ISSN: 2347-5129
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.352
IJFAS 2015; 3(1): 329-336

www.fisheriesjournal.com
Received: 12-07-2015
Accepted: 13-08-2015

DV Prasuna Devi
Department of Zoology,
Sri Venkateswara University,
Tirupati - 517 502, India.

K Hareesh
Department of Zoology,
V.S.U.P.G. Centre, Kavali - 524 201, India.

M Srinivasulu Reddy
Department of Zoology,
Sri Venkateswara University,
Tirupati - 517 502, India.

Correspondence
M Srinivasulu Reddy
Department of Zoology,
Sri Venkateswara University,
Tirupati - 517 502, India.

Studies on the Proximate Composition of Tropical Freshwater Prawn *Macrobrachium rosenbergii*

DV Prasuna Devi, K Hareesh, M Srinivasulu Reddy

Abstract
Studies on the proximate composition of Male, Female and Berried Females of Freshwater prawns *Macrobrachium rosenbergii* was conducted and nutritional values i.e. Protein, Carbohydrate, Lipid, Ash, Moisture, Free Amino acids, Fatty Acids, DNA and RNA contents were analysed and presented. Morphometric data obtained for freshwater prawn *M. rosenbergii*, Male, Female and Berried Female sex clearly indicates the differential growth patterns of Male and Female sexes. Due to edible nature of Crustaceans including prawns constitute one of the major sources of nutritive materials for humans and form one of the key points of food chain cycle. The organic constituents of Muscle tissue i.e. Protein, Carbohydrate, Lipid, Free amino acids and Fatty acids clearly reveals the nutritive nature of freshwater prawns. Considering the nutritional point of view, *M. rosenbergii* can be very well used as food so that a better choice for commercial culture.

Keywords: *Macrobrachium rosenbergii*; proximate composition; Fatty acids; Amino acids.

1. Introduction
Aquaculture has been described as an underwater Agriculture mainly to increase the Production above the natural, wild level. It implies some form of intervention in the rearing process by exploiting water bodies to enhance production through related stocking density, feeding and protection from predators. World Aquaculture continues to grow more rapidly than all other animal food-producing sectors, with an average annual growth rate of 8.8% from a production of below one million tonnes in early 1950's to 68.8 million tonnes during 2010-2012 [17]. The demand for animal protein for human consumption is increasing and it is met largely by terrestrial animals. In India, after the decline of Penaeid shrimp culture due to disease problems and serious environmental issues, the Fisheries and Aquaculture of Freshwater prawns came into forefront. There has been considerable increase in the culture of Freshwater prawn due to its high protein, less fat, taste and high demand in both National and International markets. The giant Freshwater prawn *Macrobrachium rosenbergii* inhabits the tidal rivers along the East Coast and West Coasts. In India the largest species that are of interest for Aquaculture are of the 100 species of Freshwater prawns belonging to the genus *Macrobrachium* recorded worldwide, 40 species are known to be distributed in India. The *Macrobrachium* sps grow to more than 15 g are regarded as commercially important. Until recently the Freshwater Prawn farming has been practiced by adopting traditional methods, where the young ones collected from the wild and reared in farms but now artificial seed collection has been introduced for successful rearing of Larval stapes of *M. rosenbergii* and *M. malcolmsonii*. In India the major commercial species are also *M. rosenbergii* and *M. malcolmsonii*. These species are also shows compatibility for polyculture [16, 30, 47] and attains relatively larger sizes up to 200 g in shorter span of time. Therefore, farming of *Macrobrachium* sps has attracted more attention in recent years. The farmed are utilized for Freshwater prawn production also significantly increased from 12,085 ha to 48,855 ha and threefold increase in cultivation in just 2-3 years. In India, millions of people suffering from malnutrition. Protein deficiency may be minimized for some extent by making availability cheaper fish meal items which are available to local communities. Prawn has become the major source of its low price and availability [3]. Determination of proximate composition in Freshwater prawns provide the information about the main organic and inorganic constituents including Proteins, Amino acids, Carbohydrates, Lipids and other substances like Vitamins and Minerals. Possessing of relatively high quality of certain components of body composition

including proteins, fat, amino acids etc., are the indicators of the existence of good physiological and biochemical condition. By keeping the above background the present study is aimed to probe the evaluation of proximate composition of muscle tissue in Freshwater prawn *M. rosenbergii*.

2. Materials and Methods

The Present study was conducted over a culture period of six months using earthen ponds located at Ramayapatnam (Latitude 15º 02¹ 55¹¹N, Longitude 80º 02¹ 50¹¹ E), Prakasam Dist. of Andhra Pradesh, India. The Prawns of desired size 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. They were separated into three groups i.e., Male, Female and Berried individuals. After grading, the exoskeleton was pealed out and homogenized in Electrical homogenizer. The grounded samples were then freeze dried and powdered and stored in Refrigerator for further biochemical analysis.

