Advances in Biological Research 3 (5-6): 153-158, 2009
ISSN 1992-0067
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Lipid Estimation from Freshwater Prawn *Macrobrachium malcomsonii*

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Abstract: Prawn is a popular delicacy sold at high market price. In the present study the total lipid content of three tissues namely hepatopancreas, gills and muscles of the freshwater prawn *Macrobrachium malcomsonii* were analysed in two different groups. Among them, one group of Juveniles and three groups of sub adults with different sizes were selected. The results of the present study showed the variation in total lipid concentration of the hepatopancreas, gills and muscles in different stages. Among the two different stages such as juveniles and three groups of sub adults, the maximum lipid concentration was noticed in juvenile prawn muscles (0.748±0.048mg/g) and minimum in the hepatopancreas (0.298±0.016mg/g). In three groups of sub adults, the maximum lipid concentration was noticed hepatopancreas (1.230±0.220mg/g) in group IV and minimum was noticed muscle (0.590±0.051mg/g) in group II. Whereas the percentage difference between the groups were noticed maximum in group I vs. group IV (105.5%) and minimum was in group 1 and 2 (4.67%). The total lipid content was found to be more in the hepatopancreas when compared to muscles and gills in both juveniles and three groups of sub adults.

Key words: Prawn · *Macrobrachium malcomsonii* · Lipid · Hepatopancreas · Muscles · Juveniles

INTRODUCTION

Lipids are nutritionally significant in crustaceans. Comparisons of wild and captive crustaceans have demonstrated the influence of dietary lipid composition on fatty acid profiles of tissues and their subsequent eject on reproductive success and spawning quality [1-6]. Lipids play an important role during the development of decapod crustaceans, not only as energy source, but also as essential nutrients [7]. Lipids are believed to be one of the key nutritional factors affecting egg hatching rates and larval survival [8]. Some essential fatty acids (EFA) have also been shown to be of special significance for gonad maturation and brood quality [9].

About one hundred species of freshwater prawn was recorded worldwide. Two members of the subfamily *palaemonidae* are potentially important for aquaculture in India; one is *Macrobrachium rosenbergii* and the other *Macrobrachium malcomsonii* [10]. The importance of lipid in aquaculture has been stressed in several culture species. Decline in total lipid in crabs, *Trapezia coralina* and *Trapezia ferrudinea* resulted in decrease in number of egg- carrying females, a high emigration rate, a slight increase in mortality and a decline in defensive behavior occurred [11]. The effect of protein and lipid sources on cholesterol concentrations in plasma, tissue and the whole body have been studied in swine and other animals [12]. The cholesterol supplementation in diets improves biological performance of prawn *Peneaus japonicus*, [13] lobsters *Homarus americanus* [14] mud crabs *Scylla serrata* [15], *Peneaus monodon* [16] and pacific white shrimp, *Litopenaeus vannamei* [17]. In spotted pinfish the highest monthly percent lipid in adults were found in September and lowest during April, it varies due to seasonal variation [18].

In crustaceans, the hepatopancreas is generally regarded as a major lipid storage organ. In the case of female crustaceans, ovaries also contain higher levels of lipid than other organs and this suggests that lipids are important for maturation of crustacean ovaries [19,13]. The fatty acid content and composition of the crustacean ovaries have a direct influence on reproduction, egg survival and embryonic development [13-3]. The purpose of studies on variation and characteristics of fatty acids in crustacean ovarian development at different physiological stages is to understand the reproduction. Knowledge of biochemical composition of Crustacean is helpful in evaluating their nutritive values. Our food must

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contain carbohydrates, lipids and proteins and minerals in required quantities for balanced growth of these proteins form the basis of life i.e., they are essential for growth since they are the building blocks of any living cell.

The freshwater prawn *M. malcomsonii* occupies 60% seafood exports and holds a unique position in both captures and culture fisheries [20]. Since it is more nutritious delicacy for human consumption and has high economic value in the world market, it is important to estimate its nutrient contents such as protein, carbohydrate and lipids. In the present study the concentration of lipids from different groups prawns, *M. malcomsonii* was analyzed.

MATERIALS AND METHODS

Collection of Animals: The different sized fresh water prawn, *M. malcomsonii* (Juveniles of 3-5cm and sub adults of 6-11 cm were collected from Lower Anicut, Cauvery River, Tamilnadu, India. They were transported in oxygenated polythene bags and acclimatized to laboratory condition in cement aquaria (6' × 3' × 3') for two weeks. One group of Juveniles (3cms -5cms) and three groups of sub adults (Group-1, 6-7cm; Group-2, 8-9cms and Group-3, 9-11 cm) were selected.

Maintenance of Animals: The animals were fed with boiled egg albumin, beef liver, pulses and rice alternatively. Water was adequately renewed. The fecal matters and the unfed feeds were removed daily. The air pump is fixed with tank to supply adequate oxygen.

