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SEASONAL VARIATION IN AMINO ACID COMPOSITION AND FATTY ACID COMPOSITION, ANTICANCER CAPACITY OF SALTWATER PRAWN (GIANT TIGER PRAWN, *PENAEUS MONODON*)

Md. Shofikul Islam[1], Dr. Md. Abul Mansur[2*], M. S. Reza[3], M. N. Haider[4], Daisuke Kimura[5] and Misa Ogushi[6]

[1]Ph.D. Student, Department of Fisheries Technology, BAU, Mymensingh-2202, Bangladesh.
[2]Professor, Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh, Principal Investigator (PI), Project No. 2023/1948/BAU.
[3]Professor, Department of Fisheries Technology, BAU, Mymensingh-2202, Bangladesh.
[4]Professor, Co-PI, Project No. 2023/1948/BAU, Department of Fisheries Technology, BAU, Mymensingh-2202, Bangladesh.
[5]Professor, Department of Health, Sports and Nutrition Studies, Faculty of Health and Welfare, Kobe Women's University, 4-7-2 Minatojima-Nakamachi, Chuo-ku, Kobe 650-0046, Japan.
[6]Junior Associate Professor, Ph.D., Department of Food and Nutritional Science, Kobe Women's Junior College, 4-7-2 Minatojima-nakamachi, Chuo-ku, Kobe-shi, Hyogo 650-0046, Japan.

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***Corresponding Author: Dr. Md. Abul Mansur**

Professor, Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh, Principal Investigator (PI), Project No. 2023/1948/BAU.

ABSTRACT

This research was conducted to know the seasonal variation in amino acid composition, fatty acid composition and anticancer capacity of the flesh of salt water prawn (Giant tiger prawn, *Penaeus monodon*) of the Bay of Bengal. For this purpose amino acid composition, fatty acid composition of the flesh of *Penaeus monodon* was estimated in winter, spring and summer season. Almost all amino acids were detected and estimated except tryptophane. Remarkable variation in amino acid content was observed during winter, spring and summer. Most noticeable seasonal variation was obtained in aspartic acid, threonine, glutamic acid, lysine, valine, isoleucine. In general the highest quantity of each amino acid was obtained in spring season compared to winter and summer. Essential amino acids and other amino acids were been detected and estimated in winter, spring and summer. Lipid of the flesh of *Penaeus monodon* contained both saturated and unsaturated fatty acids. Unsaturated fatty acids were 48.35% in winter, 60.64% in spring, only 11.6% in summer. In spring season unsaturated fatty acid percentage was highest (60.64%). There was a significant difference in the percentage of common unsaturated fatty acids and saturated fatty acids in winter, spring and summer. Most of the unsaturated fatty acids were long chain (C16 to C22). Some unsaturated fatty acids were polyunsaturated and some were n-3 polyunsaturated fatty acids. EPA and DHA have been detected in *Penaeus monodon* the percentage of which was highest in spring season. In winter season poly-phenol content was 20.3 µmol/100g DW and antioxidant capacity was 115.3 µg/g which indicate anticancer property of the flesh of the salt water prawn (Giant Tiger Prawn, *Penaeus monodon*).

KEYWORDS: Amino acid, fatty acid, poly-phenol, antioxidant capacity, salt water prawn *Penaeus monodon*, seasonal variation.