The content of Total Protein was estimated by following the method of Lowry *et al.* [25] using TCA precipitated sample. Total Carbohydrate was estimated by the method of Roe [37] by using TCA extracted sample. Total Lipid was extracted with Chloroform-Methanol mixture following the method of Barnes and Blackstock [4] and method of Foch *et al.* [18] Amino acids were extracted using Sodium tungstate and Sulphuric acid. The content of Total amino acid was assayed by the method of Moore and Stein [26]. The Concentration of Fatty acid was estimated by the method of Duncombe [14]. Nucleic acid was extracted from Methanol insoluble residue by the method of Schneider [41] and the contents of DNA and RNA were estimated by following the method of Burton [9] and Ceriotti [10], respectively. The pre weighted wet tissue samples were dried at 40 ºC to measure the moisture content. The dried tissue sample was subjected to 600 ºC under Muffle Furnace to measure to measure the ash content.

Analysis of Profiles of Amino acids

The individual amino acids were determined in Muscle tissue using LKB Automatic Amino acid Analyser. Amino acids were extracted into Ethanol medium and were subsequently dissolved in Citrate buffer (0.1 M) and 0.5 ml was loaded for quantification suitable standards also run simultaneously. All the conditions pertaining to the quantification were standardized [33].

Analysis of Fatty acid Profiles

The Profiles of Fatty acid were estimated by following Gas Chromatographic (GC) method [32]. Fatty acids were obtained from Lipids by saponification using Sodium hydroxide dissolved in Methanol-Water mixture (Hydrolysis with alkali). They were methylated into Fatty acid methyl ester using Hydrochloric Acid and Methanol mixture, which can be easily identified by Gas Chromatography. The Fatty acid methyl ester was separated using the mixture of Hexane and anhydrous diethyl ether. For the Organic Phase aqueous Sodium Hydroxide was used as base wash and the upper organic layer was separated. 3 µl sample was injected and analysed using Chemito 8610 Gas Chromatography, with BPX 70 capillary column and Frame ionization dictator. Nitrogen was used as carrier gas. The Chromatogram was used for calculation. Slandered Fatty acids were analysed simultaneously. Based on the retention time and peak area, the standard Fatty acids, each Fatty acid in the unknown sample was identified.

The data obtained was subjected to Statistical Analysis in SPSS.

3. Results

Morphometric data obtained for Freshwater prawn *Macrobrachium rosenbergii*, Male, Female and Berried Female sex were recorded and presented in Table.1. The differences in Body length and weight were observed with reference to individual sex of prawns. The Male Prawns recorded more growth potentials compared to Female and Berried Female Prawns (Figure.1). The Proximate composition of Muscle tissues of Freshwater prawns were analysed and presented in Table.2. Biomolecules of Muscle tissue includes Proteins, Carbohydrates, Lipids, Moisture content, Ash, Amino acids, Fatty acids, DNA and RNA were estimated and presented in Table.2. The data was subjected to Statistical Analysis and the Results were presented in Table.3. Under Proximate composition studies, biomolecules including Proteins, Carbohydrates, Lipids, Moisture content, Ash were estimated and presented in Table. 4. The Profiles of individual amino acids recorded for Muscle tissue of prawns were presented in Table.5. Amino acids including Arginine, Histidine, Phenylalanine, Leucine, Tyrosine, Tryptophane, Methionine, Valine, Threonine, Glutamine, Glycine and Proline were estimated and presented in Table.5. The Profiles of Fatty acids including Saturated, Monounsaturated and Polyunsaturated Fatty acids were estimated in the Muscle tissues of prawns and presented in Table. 6.

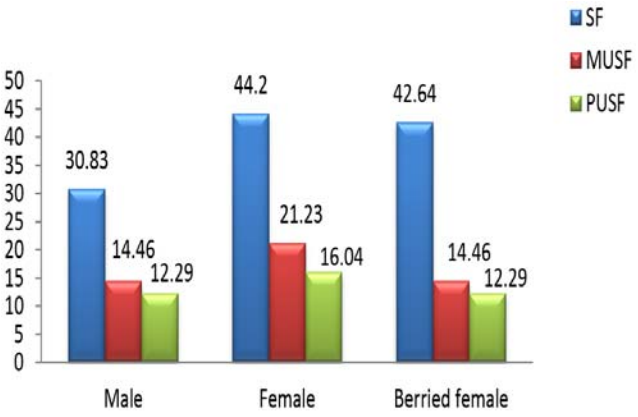

Fig 2: Saturated, Monounsaturated and Polyunsaturated Fatty acids (%) in the Muscle tissue of Prawn *M. rosenbergii*

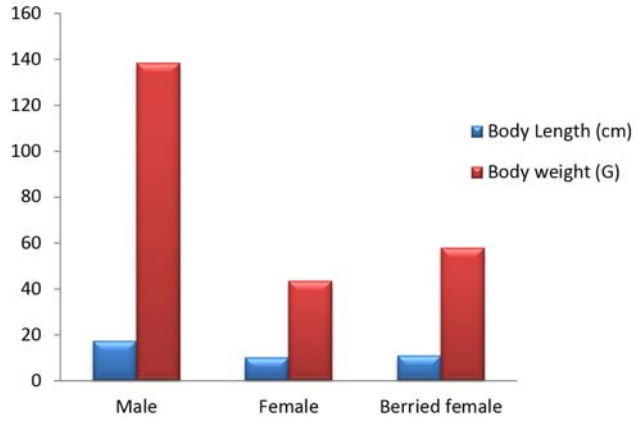

Fig 1: Length – Weight relationship in prawn *M. rosenbergii*

Table 1: Morphometric details of Male, Female & Berried Female Freshwater Prawn *M. rosenbergii*

	Male	Female	Berried Female
Body Length (cm)	17.38 ± 1.45	10.12 ± 0.85	11.13 ± 0.92
Body weight (g)	138.49 ± 8.45	43.45 ± 3.28	58.16 ± 5.18

Each value is Mean ± SD of Six individual observations.