Collection of Tissue from the Animals: The tissues such as hepatopancreas, gills and muscle were dissected out carefully and preserved in screw cap vials at 0°C. For each group tissues from three prawns were dissected and pooled to constitute single observation and thus three such observations were made for each group. Therefore totally nine prawns were sacrificed for each group.

Estimation of Total Lipids: Total lipid was extracted from the freeze-dried samples using dichloromethane/methanol (2:1) and measured gravimetrically [21] estimated by Barners and Blackstock [22] method.

Standard Graph Preparation: Standard graph was prepared using cholesterol as standard. The different known quality of cholesterol as standard was taken in different test tubes and subjected to the prescribed methodology for the estimation of lipid. The standard was taken in the X-axis and the corresponding O.D values were plotted in the Y-axis. A linear line was drawn.

RESULT AND DISCUSSION

The variation in the total lipid concentration of juveniles and three groups of sub adults are shown in Table 1 and Fig. 1-3. It was found to be in increasing trend from group I to Group IV (Group- IV > Group- III > group- II > Group I). Among the three tissues tested the concentration of total lipid was found to be maximum in the hepatopancreas, less in the gills and least in the muscle. Among them the lipid concentration of juveniles, maximum was noticed hepatopancreas (0.748±0.048mg/g) and minimum concentration in muscle (0.298±0.016). In sub adults the maximum lipid concentration was noticed group IV (size 9-11cm) in heptopancreas (1.230±0.220mg/g) and minimum was noticed group II (5-7cm) in muscles (0.590±0.051mg/g).

In the muscle tissue the percentage difference in concentration of the total lipid between group I and Group IV was found to be 105.5%. In the gills, the percentage of total lipid increased between group I and group IV was 81.10%. Similarly the percentage difference in the hepatopancreas was 65.24%. The minimum percentage of total lipid decreased in hepatopancreas 4.67%. The overall percentage increase was found to be maximum in the muscle than that of the gills and the hepatopancreas (Table 2 and Fig. 4).

Table 1: Concentration of total lipid (mg/g) in tissues of *M. malcolmsoii*

	Juveniles		Sub adults	
Tissues	Group 1 (3-5cm)	Group 2 (6-7cm)	Group 3 (8-9cm)	Group 4 (10-11cm)
Hepatopancreas	0.748±0.048	0.783±0.081	0.930±0.117	1.230±0.220
Gills	0.381±0.024	0.596±0.050	0.696±0.053	0.783±0.814
Muscles	0.298±0.016	0.590±0.051	0.646±0.040	0.740±0.049

Each value is mean ± SD of three individual observations

Table 2: Percentage (%) difference in concentration of total lipid between different groups of *M. malcolmsonii*

	Juveniles		Sub adults	
Tissues	Group 1 vs. Group 2	Group 2 vs.Group 3	Group 3 vs. Group 4	Group 1vs. Group 4
Hepatopancreas	4.67	18.77	32.99	65.24
Gills	6.29	47.16	15.71	81.10
Muscles	56.40	16.77	12.50	105.50

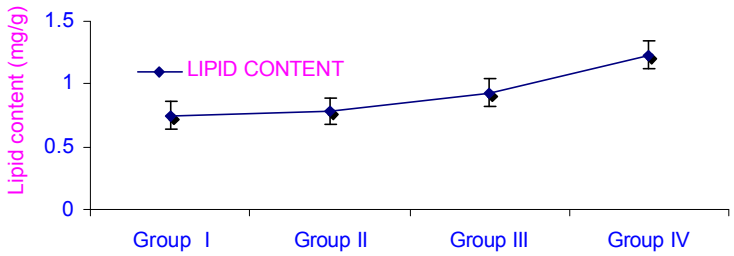

Fig. 1: Concentration of total lipid (mg/g) in the Hepatopancreas of *M. malcolmsonii*

