp collected from Gorai creek of Mumbai Suburb of west coast, India

Metapenaeus stridulans												
4	Pre-monsoon				Monsoon				Post-monsoon			
	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body
Ash	0.37 ±0.07	0.36 ±0.05	0.34 ±0.04	0.47 ±0.05	0.37 ±0.06	0.39 ±0.04	0.40 ±0.03	0.37 ±0.04	0.39 ±0.04	0.37 ±0.04	0.48 ±0.02	0.46 ±0.04
Moisture-Content	99.71 ±0.04	99.72 ±0.02	99.35 ±0.04	99.70 ±0.07	99.61 ±0.04	99.61 ±0.04	99.31 ±0.06	99.71 ±0.07	99.68 ±0.03	99.71 ±0.08	99.38 ±0.05	99.71 ±0.04
Carbohydrate	0.12 ±0.02	0.11 ±0.02	0.15 ±0.04	0.10 ±0.01	0.17 ±0.09	0.09 ±0.02	0.15 ±0.05	0.11 ±0.01	0.2 ±0.11	0.14 ±0.04	0.11 ±0.02	0.11 ±0.009
Protein	0.17 ±0.08	0.21 ±0.04	0.23 ±0.06	0.11 ±0.02	0.16 ±0.04	0.15 ±0.06	0.16 ±0.03	0.14 ±0.03	0.23 ±0.05	0.22 ±0.06	0.15 ±0.06	0.14 ±0.02
Lipids	0.11 ±0.02	0.17 ±0.04	0.16 ±0.04	0.11 ±0.02	0.11 ±0.02	0.14 ±0.02	0.16 ±0.03	0.11 ±0.01	0.12 ±0.01	0.15 ±0.03	0.13 ±0.04	0.11 ±0.02

Table 5. Showing range of proximate composition from the shrimp collected from Gorai creek of Mumbai Suburb of west coast, India

Acetes indicus												
05	Pre-monsoon				Monsoon				Post-monsoon			
	Gills	Carapace	Remaining body	Whole body Metapenaeus	Gills	Carapace	Remaining body	Whole body	Gills	Carapace	Remaining body	Whole body
Ash	0.11 ±0.02	0.36 ±0.05	0.35 ±0.04	0.47 ±0.04	0.36 ±0.05	0.39 ±0.04	0.39 ±0.04	0.37 ±0.05	0.37 ±0.07	0.37 ±0.042	0.47 ±0.04	0.37 ±0.05
Moisture-Content	99.68 ±0.06	99.67 ±0.04	99.35 ±0.05	99.69 ±0.05	99.65 ±0.04	99.67 ±0.05	99.37 ±0.05	99.71 ±0.06	99.67 ±0.05	99.70 ±0.02	99.38 ±0.04	99.71 ±0.05
Carbohydrate	0.12 ±0.02	0.10 ±0.01	0.15 ±0.05	0.09 ±0.01	0.15 ±0.03	0.11 ±0.03	0.2 ±0.009	0.10 ±0.01	0.18 ±0.04	0.12 ±0.02	0.15 ±0.02	0.10 ±0.01
Protein	0.15 ±0.04	0.17 ±0.02	0.21 ±0.06	0.11 ±0.02	0.16 ±0.04	0.12 ±0.01	0.13 ±0.02	0.13 ±0.02	0.19 ±0.005	0.16 ±0.03	0.18 ±0.01	0.13 ±0.02
Lipids	0.11 ±0.02	0.14 ±0.04	0.14 ±0.05	0.11 ±0.02	0.11 ±0.02	0.13 ±0.01	0.17 ±0.02	0.12 ±0.02	0.12 ±0.016	0.13 ±0.03	0.17 ±0.02	0.12 ±0.009