INTRODUCTION

Salt water prawn of the Bay of Bengal along the Bangladesh coast Giant tiger prawn (*Penaeus monodon*) is a famous food commodity at home and abroad because of its delicious taste and large size. It has a good export market in UK, Europe, USA, Japan. This salt water prawn species is a good source of protein and lipid. Both protein and lipid supply energy and provide many health benefits. Body composition including protein, lipid, amino acid, fatty acid varies in different seasons. Such variation depends on some factors. In all species of fish seasonal change in certain bodily characteristics occur (Connell, 1980).[1] Amino acids are the structural components of protein. In other words amino acids are the basic unit of protein and function of protein depends on the chemical make-up e.g. type, quantity and nature of amino acids. Function of protein is influenced by the presence of amino acids and it is quite dependent when

present in food. Functional diversity of protein essentially arises from their chemical makeup. Proteins are highly complex polymer, made up of 20 different amino acids. The constituents are linked via substituted amide bonds. (Damodaran, 1996).[2] Fatty acids are liberated by hydrolysis from naturally occurring fats. Fatty acids are the basic unit of fat of any aquatic animal or any food commodity. Function of fat is also dependent on the type, quantity, nature of fatty acids. It is particularly true for fat/oil of fish and aquatic invertebrates. Animal fats consists of depot fats from domestic land animals (e.g. lard and tallow), all containing large amount of C16 and C18 fatty acids, medium amounts of unsaturated acids, mostly oleic and linoleic, and small amounts of odd-numbered acids. These fats contain appreciable amounts of fully saturated triglycerols and exhibit relatively high melting point. Egg lipids are of particular importance because of their emulsifying properties and their high content of cholesterol. Fats and oils of marine animals typically contain large amounts of long-chain omega-3-polyunsaturated fatty acids, with up to six double bonds, and they are usually rich in vitamins A and D. Because of their high degree of unsaturation, they are less resistant to oxidation than other animal oils or vegetable oils (Nawar, 1996).[3]

Aquatic animal protein and lipid have many health beneficial functions in human body. It has already been mentioned that amino acids are the structural unit of protein. Amino acids possess amine group and carboxylic group. Amino acids have many properties of which taste is most noticeable e.g. glutamic acid possess meaty flavor and taste, glycine, alanine, valine, serine possess sweet taste. All amino acids are necessary for health. But human body cannot synthesis some of the amino acids but these are necessary for health. These amino acids are called essential amino acids. Essential amino acids help in many biological function in human cell e.g. anti-mutagenicity, anti-aging, anti-carcinogenicity etc. Prawn and fish protein contain all essential amino acids. Lipid is also an important nutrient. Most fish and shellfish lipid contain long chain fatty acids and contain unsaturated fatty acids, DHA, EPA, omega-3 polyunsaturated fatty acids which are beneficial for health. Prawn and fish lipid vary substantially in chain length and most of the unsaturated fatty acids are C16, C18, C20 and C22 acids. Prawn and fish lipid contains essential fatty acids including DHA and EPA which supply energy in human cell (9 KCal/g), lowers cholesterol level in human body. DHA and EPA have anti-stress effect and increase learning capacity as well as memory capacity in children. Omega-3-polyunsaturated fatty acids of prawn and fish lipid are effective against coronary heart disease. Polar lipid helps brain maturity. Most often prawn and fish lipid contain fat soluble vitamins e.g. Vit. A, Vit. D, Vit, E in a reasonable quantity These vitamins have additional health benefits. DHA and EPA increase the beneficial part of cholesterol in human body and lowering the most damaging component. Dangerously high level of triglycerides falls to normal level in patients on prawn and fish oils. Aquatic animal lipid consumption results relief from arthritis, migraine, skin disorder. Most often aquatic animal particularly prawn and pelagic fish lipid possess polyphenols, antioxidants. Regular consumption of such lipid is effective against atherosclerosis, aging, cancer, cardiovascular diseases and various chronic diseases.