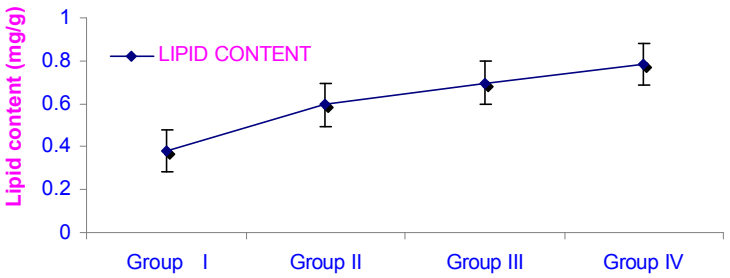

Fig. 2: Concentration of total lipid (mg/g) in the Gills of *M. malcolmsonii*

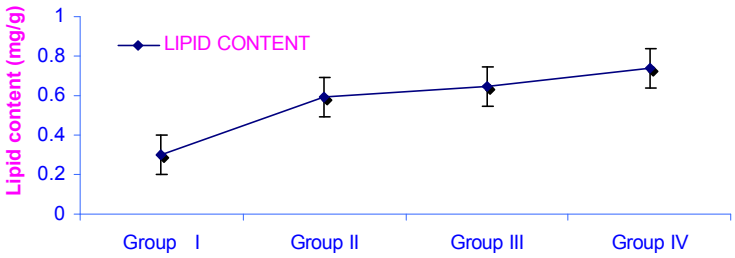

Fig. 3: Concentration of total lipid (mg/g) in the muscles of *M. malcolmsonii*

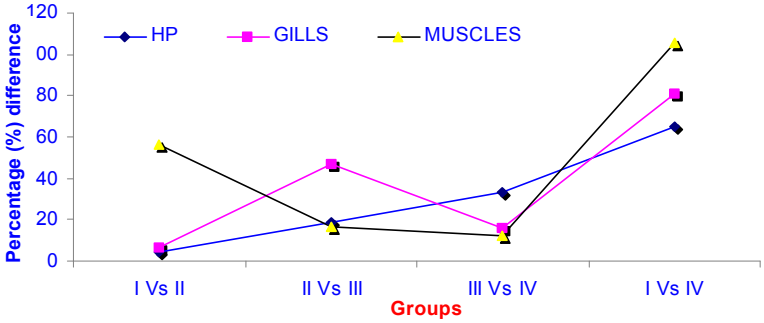

Fig. 4: Percentage (%) difference in concentration of total lipid between different groups of *M. malcolmsonii*

Cholesterol is a vital component of cell membranes and is a precursor of bile acids, steroids and moulting hormones. It is reported to be one of the essential nutrients for growth and survival of crustaceans [23]. Although various aspects of sterol metabolism including biosynthesis, side chain modification, absorption and transport are not fully understood, it is generally believed that most crustaceans require a dietary source of cholesterol [24]. Poly unsaturated fatty acids are essential for the growth of crustaceans. They have been reported to improve the growth of freshwater prawn *M. rosenbergii* [25] and other prawns such as *Peneaus chinensis* [256], *Peneaus japonicus* [27], *Peneaus indicus* [28] and *Peneaus duodarum* [29].

Hepatopancreas is a bilaterally bilobed brown yellowish organ. The structure formed by mass of blood tubules. It is the major lipid storage organ [30]. Lipids in digestive glands have also been hypothesized to be possible substrate and suitable site for energy storage in cephalopods [31]. In the present results suggested that the lipid content muscles more in sub adults stage then juveniles.

In *Gammarus locusta*, the similarity of lipid classes found in the different age classes and concentration of each component in whole body increased with age. The total lipid concentration was found to be higher in adults than in juvenilies [32]. A juvenile has lower lipid levels found in benthic amphipods *Pentoporeia fernata*, *Monopereai affinis* [33]. In the estuarine crab, *Chasmagnathus granulata* the gills and muscle lipids were significantly lower when subjected to hypo osmotic stress than those subjected to the hyper osmotic stress or maintained at control salinity [34]. In *P. esculentus*, the total lipid levels in epidermis were high in late premoult and early post moulting. When new cuticle is being secreted, cuticle lipid together with other major components was reabsorbed from old cuticle prior to ecdysis, however the cuticle phospholipids appeared to be labile at all moult stage [35]. Similarly in the present result showing the total lipid was maximum in sub adult stage then juveniles in all three parts such as hepatopancreas, gills and muscles respectively.

The total lipid content of the freshwater prawn *M. malcomsonii* was found to be greater than marine shrimp [36]. In *Ommasterephid squidllex*, the high lipid content of digestive gland of female provides fuel to support the extended brooding period of the gonatids [37]. Voogt *et al.* [38] reported that cephalopods are able to synthesize sterols, although molluscs in general appearance can carry out this biosynthesis slowly. The dietary lipid concentration of 7-8% was the optimum level for crustaceans [39]. A dietary lipid level of 8% supports the best growth of *P. japonicus* [40]. A dietary lipid level of 8.1% gives the highest gonad somatic index, a lipid level higher than 9% negatively affects maturation of *L. vannamei* [41] and lipid level greater than 13.9% reduces the percentage of mating per night of female *P. styliorostris* [42].

Dietary fatty acids are not stored in shrimp body but in the hepatopancreas as energy source [43]. Egg bearing females of *Macrobrachium nobili* have a higher caloric value as compared to *M. malcomsonii* and are the excellent source of polyunsaturated fatty acids which are fatty acids essential for human health.Lipids play an important role in embryonic metabolism as they are the most important energy source and provide at least 60% of the total energy expended by the developing crustacean embryo [44]. In *M. rosenbergii* decline of lipid level during growth period suggest probable utilization of lipids as the major metabolic source of energy [45].

In the present study the total lipid content of three tissues namely hepatopancreas, gills and muscles were analyzed. The result shows an increasing trend due to the increase in size during growth. The total lipid content was found to be maximum in the hepatopancreas when compared to muscles and gills. The lipid content may vary due to the types of food intake, climate, age, sex and habitat etc.

ACKNOWLEDGMENT

I am great full to Prof. G. Vanithakumari and Prof. S. Sasikala, Head of the Department, Department of Zoology and my classmates for encourage and valuable helps during study period.

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