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Proximate Composition and Mineral Contents of Freshwater Crab *Spiralothelphusa hydrodroma* (Herbst, 1794) from Parangipettai, South East Coast of India

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Abstract

The role of aquatic rice field species in rural diets has been underestimated. These aquatic animals potentially supply most of the protein, carbohydrate and other nutrients that are needed by the villagers. The information on nutritional composition of aquatic animal resources from rice fields is scarce since they are not common in the food baskets of most other countries. Generally marine crabs are widely used as food and feed supplements throughout the world, but people do not consider paddy fields for freshwater crabs. Although large numbers of freshwater crabs are suitable for human consumption, these aquatic animals are not consumed in large quantities elsewhere. National and regional food composition data bases contain very limited info on nutritional composition of these species. In the present study an attempt has been made to evaluate the nutritional status of the edible potamid crab *S. hydrodroma*. The result showed that the parameters like protein, carbohydrate, lipid, moisture and ash and minerals of calcium, magnesium, potassium, sodium, iron, copper and zinc were maximum in cephalothorax and minimum in swimming and walking legs.

Keywords: Protein; Carbohydrate; Lipid; Minerals; *S. hydrodroma;* Wonderful scientific research

Introduction

The fresh water crabs is significantly an important for biological role in the food webs. More than 6,700 known species of Brachyuran crabs and over 1,300 true freshwater crabs were identified along in the world. The true freshwater crabs are fully adopted for freshwater, semi-terrestrial or terrestrial appears of life and has with the ability of characterization of complete the life cycle entirely in that region. The freshwater crabs are good source of food and medicinal values and are an important role in the food chain of aquatic ecosystems [1,2]. Nowadays, crabs play a significant role in the fishery wealth of many nations [3]. Mostly, the fishes, birds, caymans and mammals were resource of foods are mainly depends on the crabs [4,5]. There are an important protein source and are consumed in many parts of the world. Ng PKL noted that in Southern India, large potamids and parathelphusids are occasionally eaten by local peoples [4]. Yeo DCJ commented that potamids are important in the diet of rural and hill tribes of the country [6]. Freshwater crabs are also consumed for purported medicinal and tonic properties, including treatment of stomach ailments and physical injuries [7] and as food [8]. To know the nutritional value of crabs, biochemical studies are very important [9]. The nutritive value of freshwater crabs yet there is no clear cut information of the consumed peoples. Since, little work has been done in the biochemical composition of the freshwater crabs in India. The present study was undertaken to estimate the proximate composition and minerals in *S. hydrodroma*.

Materials and Methods

The adult crabs of S. hydrodroma were collected from the paddy fields of in and around Parangipettai. After reaching the laboratory they were washed carefully with distilled water to remove the dust and algal particles and later ice killed. The edible parts of the muscle tissues cephalothorax and the swimming and walking legs were removed with sharp forceps. The removed muscle tissues were homogenized with pestle and mortar separately. The grounded muscles were then freeze dried and powdered and eventually stored in refrigerator for further analysis. Subsequently the powdered samples were dried at 60°C in an oven and used for biochemical analysis. The protein, carbohydrate and lipid contents were estimated by adopting the standard methods of Raymont, Dubois, Folch J [10-12] respectively. The minerals were estimated by following the standard method of Guzman HM [13].

Results and Discussion

Crab is highly nutritious and healthy owing to its content of essential amino acids, proteins, unsaturated fatty acids, carbohydrate, fat and minerals [14-16]. Proximate composition varies with the species and is influenced by season, water temperature and spawning cycle [17]. They require for dietary importance, food texture, peptides and amino acids contribute to food flavour [18]. Protein is essential for the sustenance of life and accordingly exists in the largest quantity of all nutrients in human body [19]. An increasing demand for good quality animal protein for the exploding population has led to effective and increasing exploitation of the aquatic resources. The acceptability and easy digestibility of fish proteins make it very valuable in combating protein malnutrition, especially in children.

