

Fatty Acid Profile of Freshwater Crab (*Paratelphusa lamellifrons*) from Padma River of Rajshahi City, Bangladesh

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Abstract

Freshwater crab *Paratelphusa lamellifrons* from Padma River were investigated for proximate and fatty acid composition. Proximate analyses of the claw and body meat of crab revealed the presence of moisture, crude protein, crude lipid and ash and their amount ranges between 71.72%-81.30%, 35.01%-49.06%, 13.24%-17.64% and 19.62%-22.12% respectively, on a dry weight basis. Except lipid (17.64%), claw meat content higher amount of moisture (81.30%), protein (49.06%) and ash (22.12%) compared to body meat. The fatty acid composition was analyzed by GC-FID and total 12 types of fatty acid were recorded in the fat isolated from crab. Among the recorded fatty acids MUFA were observed as the highest (42.85%), SFA were the second (25.96%) whereas, polyunsaturated (PUFA) were the lowest (15.02%). The fatty acid compositions showed that the SFA, MUFA and PUFA were dominated by palmitic acid (20.49%), oleic acid (23.99%) and linoleic acid (9.81%) respectively. The proximate and fatty acid composition of the present study demonstrated that these species (*P. lamellifrons*) are a promising source of essential fatty acids ω -3 and ω -6 namely, DHA and EPA.

Keywords: Fatty acid profile; Proximate composition; Freshwater crab; Padma River

Introduction

Fats are essential parts of your body's ability to function. From body temperature to weight management, maintaining a good level of healthy fats in your body is extremely important to long-term health. Aquatic animal fats are good sources of essential fatty acids that are not synthesized in the human body. They act as an important metabolic fuel to facilitate the absorption of fat-soluble vitamins (vitamins A, D, E, and K) [1], plays central role in providing energy to tissues, particularly during fasting [2] and during the development of Mediterranean crustaceans [3]. Being rich in vitamins and minerals, crab meat is also low in fat and contains Omega-3 polyunsaturated fatty acids (EPA and DHA) which, provide protection from heart disease [4] and aid brain and [5], foetal development to cancer prevention [6]. Poly unsaturated fatty (PUFA) acid contents like linolenic (18:3n-3), linoleic (18:2n-6) and their ratio are also used to evaluate the quality of animal meat and aquatic products [7,8,9]. Fresh water crabs play a significant role in nutrient cycle, water quality monitoring and fishery wealth as they are consumed in many parts of the world [10]. Freshwater crabs are also consumed for purported medicinal and tonic properties, including treatment of stomach ailments and physical injuries [11]. Hepatopancreas of crustaceans is generally regarded as a major lipid storage organ. The importance of crabs as a source of protein rich food for the growing population of Bangladesh especially in the coastal sector, and also as an excellent raw for seafood products for export purpose is increasingly recognized in the country in the recent years. Many commercially important fresh water and marine crabs found in Bangladesh have a great prospect as important hidden living resources of Bangladesh [12]. In Bangladesh there are 15 species of crab have been recorded so far among which 11 species are identified as marine crabs and 4 species as freshwater crabs. Among the four species of freshwater crabs only the *Paratelphusa lamellifrons* is used as food [13,14]. *Paratelphusa lamellifrons*, commonly known as Pati Kankra belongs to the family Portunidae, which represents more than 1280

species [15]. The carapace of the species was boarder than long, robust, not deep, dorsal surface flat in dorsal and frontal views, gently convex, smooth except postorbital cristae and lateral margins [16]. Morphology, biology as well as biochemical and fatty acid composition of crab have been extensively investigated by many researchers from different parts of the world [17-22] including Bangladesh [23-29] and remained neglected of the world's inland aquatic ecosystem although they qualify themselves as a nutrient rich food item and important from ecological as well as economical point of view, So, the aim of the present study is to investigate the fatty acid composition of freshwater crab (*Paratelphusa lamellifrons*) caught from Padma river near Rajshahi city, Bangladesh to enrich its nutritional information to explore the utilization of these species in some extent.