Average quantity and percentage of amino acid and fatty acid vary in different seasons. Such variation depends on some factors e.g species, size, spawning, water temperature, geographical difference, feed availability etc. Seasonal, cyclical changes in composition are observed in many species though less noticeable in some shell fish (Connell *et. al*., 1976).[4] So it is necessary to elucidate the seasonal variation of amino acid composition, fatty acid composition in prawn and shrimp of Bangladesh. The seasonal variation in proximate composition, quality, heavy metal content in salt water prawn (Giant tiger prawn, *Penaeus monodon*) of the Bay of Bengal along the Bangladesh coast was studied and we have reported in our previous publication (Mansur *et. al*., 2023).[5] In this part of our research we are reporting the seasonal variation in amino acid composition and fatty acid composition of *Penaeus monodon* of the Bay of Bengal along the Bangladesh coast. In Bangladesh data on seasonal variation in amino acids composition, fatty acid composition, proportion of saturated and unsaturated fatty acid in the lipid of prawn and shrimp are very scarce. Enough reliable data on seasonal variation in amino acid composition, fatty acid composition are necessary for the awareness of the consumers as well as it has academic importance. Such research is important for the processing industries too because high quality value-added product can only be produced from high quality raw material. It also influence the acceptability in the International market, it influence price, shelf-life of prawn and shrimp.

We have conducted experiment on poly-phenols and anti-oxidant capacity of the flesh of salt water prawn (Giant tiger prawn, *Penaeus monodon*) in winter season. Poly-phenol is active against cancer. Antioxidants are active against free radicals. Free radicals are formed in the human body through different life processes. These processes are important for life but free radicals are harmful for health. The free radicals cause oxidative damage to biomolecules, very rapidly take part to reaction with lipid, protein, DNA to induce membrane damage, denaturation of protein, inactivation of enzymes, breakage of strand and base modification of DNA. Such interactions cause some diseases e.g. atherosclerosis, aging, cancer, cardiovascular diseases and various chronic diseases, So the result of the present research will be helpful to the processors and the consumers at home and abroad. Such information is important for export of prawn and shrimp from Bangladesh to International market.

MATERIALS AND METHOD

Collection of raw material

Salt water prawn (Giant tiger prawn, *Penaeus monodon*) were collected/purchased from a supplier of Cox's Bazar. These salt water prawn were harvested from the Bay of Bengal along the Cox's Bazar coast during commercial fishing. Salt water prawn were was packed in a Styrofoam box with sufficient ice and transported to the Laboratory of the Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202 which took nearly 16 hours journey by bus. On arrival to the Laboratory the salt water prawn samples were frozen stored at -20℃ for subsequent laboratory analysis. A portion of samples were sent to the BCSIR (Bangladesh Council of Scientific and Industrial Research) for Amino acid analysis and fatty acid analysis. Samples were purchased from the same place in winter, spring and summer.

Laboratory analyses

Amino acid analysis was conducted by Acid Hydrolysis Method (Sykum AAAS433-D Amino acid Analyzer). The method used for this assay was used on chromatographic technique which we used in our previous experiment (Mansur *et. al*, 2024).[6] The method is described below.

Sample preparation: First the appendage, head, shell of *Penaeus monodon* were removed by forceps, scissors and knife. Only the flesh was taken for experiment. Accurately weighed 200-250 mg prawn flesh was taken Then it was dissolved with hydrolysis solution (300 ml of 37% HCl, 200 ml of DI water and 0.5 g phenol to prepare 500 ml Hydrlysis Solution). After soaking and mixing, the samples were kept at 120℃ for 24 hours. After that the pH had been adjusted within the range of 2.9 to 3.1. After adjusting the pH, sample volume was adjusted to 250 ml. Then from this 250 ml sample stock 100 µL of sample was taken which was being filtered by 0.45 µM Syringe filter. With this 100 µL of sample, 900 µL of sample dilution buffer (Na-acetate buffer, pH = 2.9 to 3.1) was added. Then it was ready for run. 100 µL of sample was taken. Then the sample was passed through the reaction chamber where it reacted with the reagent ninhydrin. The baseline for the isolation of amino acid was done by two different buffers with varied pH. One with acidic 1.9 to 3.1 and the another one with 10.5 to 11.85.

Fatty acid analysis: GC (Gas Chromatography) method was followed for fatty acid analysis.