Table 2: Proximate Composition of Organic Constituents (%) in the Muscle tissue of Freshwater Prawn *Macrobrachium rosenbergii* (Male, Female and Berried Females) at different stages of culture activity.

Length (mm)	Organic Constituents (%)				
	Protein	Carbohydrate	Lipid	Moisture	Ash
Male					
36-45	63.12±0.84	2.34±0.13	4.25±0.21	80.21±1.25	5.19±0.24
46-55	64.52±0.98	2.75±0.14	3.51±0.18	79.51±1.34	5.81±0.28
56-65	62.18±1.02	2.49±0.13	4.75±0.23	79.82±1.32	5.94±0.29
66-75	60.21±1.08	1.94±0.12	5.02±0.26	81.12±1.13	6.24±0.32
76-85	59.52±0.94	2.24±0.13	4.65±0.25	81.32±1.14	6.75±0.34
86-95	58.54±0.98	2.41±0.12	5.48±0.22	80.34±1.22	6.54±0.39
96-105	62.81±0.92	2.51±0.14	5.57±0.25	82.67±1.34	6.68±0.41
106-115	63.22±0.84	3.35±0.17	4.12±0.23	82.24±1.26	6.42±0.37
116-125	62.14±0.82	2.55±0.12	3.84±0.21	81.84±1.32	6.84±0.38
126-135	62.75±0.84	2.74±0.14	3.93±0.22	81.72±1.28	6.78±0.42
136-145	62.88±1.02	2.59±0.14	3.95±0.27	80.89±1.31	6.94±0.42
146-155	62.39±1.04	2.58±0.12	3.89±0.24	80.94±1.36	6.85±0.41
156-165	62.45±0.89	2.62±0.18	3.85±0.29	81.32±1.33	6.78±0.43
166-175	62.58±1.04	2.59±0.15	3.94±0.27	80.88±1.41	6.84±0.41
Female					
35-45	61.82±1.08	2.14±0.15	4.52±0.31	79.14±1.21	5.12±0.43
46-55	62.13±1.04	1.83±0.18	5.18±0.32	80.35±1.23	5.25±0.45
56-65	60.12±1.09	2.18±0.14	4.52±0.31	78.24±1.29	6.01±0.43
66-75	60.82±1.08	2.19±0.13	4.08±0.29	77.94±1.31	6.18±0.46
76-85	59.41±0.94	2.45±0.17	5.84±0.28	77.52±1.37	6.29±0.47
86-95	58.21±0.94	2.28±0.13	4.54±0.29	78.59±1.32	6.45±0.46
Berried Female					
35-45	60.52±0.95	1.82±0.13	4.02±0.29	78.49±1.28	5.51±0.49
46-55	58.82±1.04	2.05±0.19	3.21±0.25	79.85±1.31	5.78±0.41
56-65	58.45±0.88	1.85±0.15	4.21±0.28	80.72±1.35	6.21±0.46
66-75	57.52±0.94	2.42±0.17	3.68±0.26	81.11±1.36	6.59±0.49
76-85	57.15±0.95	1.91±0.18	3.52±0.24	82.13±1.41	6.78±0.43
86-95	56.18±0.94	2.21±0.15	4.69±0.26	81.09±1.37	6.62±0.47

Each value is Mean ± SD of six individual observations.

Table 3: Results of One way ANOVA for different Organic constituents in the Muscle tissue of prawn *M. rosenbergii*

		Sum of Squares	df	Mean Square	F	p value
Length	Between Groups	67.820	2	33.910	14.055	.000
	Within Groups	55.493	23	2.413		
	Total	123.314	25			
Protein	Between Groups	1.301	2	.650	8.578	.002
	Within Groups	1.744	23	.076		
	Total	3.045	25			
Carbohydrate	Between Groups	2.385	2	1.193	3.108	.064
	Within Groups	8.826	23	.384		
	Total	11.212	25			
Lipid	Between Groups	25.026	2	12.513	12.317	.000
	Within Groups	23.367	23	1.016		
	Total	48.393	25			
Moisture	Between Groups	1.460	2	.730	2.675	.090
	Within Groups	6.275	23	.273		
	Total	7.735	25			
Ash	Between Groups	3.623	2	1.811	5.043	.015
	Within Groups	8.262	23	.359		
	Total	11.885	25			

Table 4: Proximate composition of Muscle tissue of Male, Female and Berried Females of Freshwater prawn *M. rosenbergii.*

