

Fatty Acids Profile of the Freshwater Prawn (*Macrobrachium rosenbergii*) Collected from Pollonnaruwa Reservoirs

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Abstract

Freshwater prawn is a popular delicacy sold at high market price. The freshwater prawn, *Macrobrachium rosenbergii* is commercially important in Sri Lanka as a primary inland culture species. It can tolerate a wide range of environmental temperature and wide ranges of water quality conditions as well as having a high tolerance for diseases compared with marine prawns. The flesh of the freshwater prawn is rich in nutrients, including: amino acids, fatty acids and essential trace minerals. In the present study the lipid content of muscle tissue, and its fatty acid profile, of freshwater prawns *M. rosenbergii* were analyzed as Fatty Acid Methyl Esters (FAME) by Gas Chromatography. There is a considerable level of lipids in the prawn muscle (0.99 ± 0.04 mg/g), and with a well balance fatty acid profile. Among the freshwater prawns collected from Polonnaruwa reservoirs (viz., Parakrama Samudraya, Kawudulla, Minneriya, Maduru Oya) the highest fatty acid class was the monounsaturated fatty acids, omega-9 (25.42 %), followed by 17.48% of omega-3 polyunsaturated fatty acids (PUFA), and then 9.65 % of omega-6 PUFA. According to the individual fatty acids, the oleic acid (18:1n-9) and palmitic acid (16:0) were in highest amount 25.01 ± 1.26 % and 23.50 ± 1.72 % respectively. The omega-3 PUFA, which were found in the lipid fraction of freshwater prawn were: α -Linolenic acid (ALA, 18:3n-3), Eicosapentaenoic acid (EPA, 20:5n-3) and Docosaheptaenoic acid (DHA, 22:6n-3), with EPA and ALA being more abundant in the flesh of the freshwater prawns. In general, freshwater prawn *M. rosenbergii* has a healthy and nutritious fatty acid profile, and could play an important role in the maintenance of good health of human being.

Key word: prawn, lipids, fatty acids, omega-3

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Introduction:

The main purpose of aquaculture has been to increase the production of natural and wild candidature species for human consumption to reduce the health risk. In Sri Lanka, prawns are considering as a one of the major groups of crustaceans. The shrimp farming industry has suffered serious losses due to outbreak of viral diseases. Recently, freshwater shrimps have been recognized as an alternative and eco-friendly, sustainable system for prawn production. Mainly freshwater prawn species found in the reservoirs throughout the country and although make high priced product and have high market demand in both domestic and export markets (Rangappa *et al.* 2012). Lipids are believed to be one of the key nutrition factors which are important for supply energy through metabolism in the human body. It important in maintaining physiological and structural integrity of cellular and sub-cellular membrane and lipid also act as a carriers of fat soluble nutrients such as fat soluble vitamins like A,D,E and K. (Mahalingamet *al.* 2009)

Fish consumption, fish oil, lipids and the coronary heart diseases are the most related findings and gave the evidence for control the health risk of the human being. Most of the peoples' concern about the nutritional benefits from consuming fish and fishery products through obtains protein, omega-3 beneficial polyunsaturated fatty acids (PUFA), vitamins and other trace minerals. Omega-3 fatty acids are one of essential fatty acids found in the fatty acid profile. In the human body, these essential fatty acids can't synthesizes, and need to obtain in the diet. (Bhavan *et al.* 2010). These fatty acids provide the health benefits due to their capability of affect several processes in the body, such as cardiovascular, neurological and immune function.

Omega-3 fatty acids are highly concentrated in the brain and are important for memory and performance and the behavioral functions. If we do not get the enough omega fatty acids, the infants are at the risk neurological and vision problems. And the other hand the pregnant women are affected by poor memory, heart problem, dry skin, depression, poor circulation etc due to lack of sufficient dietary essential fatty acids. So that, the balance of the mega-6/omega-3 ratio and omega-6/omega-9 ratio in our diet is very much important. (Samuelet *al.* 1998)

In the present study, an attempt has been made to evaluate the fatty acid composition of the muscle tissue of the freshwater prawn, *Macrobrachium rosenbergii* found in the Polonnaruwa reservoirs. Determination fatty acid composition in freshwater prawns provides the information about the essential fatty acids such as omega 3, omega 6, DHA, EPA etc. The profiling of fatty acids of fresh water prawns will help in understanding the nutritional quality of the prawns.