In our present study the ash content (Table 1, 2, 3, 4, 5) in *Parapenaeopsis sculptilis* is ranges from (0.41 -0.82 %). The minimum estimated ash is found in remaining body (0.41±0.01 %) in pre monsoon, whereas the maximum ash content was recorded in gills (0.82±0.061%) in pre monsoon season. In *Parapenaeopsis hardwickii* the range of ash content was recorded to be (0.35-0.74 %). The minimum ash content was found in gills of (0.35±0.04%) in pre monsoon season and maximum ash content found in (0.74±0.08%) in pre monsoon season. In shrimp *Solenocera crassicornis* the range of ash content is (0.34-0.45%). The minimum ash content was recorded in remaining body (0.34±0.05%) in the pre monsoon season and the maximum ash content found in gills and whole body (0.45±0.05%) in pre monsoon and post monsoon. In *Metapenaeus stridulans* the range of ash content was recorded to be (0.34-0.48%). The Minimum and maximum ash content found in remaining body (0.34±0.04%; 0.48±0.02%) in pre monsoon and post monsoon seasons respectively. In shrimp *Acetes indicus* the minimum and maximum ash content was ranges from (0.11 -0.47 %). The minimum ash content was recorded in gills (0.11±0.02%) whereas the maximum ash content was found in whole body and remaining body (0.47±0.04%) in pre monsoon and post monsoon. In our present investigation our results are in comparable with some of the researchers cited here in above. From our findings it is concluded that the shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, and *Acetes indicus* this might be because of these species are the good source of mineral contents such as calcium, potassium, zinc, iron and magnesium.

Moisture Content

The presence of high moisture content, high amount of amino acid and low levels of connective tissues makes the prawns and shrimps highly perishable (Shamasunder and Prakash,

1994). High amount of moisture and ash content was recorded in male prawns (Amer et al. 1991). They reported that the muscles of male prawn contains relatively high amount of water and ash where as female prawns contains high amount of carbohydrates, fat, and proteins. High amount of moisture content was recorded in male in winter and summer seasons than the female prawns (Nargis, 2006). The decreasing order of moisture content was recorded in *P. senegalensis*, *S. crumenophthalmus*, *C. gariepinus* to *S. scrombus* (Nargis, 2006). In different size groups and sexes of *Macrobrachium idea*, the moisture content in males and females ranged from 77.43 to 80.54% in 61-70mm and 101-110 mm size groups respectively (Dinakaran, et al., 2009). The moisture content in fresh sample of *Penaeus notialis*, was recorded as 35.10%; moisture content in sundry *Penaeus notialis*, sample is 16.56%; in boiled *Penaeus notialis* sample 38.33%; and in smoked *Penaeus notialis* sample are found 11.72% (Bello, 2013).

In our present study the moisture content (Table 1-5) in *Parapenaeopsis sculptilis* is ranges from (99.44-99.89%). The minimum estimated moisture content is found in remaining body (99.44±0.10 %) in pre monsoon, whereas the maximum moisture content was recorded in whole body (99.89±0.06%) in post monsoon season. In *Parapenaeopsis hardwickii* the range of moisture content was recorded to be (99.43-99.82 %). The minimum moisture content was found in remaining body (99.43±0.09%) in monsoon season, whereas maximum moisture content was recorded in carapace (99.82 ±0.04%) in monsoon season. In shrimp *Solenocera crassicornis* the range of moisture content is (99.34 -99.69 %). The minimum moisture content was recorded in remaining body (99.34 ±0.05%) in the pre monsoon season and the maximum moisture content were recorded in gills, whole body and remaining body (99.69±0.06%) in pre monsoon and post monsoon seasons. In *Metapenaeus stridulans*, range of moisture content was recorded to be (99.31— 99.71%). The

minimum moisture content was found in remaining body and carapace ($99.31\pm 0.06\%$) in monsoon season and maximum moisture content was recorded in carapace ($99.72\pm 0.02\%$) in pre monsoon season. In shrimp *Acetes indicus* the minimum and maximum moisture content was ranges from ($99.35 - 99.71\%$). The minimum moisture content was recorded in remaining body ($99.35\pm 0.05\%$) whereas the maximum moisture content was found in whole body ($99.71\pm 0.06\%$) in pre monsoon and post monsoon seasons. In our present investigation our results are found to be higher as to that of the researchers cited here in above. From our findings it is concluded that the shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, and *Acetes indicus* showed elevated levels of moisture content, that may be because decreased levels of lipid in the studied shrimp species.