Parameter	Male	Female	Berried Female
Protein[a]	62.18 ± 0.58	59.39 ± 0.45	58.03 ± 0.46
Carbohydrate[a]	2.75 ± 0.08	2.12 ± 0.05	2.03 ± 0.04
Lipid[a]	4.78 ± 0.18	5.03 ± 0.19	4.12 ± 0.14
Ash[a]	7.12 ± 0.14	6.32 ± 0.12	7.63 ± 0.17
Moisture[e]	81.37 ± 1.29	77.32 ± 1.12	81.03 ± 1.08
Amino Acids[b]	19.74 ± 0.25	18.11 ± 0.21	16.93 ± 0.22
Fatty Acids[a]	57.58 ± 1.19	81.47 ± 1.38	80.63 ± 1.29
DNA[a]	2.38 ± 0.19	2.26 ± 0.14	2.33 ± 0.17
RNA[a]	4.18 ± 0.24	4.53 ± 0.34	4.33 ± 0.31

Each value is Mean ± SD of Six individual observations.
a: Values represented as % weight.
b: g/100 g wet weight of tissue.

Table 5: Amino acid profile of Muscle tissue of Freshwater prawn *M. rosenbergii*.

Amino acid	Male	Female	Berried Female
Arginine	0.94 ± 0.05	0.88 ± 0.05	0.89 ± 0.04
Histidine	2.42 ± 0.13	2.18 ± 0.10	2.12 ± 0.11
Phenylalanine	0.84 ± 0.04	0.81 ± 0.04	0.78 ± 0.05
Leucine	0.95 ± 0.06	0.95 ± 0.05	0.91 ± 0.04
Tyrosine	2.43 ± 0.12	2.19 ± 0.13	2.09 ± 0.12
Tryptophan	2.48 ± 0.14	2.32 ± 0.13	2.13 ± 0.14
Methionine	2.59 ± 0.14	2.38 ± 0.12	2.11 ± 0.12
Valine	1.13 ± 0.10	1.02 ± 0.08	0.99 ± 0.07
Threonine	1.48 ± 0.11	1.32 ± 0.12	1.21 ± 0.09
Glutamine	1.25 ± 0.11	1.12 ± 0.08	1.08 ± 0.07
Glycine	1.96 ± 0.12	1.79 ± 0.12	1.54 ± 0.12
Proline	1.27 ± 0.11	1.15 ± 0.10	1.08 ± 0.09

Each value is Mean ± SD of six individual observations. Values are expressed as g/100 g wet weight of tissue

Table 6: Muscle tissue Fatty acid profiles (% weight) in Male and Female Freshwater prawn *M. rosenbergii*.

Type of Fatty Acid	Female	Berried Female	Male
Saturated Fatty acids:			
C12:0	1.03±0.12	1.12±0.13	0.62±0.14
C14:0	3.84±0.24	3.98±0.28	3.02±0.25
C15:0	1.72±0.12	1.92±0.15	1.21±0.17
C16:0	28.12±1.14	26.84±1.25	19.93±1.45
C17:0	2.72±0.34	2.84±0.32	2.03±0.34
C18:0	6.77±0.42	5.94±0.45	4.02±0.43
Total	44.2	42.64	30.83
Monounsaturated Fatty acids			
C15:1n 5	0.38±0.05	0.44±0.08	0.94±0.12
C17:1 n 8	1.12±0.14	1.18±0.14	0.92±0.11
C18:1 n 9	15.34±0.98	16.72±0.85	10.24±0.88
C18:1 n 7	4.39±0.14	3.85±0.15	2.36±0.12
Total	21.23	22.19	14.46
Polyunsaturated Fatty acids			
C18:2 n 6	8.12±0.85	8.04±0.82	6.93±0.83
C18:3 n 6	0.74±0.08	0.73±0.08	0.49±0.04
C20: 2 n 6	0.53±0.04	0.62±0.05	0.74±0.08
C20: 4 n 6	6.65±0.42	6.41±0.48	4.13±0.42
Total	16.04	15.8	12.29

Each value is Mean ± SD of six individual observations.

4. Discussion

Biochemical compositions of organisms are known to vary with season, size of the animal, stages of maturity and availability of food, temperature etc., several edible Crustaceans constitute one of the major sources of nutrition food materials for human beings and form one of the key points of food chain cycle. In day today life, several Crustaceans which are available in the local markets for human consumption are very delicious and possess relatively good amount of Proteins and Amino acids, along with other nutrient substances. The Edible class of Crustaceans includes prawns belongs to Penaeids and Palaemonidae, both are relatively highly nutritious and forms good source of Proteins. Due to the presence of Fibre content present in prawns has got a nutritional advantage that it will assess in the reduction of constipation and other related problems in human beings. The nutritive values of Crustaceans including the prawns were demonstrated through the biochemical consumption of Protein content, Carbohydrate, Lipid, Amino acids, Fatty acids, Vitamins, Minerals etc.,. Therefore the present investigation is aimed to understand the biochemical composition of Freshwater prawn *M. rosenbergii*. During the culture activity