Materials and Methods

Sample collection and preparation

The freshwater crabs *Paratelphusa lamellifrons* were collected from the fisherman who, collect fish by using net which is locally known as Kholsoon, Thusi, Duayr and sometimes through hand from the river Padma of Rajshahi City during the month of May, 2015. Collected crab were then washed with running tap water to remove any adhering

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materials and then meat of claw and cephalothorax were separated, dried in an electric oven at 60°C for about 24 h. The dried crab sample were then crushed into powder form with motor and pestle and kept in refrigerator until analyzed for moisture, lipid, ash, and crude protein and fatty acid compositions.

Proximate composition analysis

Moisture was estimated using automatic moisture analyzer (RADWAG, MAC 50/NH, Germany). About 1 g to 2 g of represented sample was placed at the pan of the analyzer and then results were displayed within a few minutes. Crude protein content was determined by the Kjeldahl method [30], and crude protein was calculated by multiplying total nitrogen with a conversion factor 6.25. Fat content was determined by using the Soxhlet extraction method [30]. Ash content in crab sample was determined as described by AOAC [31].

Fatty acids analysis

For the estimation of fatty acid compositions total lipid from whole crab was extracted using the chloroform: methanol (2:1, v/v; containing BHT 0.1 mg/100 g) method [32]. Fats were extracted and fatty acids methyl esters (FAMES) were prepared according to the method of Metcalfe et al. [33]. After lipid extraction, using the Soxhlet method and saponification, fatty acids were esterified. FAMES were finally extracted using methanol. FAMES, were analysed by gas chromatography using a Shimadzu gas chromatograph (GC-2010) equipped with polar capillary column (SPTM-2560, 75 m length, 0.18 mm I.D., 0.14 micron film thickness). The oven temperature was programmed from an initial temperature of 180°C (45 min hold), rising to 240°C at 4°C/min, and held isothermal (240°C) for 15 min. Nitrogen was used as a carrier gas at a flow rate of 1 ml/min. The injection port and the flame ionization detector were maintained at 250°C. Identification was made by comparison of retention times to those of authentic standards.

Results and Discussion

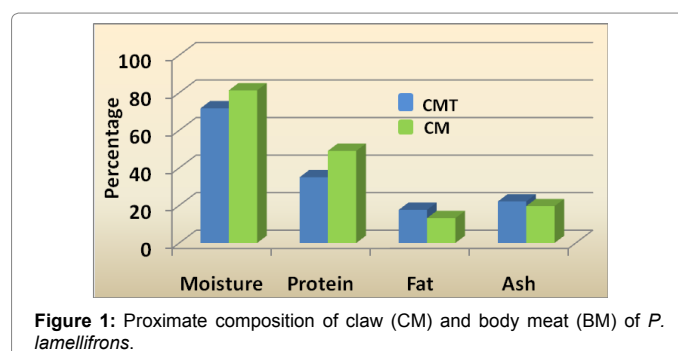
The proximate compositions of claw and body meat of *P. Lamellifrons* collected from Padma River are shown in Table 1 and Figure 1. The results of the present study revealed that claw meat of *P. Lamellifrons* contains maximum amount of proximate constituents than the body meat except fat which is lower than the body meat. Amount of moisture ranges between 71.72%-81.30% and the moisture content was found highest in claw meat $81.30\% \pm 1.57\%$ and lowest in body meat $71.72\% \pm 0.75\%$. Similar observations were also been reported by many workers [29-31], Priya et al. reported moisture content in claw and body meat of *M. masoniana* is $80.98\% \pm 1.79\%$ and $79.66\% \pm 1.58\%$ in female and $78.27\% \pm 1.45\%$ and $78.25\% \pm 1.31\%$ in male crab respectively.

Protein which is the most important biochemical component in crustaceans was recorded maximum in claw meat 49.06 ± 1.01 minimum values in body meat 35.01 ± 1.03 g/100 g (Table 1 and Figure 1). Similar trend as well as result between the present and previous studies was also observed where protein content in claw meat reported higher compared to other parts [22,34-36]. Some previous studied of protein content also found varies with our present studied as reported

Name of specimen	Moisture (%)	Protein (%)	Ash (%)	Fat (%)
BM	71.72 ± 0.75	35.01 ± 1.03	19.62 ± 0.86	17.64 ± 1.0
CM	81.30 ± 1.57	49.06 ± 1.01	22.12 ± 0.16	13.24 ± 0.80

BM: Body Meat, CM: Claw Meat

Table 1: Proximate composition of crab claw and body meat (dry weight basis).



by Cherif, et al. [17] 18.03% in claw meat of *C. mediterraneus* and 17.8%, in *C. affinis* by Vasconcelos, P. [37].