Polyphenol and antioxidant capacity

Sample preparation: At first the appendage, head, shell of *Penaeus monodon* were removed by forceps, scissors, knife etc. Only the flesh was collected. Then the flesh of prawn was chopped finely by a sharp knife. The chopped flesh of the prawn was taken in the crucibles. Each crucible contained 10 g chopped prawn flesh. Then the crucibles with prawn flesh were heated in a hot air oven at 105℃ for 24 hours. Then the crucibles were cooled within a desiccator up to the room temperature. At this stage the cooled crucibles were taken out of the desiccator and the dried flesh was taken in plastic sample bottle. These samples were carried to Japan at ambient temperature and used for laboratory analysis for the detection and estimation of Poly-phenol, anti-oxidant capacity according to the DPPH method.[7]

RESULT AND DISCUSSION

Seasonal variation of major amino acid content in *Penaeus monodon* is stated in Table 1. Considerable difference in amino acid content of *Penaeus monodon* was obtained in the present research. Most noticeable difference in quantity of amino acid was observed in aspartic acid, glutamic acid, glycine, valine, leucine, tyrosine, lysine, arginine. Aspartic acid was 69.77 mg/g in winter, 101.62 mg/g in spring and 84.99 mg/g in summer. Glutamic acid was 128.82 mg/g in winter, 144.5 mg/g in spring and 135.13 mg/g in summer. Glycine was 68.8 mg/g in winter, 50.97 mg/g in spring and 49.70 mg/g in summer. Valine was 20.23 mg/g in winter, 49.56 mg/g in spring and 41.31 mg/g in summer. Leucine was 46.73 mg/g in winter, 36 mg/g in spring and 43.35 mg/g in summer. Tyrosine content was 12.66 mg/g in winter, 26.12 mg/g in spring and 21.86 mg/g in summer. Lysine content was 45.78 mg/g, 65.2 mg/g in spring and 52.46 mg/g in summer. Arginine content was 66.28 mg/g in winter, 82.28 mg/g in spring and 63.39 mg/g in summer. Amino acid content was highest in spring season, lower in winter season and least in summer season with a few exceptions. In general, seasonal variation in the quantity of essential amino acids was less than those of other common amino acids. We know that the amino acids which human body is unable to synthesis but essential for human life are known as essential amino acids. For better health and nutrition we have to take essential amino acids from dietary source along with food. Examples of essential amino acids for human are Methionine, threonine, tryptophane, valine, isoleucine, leucine, lysine. Other common amino acids (non-essential) possess many properties of which taste is an important property. Sweet, bitter, meaty taste, tasteless are the examples of such taste. Glycine, alanine, valine, serine etc possess sweet taste, leucine is tasteless, arginine is bitter, glutamic acid possesses meaty taste. It has already been

Table 1: Major amino acid (mg/g) content of *Penaeus monodon* in different seasons.

Prawn Species	Amino acid	Season		
		Winter (mg/g)	Spring (mg/g)	Summer (mg/g)
Penaeus monodon	Aspartic acid	69.77 (10.45%)	101.62 (13.0%)	84.99 (12.48%)
	Threonine	24.5 (3.68%)	32.35 (4.1%)	19.78 (2.91%)
	Serine	23.42 (3.52%)	34.54 (4.4%)	22.23 (3.27%)
	Glutamic acid	128.82 (19.35%)	144.50 (18.5%)	135.13 (19.85%)
	Glycine	68.8 (10.33%)	50.97 (6.5%)	49.7 (7.3%)
	Alanine	42.28 (6.35%)	52.97 (6.7%)	33.77 (4.96%)
	Cystine	2.2 (0.33%)	1.61 (0.2%)	5.48 (0.81%)
	Valine	20.24 (3.94%)	49.56 (6.4%)	41.31 (6.07%)
	Methionine	20.7 (3.11%)	19.81 (2.5%)	19.88 (2.92%)
	Isoleucine	18.89 (2.84%)	18.82 (2.4%)	12.81 (1.88%)
	Leucine	46.73 (7.02%)	56.83 (7.3%)	43.35 (6.37%)
	Tyrosine	12.66 (2.65%)	26.12 (3.3%)	21.86 (3.21%)
	Phenylalanine	25.59 (3.84%)	28.61 (3.7%)	19.99 (2.94%)
	Histidine	14.45 (2.17%)	15.51 (2.0%)	20.72 (3.04%)
	Lysine	45.78 (6.88%)	65.2 (8.4%)	52.46 (7.7%)
	Arginine	66.28 (9.96%)	82.28 (10.5%)	63.39 (9.31%)
	Proline	28.63 (4.45%)	33.69 (4.14%)	33.95 (4.99%)
	Tryptophane	Could not be detected		