The results of the proximate constitutes of *S. hydrodroma* are given in Table 1. It is observed that the percentage of proximate compositions is very high in cephalothorax when compared to swimming and walking legs. The moisture content was maximum in cephalothorax

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Proximate Composition (%)		
Protein	13.48 ± 2.47	3.15 ± 0.25
Carbohydrate	0.85 ± 1.10	0.34 ± 0.10
Lipid	0.57 ± 1.25	0.19 ± 0.28
Moisture	63.10 ± 40.3	15.21 ± 0.40
Ash	0.72 ± 23.19	0.31 ± 0.29
Mineral Composition (%)		
Calcium (Ca)	9.7 ± 10.8	4.3 ±1.20
Magnesium (Mg)	0.81 ± 1.32	0.36 ± 0.15
Potassium (K)	5.20 ± 3.45	3.4 ± 0.40
Sodium (Na)	7.51 ± 4.10	4.35 ± 0.23
Iron (Fe)	0.014 ± 1.13	0.08 ± 0.15
Copper (Cu)	0.02 ± 0.52	0.01 ± 0.30
Zinc (Zn)	0.15 ± 0.19	0.8 ± 0.14

Table 1: Showing the proximate and mineral composition of *S. hydrodroma* (Values are expressed in % on dry weight basis except moisture, Values are mean of three values ± SE).

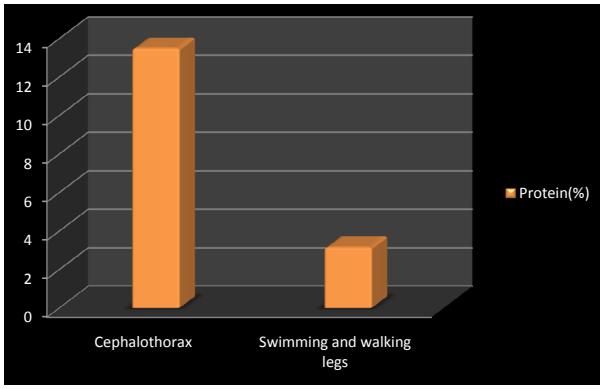

Figure 1: Protein content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

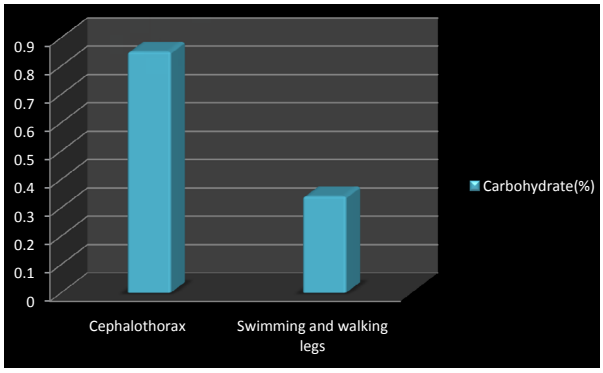

Figure 2: Carbohydrate content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

63.10 ± 40.3 and minimum in swimming and walking legs 3.15 ± 0.25 which may be advantageous in terms of the shelf life of the sample (Table 1 and Figure 5). Similar observations were also made by Akbar Z, Soundarapandian P [20,21] has been reported the moisture content of *P. pelagicus* in body meats 78.15 and claw meats–79.05, similarly the green crab *C. maenus* [22], blue crab *C. sapidus* [23]. But the moisture and ash content of the present study were somewhat higher than the values reported by Kuley E [24] in *C. sapidus*. The moisture ranged between 78.24 - 79.15% in *P. sanguinolentus* [25] and it varied from 74.3 to 75.44% [26].