Materials and Methods

The freshwater prawn samples were collected from Polannaruwa reservoirs such as Parakrama Samudraya, Kawudulla, Minneriya and Maduru Oya. The sample size was 8 from one each reservoir of roughly 65 g. The prawns were labeled under the weight and length. The muscle samples of prawns were analyzed for their fat content and fatty acid profile as composite samples. All the samples were analyzed in duplicates. Total lipids in muscle tissue samples were extracted using the method described by Bligh and Dyer, 1959. Using the gravimetric method, the fat content of the each composite sample was determined as a percentage value. According to the fat content of the each composite sample, the Bligh and Dyer extract was used for the Fatty Acid Methyl Ester (FAME) generation. Capillary Gas Chromatograph (GC) (GC-2014 Shimadzu, Kyoto, Japan) was used to determine the fatty acid profiles.

The gas chromatograph was equipped with fused silica DB wax capillary column (105 m* 0.25 μ m) and flame ionization detector (FID). Helium was used as the carrier gas at 14 psi. The initial temperature of the column was set at 160 °C and finally increased to 240 °C at a rate of 3 °C min⁻¹. The detector temperature was set at 270 °C, while the temperature at the injection port was maintained at 240 °C. Retention times of FAME standards were used to identify chromatographic peaks. Fish Qualmix sample (89-5550) was run as a quality control sample throughout the experiment.

Results and Discussion

The composition of the fatty acid profile mainly depends on the feeding habits and the surrounding environment condition of the lakes such as salinity condition, pH and temperature of the water. The lipid content of the flesh varies with the sex and the season. According to the literature survey, the crustacean hepatopancreas is a major lipid storage organ in their body. In the case of female crustacean ovaries also contain higher levels of lipid than other organs and this also suggests that, lipids are most important for maturation of crustacean ovaries and egg production. It has highly affected on the reproduction, egg survival and embryonic development. In this study, we did not categorize the shrimps according to their sex. We selected the random sample of freshwater prawns in the Polonnaruwa reservoir (n = 32) and analyzed their fatty acid profile. There were no statistical difference observed with the four reservoirs tested.

Values for fatty acid profile in the flesh of freshwater prawns are given in the table 1. In general saturated fatty acids showed in a little amount, but the palmitic acid (16:00) recorded in higher amount (23.50 ± 1.72 %). Eicosapentaenoic acid, EPA (20:5n-3) increase up to 14.97 %.

Table 1. Fatty acid profile of freshwater prawns *M. rosenbergii*

Type of Fatty Acid		Average percentage	
	Oil %	0.99 ± 0.04	
1	Myristic acid	14:00	1.49 ± 0.17
2	Pentadecanoic acid	15:00	0.95 ± 0.35
3	Palmitic acid	16:00	23.5 ± 1.72
4	Palmitoleic acid	16:01	4.1 ± 0.67
5	Stearic acid	18:00	12.1 ± 0.31
6	Oleic acid	18:1 (n-9)	25.0 ± 1.26
7	Vaccenic acid	18:1 (n-7)	4.4 ± 0.60
8	Linoleic acid	18:2 (n-6)	8.21 ± 0.85
9	Linolenic acid	18:3 (n-3)	2.51 ± 0.49
10	Octadecatetraenoic acid	18:4 (n-4)	1.09 ± 0.16
11	11-eicosenoic acid	20:1 (n-9)	ND
12	Arachidonic acid	20:4 (n-6)	0.36 ± 0.07
13	Eicosapentaenoic acid	20:5 (n-3)	14.97 ± 1.93
14	Erucic acid	22:1 (n-9)	0.21 ± 0.06
15	Docosatetraenoic acid	22:4 (n-6)	1.08 ± 0.07
16	Docosapentaenoic acid	22:5 (n-6)	ND
17	Docosahexaenoic acid	22:6 (n-3)	ND

However, the Docosahexaenoic acid (DHA), (22: 6n-3) is absent in the flesh or at very low amounts compared with EPA. Omega-6: Omega 3 ratio is 1:2 and omega6: Omega 9 ratio is 1:3 in the flesh of the freshwater prawns. PUFA of both n-3 and n-6 types are very important in biomembranes particularly in the vascular and nervous systems. n-3 fatty acids act as a suppressant to the biosynthetic pathway of prostaglandins. The present study also shows the importance of the freshwater prawns, their fatty acid profile and the importance of n-3, n-6 and n-9 PUFA in their lipids. Finally, we concluded that the freshwater prawn flesh, rich in omega-9, omega-3 and omega-6 fatty acids, which are essential to reduce the human health risk as well as the good alternative for fish consumption.

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