of any candidate species for Agriculture, determination of length-weight relationship data is most important, which will provide very useful information in market oriented farm management [35]. It has been already reported by several authors that in the case of Freshwater Prawns deferential growth patterns in both male and female sex especially in freshwater prawn *Macrobrachium* sps. The male prawn species relatively grow faster when compared to female prawns. Generally the growth of Freshwater prawns were dependent on several factors including age, sex, rate and frequency of feeding, quality of food provided, disease control management protocols, control of environmental factors, stocking density, temperature, oxygen content, water quality management, elimination of waste products, above all influence and expression of genetic materials and the above factors will influence the frequency of molting in Freshwater prawns. It has been already established that Freshwater prawns faster growth rates are associated with higher food consumption at higher temperatures. Proteins are the most prominent biochemical components of Crustaceans from eggs to adults and are strikingly dominant in younger ones. The quantity of Protein in Prawns is largely influenced by the extent of fat and water content [20]. In the present study, Males were found to have more Protein content compared to Females. The lower level of Protein content in Females suggests that amino acids, the functional units of Protein may be utilized for the development of gonads in Females compared to Males. Sriraman [42] reported the similar kind of observations in the Penaeid prawn *Penaeus merguiensis* and in Freshwater prawn *Macrobrachium idea*. Several authors reported the variations in Protein content at different stages of the life cycle in Penaeid prawns *P. indicus*, *Metapenaeus monceros*, *M. dobsoni*, Freshwater prawn *M. idea*, *Squilla*, *Acetes* sps [19, 28, 38, 42]. Several authors emphasized that, the quantities of certain constituents vary considerably in different stages of the life cycle of the Crustaceans including Prawns and Crabs and also differences are observed with in genera to genera, species to species, size, sex and condition in life cycle, feeding season, physical activity and reproductive stages etc [45, 47, 29, 30, 40]. Sriraman [42] reported that in freshwater prawn *M. idae* Protein content was higher in the younger individuals compared to adults. The higher Protein content in younger individuals may be attributed to increased Protein synthesis during the active growth phase as it has been observed in Prawns and Shrimps [1, 2, 48, 8]. In the present investigation also, the younger individuals are recorded higher Protein values compared to adults. Among Females, non-berried females showed higher values of Proteins compared to berried females. This may be attributed that some amount of Protein is being spared for the development of gonadal activity i.e., developing of eggs in berried females.

Carbohydrates are considered to be the first among the organic nutrients to be utilized to generate energy in the cell. Carbohydrates serve as precursors for the production/synthesis of amino acids and certain nutrients, which in turn play an important role in the control of metabolism necessary for growth potentials. They exist both in free and bound state along with proteins as protein-bound sugars and glycogen. Carbohydrate content exhibited an inverse relationship with Protein content. The raise in Carbohydrate content was gradual among the size groups and peak value was observed in the bigger size group, which may be due to the more synthesis and accumulation of Carbohydrates in the higher size groups compared to young ones. Various factors like, gonad development stage, starvation, feeding rates, rest, exercise and other Physiological stages are known to change the Carbohydrate levels in the prawns. In the present study, Carbohydrates content recorded higher in Males compared to Females. Among the Females, non-berried Females recorded higher values compared to berried females. Several authors reported the variations of Carbohydrates in different prawn sps [1, 2].

In general, the Lipids act as major food reserves along with potentials and are known to play an important role not only in the production of energy at cellular level and also play a vital role in the maintenance of structural integrity as the cellular and sub cellular membranes. The Lipid also acts as vehicles for the transport of Lipid soluble Vitamins A, D, E and K. Several authors reported the inverse relationship between Lipids and Protein [21, 42, 34, 28, 36]. Pillay and Nair [34] observed an inverse relationship between Lipids and moisture content. But this does not affect the Lipid composition of muscle tissue to any great extent. Several authors reported the different trends of Lipids i.e., mature female prawns of *Parapenaeopsis stylifera* showed higher lipid contents compared to immature ones [39], no major variations were reported in five species of Penaeid Prawns [22]. In the present investigation, the Lipid values are generally higher in Male sex compared to females. Among the females, the berried females showed less Lipid values compared to non-berried ones.

Ash is one of the least studied biochemical constituents of Crustaceans. In the present study, marginal and gradual rise in ash composition of muscle tissue was observed regardless of sex in prawn. *M. rosenbergii*. Similar kinds of results were also reported by several authors in the penaeid prawns and freshwater prawns including *P. stylifera* and *M. affinis* [1], in *M. idella* [2] in *M. dobsoni* and jawala pran *Acetes* sps. [28], in *P. monodon* [43] in *M. idae* [12] and *M. scabriculum* [49]. In the present investigation, the moisture content observed to be almost in the similar range for Males, non-berried and berried females. Almost similar values of water content were reported in *M. malconsonii* [44] But in the case of *M. scabriculum* and *M. idae*, berried females showed relatively higher values of moisture contents compared to male and non-berried females. [49, 12].