***Values in the parenthesis indicate the percentage to total amino acids**

mentioned that amino acids are the structural unit or basic unit of protein. Amino acid contain amine group and carboxylic group. In purely laboratory condition the molecules of amino acids have some properties. These properties are two types, e.g. physical properties, and chemical properties, Physical properties are three types: solubility, taste, and optical properties. Chemical properties are also three types: Chemical properties are due to carboxyl group, amine group, and reaction of amino acid with formaldehyde. Amino acids are broadly three types: Aliphatic amino acids, Aromatic amino acids and Heterocyclic amino acids.. Aliphatic amino acids are four types, (1) Mono-amino mono carboxylic e.g. glycine, alanine, serine, threonine, methionine, valine, leucine, isoleucine; (2) Diamino mono carboxylic e.g. lysine; (3) Mono amino dicarboxylic e.g. aspartic acid; (4) Diamino dicarboxylic e.g. cystine. Aromatic amino acids e.g. phenyl alanine, tyrosine; Heterocyclic amino acids e.g. tryptophane, histidine, proline, OH-proline. Properties of amino acids, affinity towards chemical reaction, heated condition are somewhat different when they are present in food matrices as an unit of protein. So the present research findings may be helpful to get an idea about the salt water prawn particularly its taste. Although there was a significant difference in amino acid quantity in the flesh of salt water prawn (*Penaeus monodon*) in winter, spring and summer the highest quantity of each amino acid was obtained in spring season. Glutamic acid was highest in quantity among all amino acids, which was 144.50 mg/g (18.5% to total amino acids) in spring season. Amino acid in protein is important while considering protein quality, protein characteristics, taste etc. Protein of prawn and fish have important function in human body which is related to amino acids. In general, amino acids possess radical scavenging activity, essential amino acids possess the capacity to help many biological functions in cell e.g. antimutagenicity, antiaging, anticarcinogenicity etc. From the result of the present research it is evident that the amount of amino acids is highest in spring season.

Seasonal variation of fatty acid profile of lipid of salt water prawn (*Penaeus monodon*) is stated in Table 2. Saturated and unsaturated fatty acid percentage is stated in the table. Unsaturated fatty acid percentage is less than 60% to total fatty acids. This data also varies among the seasons. Unsaturated fatty acid percentage was compared for some common unsaturated fatty acids of *Penaeus monodon* in winter, spring and summer. Percentage of these common unsaturated fatty acids was 48.35% in winter, 60.64% in spring, only 11.6% in summer. In spring season unsaturated fatty acid percentage was highest. There was a significant difference in the percentage of common unsaturated fatty acids in winter, spring and summer. The percentage of each common unsaturated fatty acid was reasonably different in winter, spring and summer. Palmitoleic acid (C16:1) was 1.87% in winter, 2.06% in spring and 4.6% in summer. Cis-9-Oleic acid (C18:1) was 14.65% in winter, 13.15% in spring and 3.43% in summer. Linoleic acid (C18:2) was 10.17% in winter, 7.72% in spring and 1.42% in summer season. Alphalinoleic acid (C18:3) was 1.82% in winter, 3.7% in spring and 0.76% in summer. Eicosadienoic acid (C20:2) was 0.7% in winter, 0.46% in spring and nil in summer. Eicosatetraenoic acid (C20:4) was 7.27% in winter, 10.89% in spring and nil in summer. Eicosapentaenoic acid (C20:5) was 7.23% in winter, 12.79% in spring and 1.32% in summer. Docosadienoic acid (C22:2) and Docosapentaenoic acid (C22:5) were detected in spring season only which were 0.44% and 2.14% respectively. Docosahexaenoic acid (C22:6) was 4.64% in winter, 7.29% in spring and nil in summer.