The protein was recorded maximum in cephalothorax, 13.48 ± 2.47 and minimum in swimming and walking legs, 3.15 ± 0.25 (Table 1 and Figure 1). This is conformity with the previous studies of recorded the protein contents *P. vigil* it was recorded protein value 15.75 to 20.16% [27]; Khan PA [28] reported that the protein values in *S. serrata* male were 11.60% and females' for 19.92%; Vasconcelos P [29] has been studied the protein content of *C. affinins* 17.8%, [30] has been observed *S. serrata* in body meat 20.11% and claw meat 18.54%; Anonymous [31] has been reported by blue crab 17.17% , the protein content of *P. pelagicus* and *P. sanguinolentus* was 0.47 to 15.91 and 12.81 to 13.6% respectively. Radhakrishnan CK, Zafar M has been reported that the protein range in *S. serrata* male 17.69 and 19.39 for females [32,33]. Thirunavukkaras N has been observed the protein in *S. tranquebarica* different parts viz., body meat 65.48 to 72.24%, claw meat 69.5 to 80.29% [34] and leg meat 69.47 to 74.7% [35] has been reported that the protein content in blue crab *C. sapidus* to be highest in the claw meat (19.55 g/100 g) compared to the other parts (18.81 g/100 g). Protein is the most important biochemical in crustaceans from eggs to adult and is strikingly dominant in young phases. Protein is essential for normal functions, growth and maintenance of body tissues. The crab is very often recommended for pregnant or lactating women is an excellent source of protein [14]. The ideal protein requirement for infants is 39%, 26% for children and 11% for adults [36]. The crab meat will serve well in complementing cereal gruels used as weaning food for children in the tropics. Amino acids are the building blocks of proteins and serve as body builders. They are utilized to form various cell structures, of which they are key components and they serve as source of energy [37]. The carbohydrate content was significantly higher in cephalothorax 0.85 ± 1.10 and minimum in swimming and walking legs 0.34 ± 0.10 (Table 1 and Figure 2). Similar trend was already reported in different crabs viz., the range of carbohydrate was 0.3 to 0.63% in *P. vigil* [27], 2.4 to 3.4% in *C. smithii* [38], 0.17% in body meat and 0.24% in claw meat of *S. serrata* [30], 0.16 to 0.55% in *P. pelagicus,* 0.44 to 0.73% in *P. sanguinolentus* [32], 0.59 to 2.23% in body meat, 0.68 to 2.87% *in* claw meat and 0.76 to 2.76% *in* leg meat of *S. tranquebarica* [34].

The lipid contents were higher in cephalothorax (0.57 ± 1.25) and minimum in swimming and walking legs 0.19 ± 0.28 (Table 1 and Figure 3). Similar trend was already reported in different crabs viz., the range of carbohydrate was 5.13 to 9.73 % in *P. vigil* [27], 6.2 to 7.6% in *C. smithii* [32], 0.7% in *C. affinis* [29], 1.5% blue crab in [31], 1.65%