Lipids which are the main organic reserve and source of metabolic energy are indispensable in maintaining cellular integrity. In the present study lipid content recorded in claw and body meat of *P. lamellifrons* ranges between 13.24%-17.64%. From Table 1 and Figure 1 it is evident that content of lipid in body meat ($17.64 \pm 1.0\%$) is higher than that of claw meat ($13.24 \pm 0.80\%$). Our results are more than 2 to 3 times higher with the findings [22], wherein lipids were found to be $4.82\% \pm 0.61\%$ and $3.38 \pm 0.35\%$ in body and claw meat in female and $5.15\% \pm 0.67\%$, $3.39\% \pm 0.67\%$ in male crab *M. masoniana*; $4.68\% \pm 0.28\%$ and $3.92\% \pm 0.25\%$ in body and claw meat in male and $4.44\% \pm 0.52\%$ and $3.81\% \pm 0.33\%$ in female crab *P. pelagicus* [34], $4.83\% \pm 0.61\%$ in female crab *P. masoniana* [38].

The ash content varied from $19.62\% \pm 0.86\%$ to $22.12 \pm 0.16\%$ in body and claw meat of *P. lamellifrons* on dry weight basis. As like moisture and protein, ash content has been found to be higher in claw meat ($22.12\% \pm 0.16\%$) than body meat ($19.62\% \pm 0.86\%$) (Table 1, Figure 1). Similar trend was reported for different crab but the present value is near about 2 fold higher with the previous published reports $8.37\% \pm 1.66\%$ and $10.22\% \pm 2.63\%$ in body and claw meat in female and $8.56\% \pm 1.62\%$, $9.10\% \pm 1.99\%$ in male crab *M. masoniana* [22]; $8.56\% \pm 0.50\%$ and $9.89\% \pm 0.55\%$ in body and claw meat in male and $8.44\% \pm 0.44\%$ and $11.33\% \pm 0.93\%$ in female crab *P. pelagicus* [34]; $4.83\% \pm 0.61\%$ in female crab *P. masoniana* [38].

Variation in proximate composition results which were observed between the present and earlier reported results are due to with the species and its influenced by season, water temperature, and spawning cycle [39] as well as basis of expression of results such as dry weight/wet weight.

The fatty acid composition of freshwater crab *P. lamellifrons* which was analysed by GC-FID is summarized in Table 2 and their graphical presentation is shown in Figure 2. Total 12 types of fatty acid were recorded in the lipid of *P. lamellifrons*. Among the recorded fatty acids MUFA were observed as the highest (42.85%), SFA were the second (25.96%) whereas, polyunsaturated (PUFA) were the lowest (15.02%). The main saturated fatty acids were myristic (14:0) 1.58%, palmitic (16:0) 20.49% and stearic (18:0) acids 3.89%, while palmitic acid was the dominant among saturated fatty acid and stearic acid is the lowest. King et al. [40] reported a somewhat lower palmitic (13.4%) and higher stearic (4.46%) contents in the total lipids of Dungeness crab (*Cancer magister*) whereas Ramamoorthy et al. [18] reported lower palmitic 4.98%, 1.11%, and 2.04% in *P. pelagicus*, *P. gladiator* and *C. lucifera* and higher stearic acid 10.86% in *P. pelagicus* but lower in *P. gladiator* and *C. lucifera* 1.03% and 2.94%.