One of the major requirements of prawn culture is conversion of dietary Protein into the stuff of the body i.e., tissue protein. Protein is essential for normal function, growth and maintenance of the body tissues. Its content is considered to be an important tool for the evaluation of physiological standards. Amino acids are the building blocks of the proteins and serve as boy builders. They are utilized to form various cell structures, as which they are key components and they serve as source of energy. Crustacean muscles contain high concentrations of free amino acids such as Arginine, Glycine, Proline, Glutamine and Alanine [13, 8, 33]. The free amino acids are known to play an important role indifferent functions of the body of Crustaceans such as osmo-regulation [15], neurotransmitter [27], metabolic pathways of growth including Protein synthesis [53], allergic and inflammatory reactions. In the present study, the levels of indispensable amino acids are relatively higher in Males compared to Females. The amino acid quantity was increased in both Male and Females during the course of growth stapes, and the increased amino acid trend is more pronounced in Females compared to Males. This clearly suggests that sex differences and unique physiology of adult female prawns.

In the present study muscle tissue fatty acids were estimated in

Male, non-berried Female and berried female *M. rosenbergii* and presented in Table.5. Among the three different types of fatty acids estimated in the muscle tissue of prawns of different sexes, saturated fatty acids recorded highest amounts compared to other monounsaturated and polyunsaturated fatty acids. Highest amounts of saturated fatty acids were observed in the muscle tissue followed by monounsaturated fatty acids and finally polyunsaturated fatty acids. The above contents of fatty acids are more pronounced in Female sex compared to Male sex, it may be due to the storage of Lipids for development of gonads. Similar kinds of observations were reported in freshwater prawns *M. scabriculum* [49] and *M. idea* [12]. In the present study, Saturated, Monounsaturated and polyunsaturated fatty acids of Muscle tissue depicts a clear trend. The saturated fatty acids recorded highest levels in females compared to males. Among the saturated fatty acids, C16:0 (Palmitic acid) content is more dominating compared to other saturated fatty acids (Table.5). The remaining saturated contents were relatively lesser in the muscle tissue in both the sexes i.e., Male and Females. Monounsaturated and Polyunsaturated fatty acids also followed the same trend i.e., higher level were observed in females compared to males. In case of Crustaceans both hepato-pancreases and muscle tissues were the primary tissues for the storage of Lipids. But the hepato-pancreas is the main lipid storage organ in the form of Triglycerides, Phospholipids etc., but in the case of muscle tissues of prawns phospholipids are the principal sources as lipid reserves [11] and precursor for endocrine hormones. Generally, the muscle of the prawn contains lower quality of lipids [6, 7], therefore prawns are being preferred by the consumers. The higher quality of total lipid and fatty acids recorded in the adult female prawns may be necessitated for performing certain specific physiological activity related that the incorporation of fatty acids in the diet produced better growth rates and survival in several candidate species of Aquaculture. In the present study, the presence of n-3 PUFA, particularly Linoleic acid, EPA and DHA indicates between growth rates and survival of *M. rosenbergii*. The higher levels of EPA and DHA would also increase the Stress tolerance and membrane permeability [51, 52]. The Arachidonic acid is considered to be the precursor for prostaglandin hormone, which is essential for reproduction and vitellogenesis [5, 46]. In the present study, Arachidonic acid levels were also found to be relatively higher in female prawns compared to male prawns including its involvement in gonadal growth and maturation. Into the Female prawns are possessing higher quality of fatty acids compared to male prawns indicates their nutritional values, physiological and reproductive states. More over the interaction and intricacies between omega-3, omega-6 and omega-9 fatty acids are more crucial for the maintenance of good health. The omega-3 fatty acids have Anti-inflammatory and Anti- coagulant properties as well as may other important health benefits. The omega-6 fatty acids have their role in female reproduction, whereas omega-9 fatty acids help to reduce the risk of Artheosclerosis, cardiovascular disease and stroke. Since *M. rosenbergii* contains considerable amounts of PUFA it can be a healthy choice of daily diet.

Crustaceans exhibit both physiological and biochemical changes associated with molting cycle, since molting phenomenon is an important event associated with growth in Crustaceans including prawns. In the present investigation the quality of DNA was found to be almost equal in both the sexes Male and Female *M. rosenbergii*. Several authors reported that, the DNA content remained almost stable and assumed to be constant in normal somatic cells of penaeid prawns *P. monodon* [24]. Whereas the quality of RNA in any cell reflects the cell involvement in Protein biosynthesis and Protein production [50]. In the present study, the quality RNA was found to be relatively higher in females compared to males. This clearly suggests that the protein synthetic potentiality more pronounced in Females compared to Males. To Support the present results, Jayaprakas & Sambhu [23] reported that, the increased RNA content in the hepato-pancreas and muscle tissues of prawn *P. indicus* has been correlated with enhanced protein synthesis and better growth rates in prawns.

The present investigation may be concluded that the variations in muscle constituents of *M. rosengbergii* in Male, Female and Berried females indicates the dynamics of Proteins, Lipids, Carbohydrates and other biomolecules like RNA and DNA are involved in several metabolic events include every metabolism, gonadal development and other events of the body. From the data obtained in the present study, *M. rosenbergii* is considered to be a very good species for consumption as they are possessing high amounts of Protein, amino acids and essential amino acids and low amounts of total fats.

5. Acknowledgements

Prof. MSR thanks UGC, New Delhi for financial support M/S Alpha Biologicals, Nellore for Their Technical support. We thank Prof. K.V.S. Sarma, Department of Statistics for his help in Data Analysis.