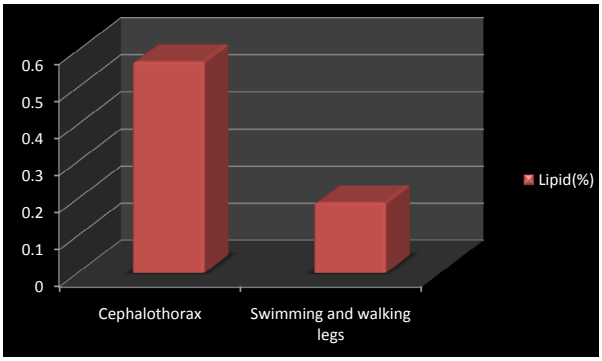

Figure 3: Lipid content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

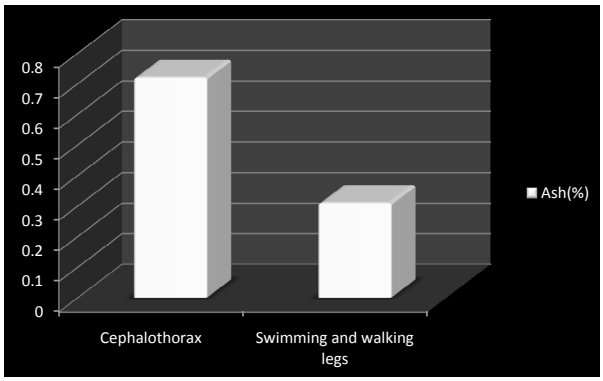

Figure 4: Ash content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

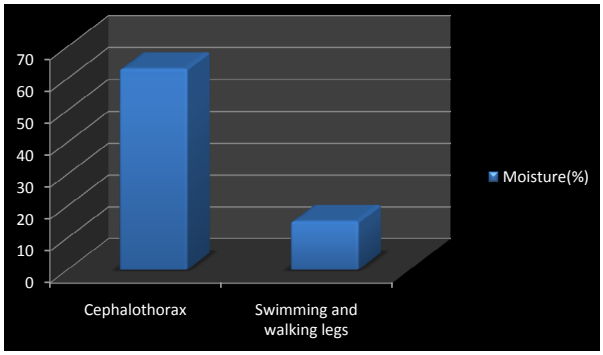

Figure 5: Moisture content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

in body meat and 2.01% in claw meat of *S. serrata* [30], 3.3 to 5.6% in *P. pelagicus,* 3.8 to 5.5% in *P. sanguinolentus* [32], 0.9 to 1.6 % in body meat, 1.83 to 2.06% in claw meat and 1.58 to 2.08% in leg meat of *S. tranquebarica* [34]. 0.43% in egg, 0.7% in without egg, 1.07%, in body meat and 1.0% in claw meat of *S. serrata* [39]. In crustaceans, lipids are not only the main organic reserve and source of metabolic energy but also indispensable in maintaining cellular integrity. Lipids as a general rule act as major food reserve along with protein and are subject to periodic fluctuation influenced by environmental variable like temperature [40]. Ash content was maximum in cephalothorax (0.72 ± 23.19) and minimum in swimming and walking legs (0.31 ± 0.29) (Table 1 and Figure 4). Similar trend was already reported in different crabs viz., [41] has been studied in Edible Crab, *Podophthalmus vigil,* [22] has been studied in green crab *C. maenus*, [30] has been studied in S. *serrata*, [15] has been studied in blue crab, [42] has been studied in green and blue crab, 17-19% in *S. tranquebarica* [26], 7.62 to 7.83% in *P. sanguinolentus*[25].

The results of the various minerals compositions of *S. hydrodroma* are shown in Table 1. It is also observed that the percentage of mineral compositions is very high in ephalothorax when compared to swimming and walking legs. The calcium (ca) recorded was maximum in cephalothorax 9.7 ± 10.8 and minimum in swimming and walking legs 4.3 ± 1.20 (Table 1 and Figure 6). Earlier report agreed with this study where 2157.86 ± 1.01 mg/100 g of calcium was recorded