Carbohydrate Content

Amongst the organic nutrients, carbohydrates considered to be the first to generate and utilized required energy (Heath, 1987). Carbohydrates act as precursors for the dispensable amino acids and some nutrients, which are metabolic intermediates and are necessary for growth (NRC, 1993). Some environmental and physiological factors including seasons and feed intake affect the levels of carbohydrates in fish. Availability of food and seasonal difference are responsible for changes in carbohydrate contents which adversely affect the reproductive cycle and tissue biochemistry particularly fat (Bumb 1992). The carbohydrate content was recorded in different size and sexes of prawn *Macrobrachium idea*. It was found that, carbohydrates constitute major percentage of biochemical constituent present in muscles of *M. idea* and was inversely proportional to protein and ash contents Dinakaran, et al., (2009). Similar findings were recorded by (Sriraman, 1978; Nair and Prabhu, 1990; Reddy and Shanbhogue, 1994; Sambhu and Jayaprakash, 1994). Whereas, according to (Rose and Nunes, 2003; Nargis, 2006), the proportion of protein was higher followed by carbohydrates and lipid present in the muscle of the prawns. No remarkable differences were noted in carbohydrate content amongst different size groups of studied shrimp species (Kutty and Paruhekar 1984; Ajitkumar, 1990). Male prawns showed higher carbohydrates content in their muscles than female prawns (Kumar, 1990). Proximate composition of the fresh and the various processed samples of prawn (*Penaeus notialis*,) the mean values of the proximate composition of carbohydrate content in fresh sample 9.52%, while the smoked sample had the highest 44.56%; 8.50 and that of the sundried, boiled and smoked samples are 5.65, 7.50 and 4.50 respectively (Bello, 2013).

In our present study the carbohydrates content (Table 1-5) in *Parapenaeopsis sculptilis* is ranges from (0.08-0.13%). The minimum estimated carbohydrates are found in gills, whole body remaining body ($0.08\pm 0.03\%$) in premonsoon, monsoon and post monsoon, whereas maximum carbohydrates content recorded in remaining body ($0.13\pm 0.061\%$) in monsoon

season. In *Parapenaeopsis hardwickii* the range of carbohydrates content recorded to be (0.07-0.19%). The minimum carbohydrates content was found in whole body ($0.07\pm 0.05\%$) in pre monsoon season, whereas maximum carbohydrates content was recorded in remaining body ($0.19\pm 0.12\%$) in pre monsoon season. In shrimp *Solenocera crassicornis* the range of carbohydrates content is (0.09-0.19%). The minimum carbohydrates content was recorded in remaining body ($0.09\pm 0.01\%$) in the pre monsoon season and the maximum carbohydrates content were recorded in gills ($0.19\pm 0.06\%$) in post monsoon seasons. In *Metapenaeus stridulans* the range of carbohydrates content was recorded to be (0.09-0.17%). The minimum carbohydrates content was found in carapace ($0.09\pm 0.02\%$) in monsoon season and maximum carbohydrates content was also recorded in gills ($0.17\pm 0.09\%$) in monsoon season. In shrimp *Acetes indicus* the minimum and maximum carbohydrates content was ranges from (0.09 -0.18 %). The minimum carbohydrates content was recorded in whole body ($0.09\pm 0.01\%$) in pre monsoon, whereas the maximum carbohydrates content was found in gills ($0.18\pm 0.01\%$) in post monsoon and post monsoon seasons. In our present investigation our results are found lower to that of the above cited literature here in above. From our findings it is concluded that the shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulan*, and *Acetes indicus*. Carbohydrates play an important role in energy generation but no remarkable trend in fluctuation of carbohydrate was noted amongst the studied shrimps. This might be differences in the seasons and may be because of scarcity of food which may be responsible for lowering the energy level.