6. References

1. Achuthan kutty CT, Parulekar AH. Biochemical composition of muscle tissue of penaeid prawns, *Mahasagar-Bul*, Natl. Inst. Oceanogr 1984; 17(14):239-242.
2. Ajith KM. Studies on the proximate composition of the prawn *Macrobrachium idella* (Hilgendorf). M. Phil. Thesis, Annamalai University, India, 1990.
3. Adeyeye EI. Waste yield, proximate and mineral composition of three different types of land snails found in Nigeria. International Journal of Food Science and Nutrition. 1996; 47:11-116.
4. Barnes H, Blackstock J. Estimation of lipids in marine animals and tissues. Detail investigation of the sulpho-phosphovanillin method for total lipids. J Expt. Mar. Ecol. 1973; 12:103-118.
5. Bell JG, Sargent JR. Arachidonic acid in Aquaculture feeds: Current status and future opportunities. Aquaculture 2003; 218:491-499.
6. Bhavan PS, Yuvaraj C, Leena M, Sangeetha M. Concentrations of total protein, lipid, and carbohydrate in juveniles and sub adults of the prawn *Macrobrachium malcolmsonii* collected from the Cauvery River. Indian J Fisheries. 2008; 55:323-325.
7. Bhavan PS. Concentrations of total protein, lipid, carbohydrate, DNA and ATPase in tissues of the freshwater prawn Macrobrachium malcolmsonii. Fishing Chimes 2009; 29:44-46.
8. Bhavani M. Studies on the Determination of Nutritional requirements for the Freshwater prawn *Macrobrachium rosenbergii* (de Man). PhD Thesis, S.V. University, Tirupati, 2015.
9. Burton K. A study of the condition and mechanism of the diphenylamine for the colorimetric estimation of deoxyribonucleic acid. Biochem J. 1956; 62:315-323.