Among 12 fatty acids as shown in Table 2, three are SFA, 9 are UFA of which 5 were monounsaturated fatty acids (MUFA) constitute 42.85% of the total lipid and 4 were highly unsaturated fatty acids (PUFA). Table 2 results indicated that monounsaturated fatty acid (MUFA) was the predominant components among the investigated fatty acid SFA, MUFA and PUFA and their amount was noticed in the following order oleic (23.99%)>palmitoleic (15.29%)>erucic (1.94%)>myristoleic (0.92%)>cis-10-heptadecenoic acid (0.71%) which, means MUFA is dominated by oleic acid. Ramamoorthy et al. [18] reported 12.89%, 0.40% and 1.09% oleic acid in *P. pelagicus*, *P. gladiator* and *C. lucifera* respectively which is lower than our results. Cherif, et al. [17] reported total 23.21% (on average from four sites) MUFA in green crab (*C. mediterraneus*) from the Tunisian Mediterranean coasts which is also lower than the total MUFA (42.85%) of the present study. Cis-10-Heptadecenoic acid is a C17:1 monounsaturated fatty acid that is a minor constituent of ruminant fats [41]. It has been examined for potential antitumor activity and was reported to inhibit HL-60 cell proliferation with an IC₅₀ value of 302 µM and to prevent LPS-induced tumor necrosis factor production from mouse macrophages [42].

Type of fatty acid	Name of fatty acid	C:D	%
Saturated fatty acid (SFA)	Myristic acid	(C14:0)	1.58
	Palmitic acid	(C16:0)	20.49
	Stearic acid	(C18:0)	3.89
Mono unsaturated fatty acid (MUFA)	Myristoleic acid	(C14:1) n-5	0.92
	Palmitoleic acid	(C16:1) n-7	15.29
	Cis-10-Heptadecenoic acid	(C17:1) n-7	0.71
	Oleic acid	(C18:1) n-9	23.99
	Erucic acid	(C22:1) n-9	1.94
Poly unsaturated fatty acid (PUFA)	Linoleic acid	(C18:2) n-6	9.81
	Linolenic acid	(C18:3) n-3	3.36
	Eicosapentaenoic acid (EPA)	(C20:5) n-3	1.36
	Docosahexaenoic acid (DHA)	(C22:6) n-3	0.49
Saturated fatty acid (SFA)	Total		25.96
Mono unsaturated fatty acid (MUFA)	Total		42.85
Poly unsaturated fatty acid (PUFA)	Total		15.02
n-3	Total		5.21
n-6	Total		9.81
ΣPUFA n-3/ΣPUFA n-6	Ratio		0.53

Table 2: Fatty acid composition of crab lipid (% of total fatty acid).

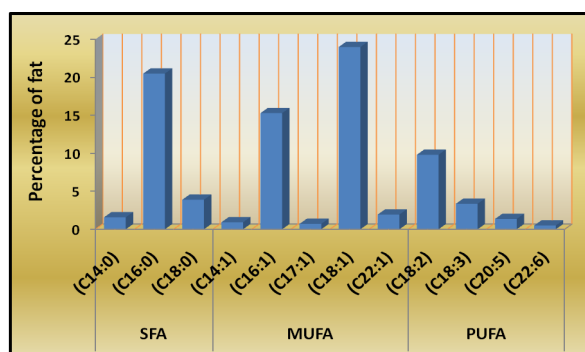


Figure 2: Fatty acid composition of crab lipid.

Monounsaturated fat is an important part of a healthy diet and also an effective first line of defense against heart disease many cancers [43], bone weakness [44].

The content of PUFA in freshwater crab *P. lamellifrons* ranged from 0.49% to 9.81% and comprises 15.02% of the total lipid. The major n-3 and n-6 PUFA was linoleic (C18:2n-6) and linolenic acid (C18:3n-3) respectively. The n-3 fatty acids accounted for 5.21% of the total and 34.69% of all PUFA whereas n-6 acids were 9.81% and 65.31% of all PUFA both of which is lower than those reported for green crab *C. mediterraneus* and *C. maenas* [17,45]. The ratio of EPA to DHA was found to be 0.53 which is lower than those reported but higher than the recommended desire minimum and maximum dietary ratio of n-3/n-6 (0.1-0.2) by FAO/WHO [46], and higher ratio was considered more beneficial for human health [47,48,49].

Conclusion

It can be concluded that claw meat, body meat as well as lipid of freshwater crab *P. lamellifrons* from Padma River are good sources of proteins and PUFAs. The results clearly indicate that freshwater crab is a nutritious food and could be good source of fatty acids especially EPA and DHA which is conditionally essential for infant growth and development. These findings also suggest long-chain PUFA could also be acquired from freshwater bodies and very healthy for human consumption and is also suitable for processing into different value added crab products.

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