in land crab *C. armatum* [43], 15.670 mg/gm in *P. vigil* [25] and Chinese mitten crab and 0.67 mg/gm in *E. sinesis* [44]. Magnesium (mg) recorded was maximum in cephalothorax 0.81 ± 1.32 and minimum in swimming and walking legs, 0.36 ± 0.15 (Table 1 and Figure 7). In the previous studies made, Magnesium (mg) was recorded to be 0.39 ± 0.01 in in land crab *C. armatum* [43], 0.212 mg/gm in *P.vigil* [25] and 0.22 mg/gm in Chinese mitten crab *E. sinesis* [44]. Potassium (K) was recorded maximum in cephalothorax 5.20 ± 3.45 and minimum was recorded in swimming and walking legs 3.4 ± 0.40 (Table 1 and Figure 8). In earlier studies, 367.19 ± 0.01 mg/100 g of Patassium was recorded in land crab *C. armatum* [43], 4.780 mg/gm in *P. vigil* [25] and 2.73 mg/gm in Chinese mitten crab *E. sinesis* [44]. Sodium (Na) recorded was maximum in cephalothorax 7.51 ± 4.10 and minimum was recorded in swimming and walking legs 4.35 ± 0.23 (Table 1 and Figure 9). In earlier studies, 297.80 ± 0.01 mg/gm of sodium (Na) was recorded in land crab *C. armatum* [43], 3.010 mg/gm in *P. vigil* [25], 1.90 mg/gm in Chinese mitten crab *E. sinesis* [44]. Iron (Fe) was recorded maximum in cephalothorax 0.014 ± 1.13 and minimum was recorded in swimming and walking legs 0.08 ± 0.15 (Table 1 and Figure 10). In earlier studies, 27 ± 95.10 mg/100 g of iron (Fe) was recorded in land crab *C. armatum* [43], 3.3570 mg/gm in *P. vigil* [25], 0.039 mg/gm in Chinese mitten crab *E. sinesis* [44]. Copper (Cu) recorded was maximum in cephalothorax 0.02 ± 0.52 and minimum was recorded in swimming and walking legs 0.01 ± 0.30 (Table 1 and Figure 11). In earlier studies, 57.83 ± 0.10 mg/100g of copper (Cu) was recorded in land crab *C. armatum* [43], 0.450 mg/gm in *P.vigil* [25], 0.16 mg/gm in Chinese mitten crab *E. sinesis* [44]. Zinc (Zn) recorded was maximum in cephalothorax 0.15 ± 0.19 and minimum was recorded in swimming and walking legs 0.8 ± 0.14 respectively (Table 1 and Figure