10. Ceriotti G. Determination of nucleic acid in animal tissues. J Biol. Chem. 1955; 214:59-70.
11. Chanmugam P, Donovan J, Wheeler CJ, Hwang DH. Differences in the lipid composition of fresh water prawn *Macrobrachium rosenbergii* and marine shrimp. J Food Science. 2006; 48:1440-1441.
12. Chandra SK. Proximate composition of edible palaemonid prawn *Macrobrachium idea* (Heller, 1862). M.Sc. Thesis, Annamalai University, India, 2009.
13. Cobb BF, Conte FS, Edwards MA. Free amino acids and osmoregulation in penaeid shrimp. J Agric. Food Chem. 1975; 23:1172-1174.
14. Duncombe WG. The colorimetric micro determination of long-chain fatty acids. Biochem. J. 1963; 88:7-10.
15. Fang LS, Tang CK, Lee DL, Chen IM. Free amino acid composition in muscle and hemolymph of the prawn *Penaeus monodon* in different salinities. *Nippon Suisan Gakkaishi* 1992; 58:1095-1102.
16. FAO. World Aquaculture and Fisheries Statistics. FAO Publication, Rome, Italy, 2007.
17. FAO. World Aquaculture and Fisheries Statistics. FAO Publication, Rome, Italy, 2014.
18. Folch JH, Less GH. Solane-Stanley. A simple method for the isolation and purification of total lipid from animal tissues. J Biological Chemistry. 1956; 226:497-509.
19. Garg DK A, Lekshmi Nair, Prabhu PV. Protein from jawla prawn *Acetes* spp. and *Squilla* Orat Squilla nepa. Fish. Technol 1977; 14(1):53-56.
20. Geiger E, Bergstrom G. Fish as food 1962; 11:30-35.
21. George JC, Patel BS. The seasonal variation in the fat content of the liver and gonads in a marine and freshwater decapod. J Anim. Morph. Physiol. 1956; 3:49-55.
22. Gopakumar K, Nair MR. Lipid composition of the species of Indian prawns. Sci. Food. Agric 1975; 26(3):319-325.
23. Jayaprakas V, Sambhu C. Growth response of white prawn, *Penaeus indicus* to dietary L-carnitine J Asian Fisheries Science. 1996; 9:209-219.
24. Kian AYS, Mustafa S. Influence of enriched live prey and other artificial diets on RNA and DNA concentration in the ovary of Tiger prawn, Penaeus monodon. J Appl. Aquacult. 2005; 16:147-153.
25. Lowry OH, Rosenbrough NJ, Farr AL Randall RJ. Protein measurement with the Folin Phenol Reagent. J Biol. Chem. 1951; 193:265-275.
26. Moore S, Stein WH. Photometric ninhydrin method for use in the chromatography of amino acid. J Biol. Chem. 1948; 176:367-388.
27. Mullen BJ, Martin RJ. The effect of dietary fat on diet selection may involve central serotonin. Am. J Physiol. Regul. Integr. Comp. Physiol. 1992; 263:R559-R563.
28. Nair AL, Prabu PV. Protein concentrates from tiny prawns. J Mar. Biol. Ass. India. 1990; 32(1-2):198-200.
29. New MB. Farming Freshwater Prawns: A Manual for the culture of the giant river prawn *Macrobrachium rosenbergii* farming. FAO Fisheries Technical FAO Rome, Italy, 2002, 428.
30. New MB. The role freshwater prawns in sustainable aquaculture. Freshwater prawns International symposium, kerala Agriculture University, Kochi, India, 2003, 10-13.
31. New MB. Freshwater prawn farming, global status, recent research and a glance at the future. Aquaculture Res 2005; 36:210-230.
32. Nichols DS, Nichols PD, McMeekin TA. Polyunsaturated fatty acids in Antarctic bacteria. *Antarctic Science* 1993; 5:149-160.
33. Padma Priya M. Studies on the monitoring of growth potentials of tiger prawn *Penaeus monodon* during feeding with commercial aqua feeds, a field study. PhD Thesis, S.V. University, Tirupathi, 2010.
34. Pillay KK, Nair NB. Observation on the biochemical changes in the gonads and other organs of *Uca annulipes*, *Portunus palagicus* and *Metapeneas affinis* during reproductive cycles. Mar. Biol 1973; 18:167-198.
35. Primavera JH, Parado-Estepa, Lebata FD. Morpho metric relationship of length and weight of giant tiger prawn *Penaeus monodon* according to life stage, sex and source. Aquaculture 1998; 164:67-75.
36. Ravichandran R. Biodiversity, Litter processing, Leaf preference and growth, biochemical and microbial aspects in crabs of Pichavaram mangroves. Ph.D. Thesis, Annamalai University, India, 2000.
37. Roe JH. The determination of sugar in blood and spinal fluid with Anthrone reagent. J Biol. Chem. 1955; 212:335-343.
38. Sambhu C, Jayaprakas V. Effect of hormones on growth, Food conversion and proximate composition of the white prawn, *Penaeus indicus* (Milne Edwards). Indian J Mar. Sci. 1994; 23:232-235.
39. Shaikhmahmud FS, Magar NG. Studies in nutritive value of Bombay prawns J Sci. Ind. Res. 1957; 16:44-48.
40. Samuel MJ, Kannupandi T, Soundarapandian P. Nutritional effects on male reproductive performance in the freshwater prawn *Macrobrachium malcolmsonii* (H. Milne Edwards). Aquaculture 1999; 172(3):327-333.
41. Schneider WC. Determination of nucleic acids in tissues by pentose analysis. In S. P. Colowickand N. O. Kaplan (Eds) Methods in Enzymology. Academic Press, London, VIII, 680-684.
42. Sriraman K. Biological and biochemical studies on the prawns of Portonova coast (Crustacea: Decapoda: Macrura). Ph.D. Thesis, Annamalai University, India, 1978.
43. Sriraman K, PSR Reddy. Biochemical studies in planktonic juveniles and adults of *Penaeus monodon*. Proc. Symp. Warm water zooplankton Spl. Publ. NIO/UNESCO, 1977, 693-699.
44. Soundarapandian P, Ananthan G. Effect of unilateral eyestalk ablation on the biochemical composition of commercially important juveniles of *Macrobrachium malcolmsonii*. Int J Zool. Res. 2008; 4(2):106-112.
45. Suneetha Y, Sreenivasula Reddy P, Naga Jyothi P, Srinivasulu Reddy M. Proximal changes during reproduction process of the Penaeid prawn, *Penaeus monodon.* World J Fish and Marine Sci. 2009; 1(4):333-337.
46. Tamaru CS, Ako H. Using commercial feeds for the culture of freshwater ornamental fishes in Hawaii.In C. Tamaru, C.S. Tamaru, S.P. Mevey, & K. Ikute (Eds.), *Spawning and maturation of aquatic species*, UJNR Technical Report. University of Hawaii sea grant college program, Honolulu, Hawaii 2000; 28:109-120
47. Tidwell JH, D'Abramo LR, Coyle SD, Yasharian D. Overview of recent research and development in temperate culture of the freshwater prawn *Macrobrachium rosenbergii* (de Man) in the South Central United States. Aquaculture Res 2005; 36:264-277.
48. Tanuja R. Some aspects of biology and utilization of the mantis shrimp *Oratosquilla neppa* from Cochin waters.

Ph.D. Thesis, Cochin University of Science and Technology, India, 1996.
49. Tiwary AK. Nutritional status of edible palaemonid prawn *Macrobrachium scabricum* (Heller, 1862). M.Sc. Thesis. Annamalai University, India, 2009.
50. Tripathi G, Varma P. Starvation induced impairment of metabolism in a fresh water catfish. *Z. Naturforsch* 2003; 58C:446-451.
51. Watanabe T. Importance of docosahexaenoic acid in marine larval fish. J World Aquac. Soc. 1993; 24:152-161.
52. Watanabe T, Arakawa T, Takeuchi T, Satoh S. Comparison between eicosapentaenoic and docosahexaenoic acids in terms of essential fatty acid efficiency in juvenile striped jack Pseudocaranx dentex. Nippon Suisan Gakkasihi 1989; 55:1989-1995.
53. Wilson RP. Amino acids and Protein. In J.E. Halver & R.W. Hardy (Eds.), *Fish Nutrition*, Academic Press, San Diego. CA, USA, 2002, 143-179.