Protein Content

For prawn culture dietary protein is one of the major requirements. Dietary protein gets converted in to tissue protein for maintenance of normal growth and body functions. It acts as an important tool for the maintenance of physiological functions and the process of evaluations (Diana, 1982). The proximate composition present in *Macrobrachium idea* varies greatly in different size groups and sexes. It was found that the maximum protein was recorded in males of smaller size group and less protein was recorded in big size group, whereas the reversible content of protein was noted in females *M. idea* (Dinakaran, et al., 2009). The quality and quantity of protein in shrimp species is largely influenced by the extent of fat and water content. In case of freshwater prawn *Penaeus merguensis* and *M. idea* showed more protein content. In case of marine water shrimps *P. indicus* and *Metapenaeus monoceros* the female shrimps recorded more proteinacious than males (Sriraman (1978). The protein content in *Squilla* was varied from 70.09 to 75.46% and in *Jawla* prawn from 61.93 to 2.64% Garg et al. (1977). The protein content in *M. dobsoni* was 65.25% and in *Acetes sp.* was 66.98% respectively (Nair and Prabhu, 1990). The protein content in *P. indicus* was varied from 44.62 to 80.87% (Sambhu and Jayaprakash, 1994). The presence of high

amount of protein in shrimps and mantis shrimps in growing phases may be attributed to increase protein synthesis (Kutty and Parulekar, 1984; Ajit kumar, 1990; Tanuja, 1996). The proximate composition of the fresh and the various processed samples of prawn (*Penaeus notialis*,) the mean values of the proximate composition of protein in fresh sample 24.31%; Protein sundry sample 24.95%; Protein in boiled sample 18.83%; and smoked sample were found to be 15.64 % (Bello, 2013).

In our present study the protein content (Table 1-5) in *Parapenaeopsis sculptilis* is ranges from (0.066 -0.26 %). The minimum estimated Protein was found in gills and whole body (0.066±0.005 %) in pre monsoon, whereas the maximum protein content was recorded in whole body (0.26±0.19%) in pre monsoon season. In *Parapenaeopsis hardwickii* the range of Protein content was recorded to be (0.12-0.37 %). The minimum protein content was found in whole body (0.12 ±0.01%) in monsoon season, whereas maximum protein content was recorded in carapace (0.37±0.08%) in pre monsoon season. In shrimp *Solenocera crassicornis* the range of Protein content is (0.11-0.20%). The minimum protein content was recorded in whole body (0.11±0.05%) in pre monsoon and post monsoon season and the maximum protein content was recorded in gills (0.20±0.07%) in pre monsoon season. In *Metapenaeus stridulans* the range of protein content was recorded to be (0.11-0.23%). The minimum protein content was found in whole body (0.11±0.02%) in pre monsoon and maximum protein content was recorded in remaining body and gills (0.23±0.06%) in pre and post monsoon season. In shrimp *Acetes indicus* minimum and maximum protein content was ranges from (0.11 -0.21 %). The minimum protein content was recorded in whole body (0.11±0.02%) in pre monsoon whereas the maximum protein content was found in remaining body (0.21±0.06%) in pre monsoon seasons. In our present investigation our results are not comparable with the researchers cited here in above. Protein is required for maintenance of body tissues for normal growth and body functions. From our findings it is concluded that the shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, and *Acetes indicus* contains low levels of protein.

Lipid Content

Lipids are very important in maintaining structural and physiological integrity of the cell and sub cellular membrane. Lipids, through metabolism produce energy of the body. Lipids produce nonfat nutrients like fat-soluble vitamins A, D, E and K (New, 1986; Richardo et al. 2003). Lipid act as food reserve like protein and mainly influenced by environmental temperature conditions (Johnstene, 1917). In *Macrobrachium idea*, the fatty acids are varied in different size groups and sexes (Dinakaran, et al., 2009). According to their study, maximum lipid content was found in males in small size groups and minimum lipids were recorded in big size groups, whereas the reversible lipid content was recorded in female

shrimp group (Dinakaran, et al., 2009). The lipid –protein inverse relationship was documented by (George and Patel, 1956; Pillay and Nair, 1973; Sriraman, 1978; Radhakrishnan, 1979; Nair and Prabhu, 1990; Ravichandran, 2000). In mature female *Parapenaeopsis stylifera* recorded higher amount of lipid content when compared with immature ones (Shaikhmahmud and Magar, 1957). The lipid content in muscle tissues of five species of penaeid shrimps does not showed any varied differences (Gopakumar and Nair, 1975). It was suggest that consistency does not find any maturity condition influences the lipid composition of muscle tissue of shrimp species (Kutty and Parulekar, 1984). There is no regularity in fat values among the size groups in males and females. The results of lipid content in prawn samples (*Penaeus notialis*) were non - significant among the sex groups and significant among the size groups (Bello, 2013).