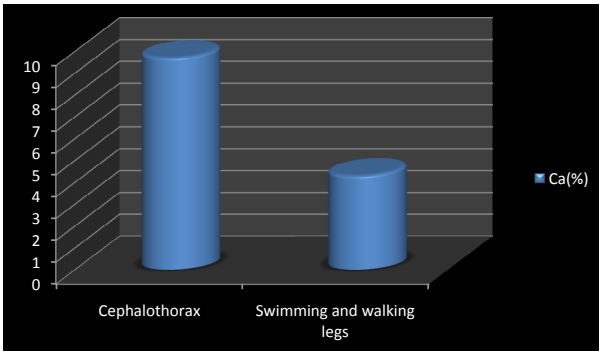

Figure 6: Calcium content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

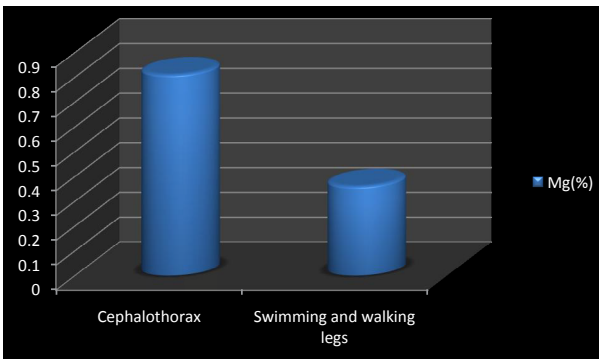

Figure 7: Magnesium content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

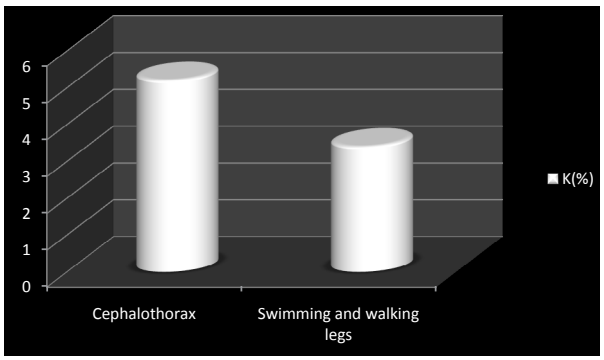

Figure 8: Potassium content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

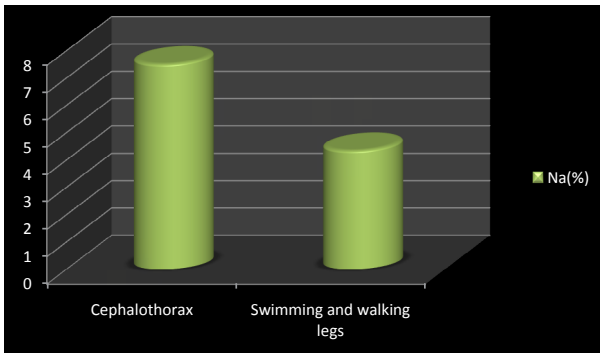

Figure 9: Sodium content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

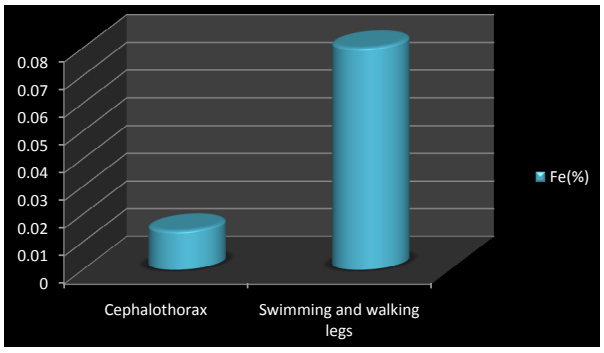

Figure 10: Iron content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

12). In earlier studies, 15.23 ± 0.11mg/100g zinc (Zn) was recorded in land crab *C. armatum* [43], 1.565 mg/gm in *P. vigil* [25], 0.091 mg/gm in Chinese mitten crab *E. sinesis* [44]. Similar observations made by [14] investigated the mineral content of freshwater crab *S. africanus africanus*. [45] has recorded nine minerals (Ca 115 ± 13 µg g-1, K 9916 ± 467 µg g^{-1}, Fe 191 ± 18 µg g^{-1}, Cu 157 ± 10 µg g^{-1}, Mn 10.3 ± 1.2 µg g^{-1}, Zn 130 ± 1 µg g^{-1}, Se, 0.71 ± 0.05 µg g^{-1}, Br 10.1 ± 1.1 µg g^{-1}, Pb 0.128 ± 0.003 µg g^{-1}) from different tissues of *S. serrata* and [46] has reported the concentration of 10 elements in (ppm)in different crustaceans viz., *S. tranquebarica* (K, 8040 ± 340, Ca 2846 ± 12, Mn 11.2 ± 2.5, Fe 156 ± 6, Cu 121 ± 12, Zn 270 ± 36, Se 0.40 ± 0.10, Br 295 ± 23, Sr 13.5 ± 1.3 and Pb 0.201 ± 0.08) and *P. monodon* (K 9095 ± 342, Ca 665 ± 19, Mn 15.2 ± 3.3, Fe 297 ± 8, Cu 77 ± 11, Zn 58 ± 21, Se 0.33 ± 0.14, Br 27 ± 6, Sr 2.55 ± 1.3 and Pb 0.147 ± 0.10 and in *P. indicus* (K 8695 ± 250, Ca 824 ± 17, Mn 11.8 ± 2.4, Fe 107 ± 4, Cu 70 ± 8, Zn 54 ± 15, Se 0.37 ± 0.10, Br 19 ± 5, Sr 2.52 ± 1.2 and Pb 0.352 ± 0.10), Salaenoi J [47] has reported the trace elements content in haemolymph and red sternum of mud crab (Calcium 342.15, Magnesium 252.68, Iron 2.46, Chloride 715, Copper 122.55, Manganese 6.76 and Zinc 23.76) and (Calcium 372.90, Magnesium 400.95, Iron 10.80, Chloride 728, Copper 37.44, Manganese 3.44 and Zinc 5.78). Moronkolaa BA [48] reported that the mineral contents of Crab *C. amnicola* in different parts.