In our present study the lipid content (Table 1-5) in *Parapenaeopsis sculptilis* is ranges from (0.07 -0.15 %). The minimum estimated lipid was found in carapace (0.07±0.02 %) in post monsoon, whereas the maximum lipid content was recorded in remaining body (0.15±0.07%) in monsoon season. In *Parapenaeopsis hardwickii* the range of lipid content was recorded to be (0.07 -0.15 %)). The minimum lipid content was found in whole body (0.07±0.02%) in pre monsoon season, whereas maximum lipid content was recorded in remaining body (0.15±0.07%) in monsoon season. In shrimp *Solenocera crassicornis* the range of lipid content is (0.09-0.14). The minimum lipid content was recorded in remaining body (0.09±0.03%) in the pre monsoon season and the maximum lipid content were recorded in carapace and remaining body (0.14±0.04%) in post monsoon seasons. In *Metapenaeus stridulans* the range of lipid content was recorded to be (0.11-0.17%). The minimum lipid content was found in gills, whole body (0.11±0.02%) in pre monsoon, monsoon, and post monsoon season and maximum lipid content was also recorded in carapace (0.17±0.02%) in pre monsoon season. In shrimp *Acetes indicus* the minimum and maximum lipid content was ranges from (0.11 -0.17 %). The minimum lipid content was recorded in gills and whole body (0.11±0.02%) in pre monsoon and monsoon, whereas the maximum lipid content was found in remaining body (0.17±0.02%) in monsoon and post monsoon seasons. In our present investigation our results are in comparable with some of the researchers cited here in above. From our findings it is concluded that the shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, and *Acetes indicus*. This might be because of the seasonal differences and availability of food may change the reproductive cycle which subsequently affect the tissue biochemistry particularly fat metabolism.

Conclusion

From this study, it is concluded that the shrimp species *Parapenaeopsis sculptilis*, *Parapenaeopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, and *Acetes indicus* have low levels of ash content this might be because of

these species are the good source of mineral contents such as calcium, potassium, zinc, iron and magnesium. We found elevated levels of moisture content that may be due to decreased levels of lipid in the studied shrimp species. From our findings, it is concluded that carbohydrates play an important role in energy generation, but no remarkable trend in fluctuation of carbohydrate was noted amongst the studied shrimps. This might be differences in the seasons and may be because of scarcity of food which may be responsible for lowering the energy level. Protein is required for maintenance of body tissues for normal growth and body functions. From our results, we found low levels of protein in the shrimp species. All the shrimp species contain a low level of lipid, which indicates their low nutritional value and physiological significance. This might be because of the seasonal differences and availability of food may change the reproductive cycle which subsequently affect the tissue biochemistry particularly fat metabolism.

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Conflict of Interest

The author hereby declares no conflict of interest.

Consent for publication

The author declares that the work has consent for publication.

Ethical consideration

Ethical approval received from the Maharashtra State Biodiversity Board, Nagpur to collect all these shrimp's species for research purpose latter no 709. The voucher specimens of *Parapenaopsis sculptilis*, *Parapenaopsis hardwickii*, *Solenocera crassicornis*, *Metapenaeus stridulans*, *Acetes indicus* were deposited at the repository centre ICAR-Mumbai Research Centre at Versova, Mumbai-400061 of CMFRI (ICAR), Dept of Agriculture, Research and Education, Ministry of Agriculture, Govt. of India vide no 7-9/2020, as per the directions by Maharashtra State Biodiversity Board. The Voucher numbers of the said specimens are No 7-9/2020.

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