Biochemical changes in the gonads, digestive gland and muscle during maturation, molting and reproduction have been examined in many species of decapods crustaceans [49,50,51]. The biochemistry of reproduction has been fairly well studied in *S. hydroroma*, this work is comprehensive and include studies relating to neurosecretory control of reproduction and moulting, protein metabolism in relation of both processes, as well as mobilization of organic resources, lipids and free sugars. In the present study, the people do not consider the edible part of legs, there are discarded and are rarely eaten. Legs contains are significant amount of nutrients, therefore yet there no clear cut information of the leg meats nutrient values. In recent days many seafood restaurants typically boil the legs and serve them with condiments such as butter and lemon juice. Since the crab *S. hydrodroma* legs are good source of protein and mineral, it can be used as a well selection of food for human consumption. In the study also recommended that the taken due to crab legs can contribute to a healthy diet. They are high in protein, carbohydrate, lipid and minerals.

Generally the crabs claw like dactyl, a Y-shaped walking leg and a fork-shaped walking leg might represent different degrees of

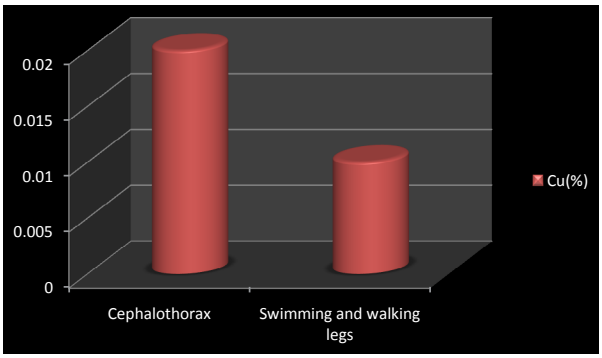

Figure 11: Copper content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

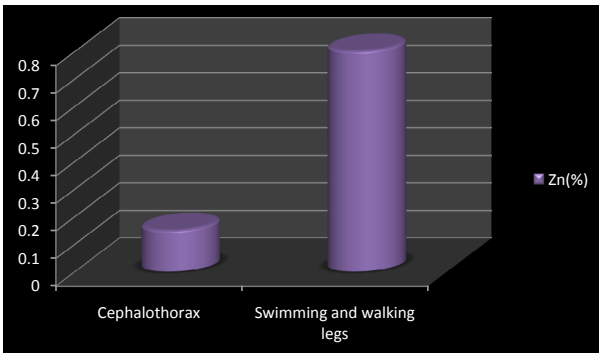

Figure 12: Zinc content in the muscle tissues of cephalothorax and swimming and walking legs of *S. hydrodroma*.

claw transformation [13,14,21]. The study indicates that the ratio of carbohydrate was less when compared to the other nutrients such as proteins and lipids in animal tissues, especially in aquatic animals [25, 27]. The previous studies suggested that the carbohydrate in the muscle tissues varied in *S. serrata* [30]. Carbohydrates constitute only a minor percentage of total biochemical composition. They also contain traces of glucose, fructose, sucrose and other mono and disaccharides [24,28]. Carbohydrates provide the body with fuel and energy to keep going throughout the day and should make up half the daily intake of food. Carbohydrates are also important for the correct working of human brain, heart and nervous, digestive and immune systems.

Nutrients are required in order to build and repair cells and body tissues, maintain the organs and bones in optimum working condition and to provide energy, fuel and warmth. Good nutrition is essential for good health and eating nutritious food can help prevent common ailments, as well as more life threatening illnesses and diseases. Crabs have 71 to 85 calories and no dietary fiber or carbohydrates. They provide 15g of high-quality protein, which represents 30 percent of the recommended daily value based on a 2,000-calorie a day diet. The present study considered the claw meat because 100 g claw meat of the blue crab consists of 1309 mg leucine and 941 mg isoleucine and assuming an adult human consumes 50 g blue crab, this can provide the daily amino acid requirement [36]. The aquatic resources make up the majority of animal protein consumed in terms of frequency and quantity [5, 8,10]. Rice based aquatic ecosystems have a high biodiversity and are a rich source of nutrient dense local food [4, 6,9]. This study documented that daily consumed aquatic animal especially crab is a good source of cheap animal protein, which is either eaten as snacks and as part of main meals by people of the country.

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