Table 2: Fatty acid profile of *Penaeus monodon* in different seasons.

Prawn species	Fatty acid type	Fatty acid	Season		
			Winter (%)	Spring (%)	Summer (%)
Penaeus monodon	Saturated	Myristic acid (C14:0)	0.563	0.83	4.06
		Pentadecylic acid (C15:0)	0.404	1.1	
		Palmitic acid (C16:0)	15.035	16.32	5.77
		Heptadecanoic acid (C17:0)	1.514	1.52	
		Stearic acid (C18:0)	12.427	7.41	3.41
		Arachidonic acid (C20:0)	0.467	0.82	0.68
		Lignoceric acid (C24:0)	1.035		0.94
	Unsaturated	Palmitoleic acid (C16:1)	1.872	2.06	4.67
		Cis-9-Oleic acid (C18:1)	14.656	13.15	3.43
		Linoleic acid (C18:2)	10.173	7.72	1.42
		Alphalinoleic acid (C18:3)	1.822	3.7	0.76
		Eicosadienoic acid (C20:2)	0.708	0.46	
		Eicosatetraenoic acid (C20:4)	7.271	10.89	
		Eicosapentaenoic acid (C20:5)	7.232	12.79	1.32
		Docosadienoic acid (C22:2)		0.44	
		Docosapentaenoic acid (C22:5)		2.14	
		Docosahexaenoic acid (C22:6)	4.645	7.29	

Apart from the stated unsaturated fatty acids a good number of saturated fatty acid were been detected and estimated in this research which have been listed in the Table 2. Among the saturated fatty acids Myristic acid (C14:0), Pentadecylic acid (C15:0), Palmitic acid (C16:0), Heptadecanoic acid (C17:0), Stearic acid (C18:0), Arachidonic acid (C20:0), Lignoceric acid (C24:0) are main. Most of the saturated fatty acids of *Penaeus monodon* are long chain fatty acids C14 to C24. Unsaturated fatty acids of *Penaeus monodon* were poly unsaturated fatty acids. Both saturated fatty acids and unsaturated fatty acids of *Penaeus monodon* varied considerably during winter, spring and summer.

In addition to the fatty acids listed in Table 2 a number of fatty acids were detected and estimated in winter, spring and summer which did not appear in these three seasons. Some were been detected in summer which were not present the flesh of *Penaeus monodon* in winter and spring. Similarly some fatty acids were been detected in winter which were not present in the flesh in spring and summer. The fatty acids which were common in the flesh lipid of *Penaeus monodon* have been listed in the Table 2 with their percentage to total fatty acids. This percentage was remarkably different in the flesh lipid of salt water prawn, *Penaeus monodon* during winter, spring and summer.

Similar research on fish lipid, fatty acids of fish lipid has been conducted by many scientists and researchers (Love, 1994; Lands, 1986; Dyerberg and Bang, 1979; Lovern, 1935, Lee and Sinnhuber, 1973; Ross, 1977; Gopakumar and Nair, 1972; Irving and Watson, 1976; Mansur, 1995).[8-16] Both freshwater fish and marine fish were used in these research works. Results of their research were that lipids occur in fish as two broad groups: (1) triglycerols (triglycerides), (2) phospholipids and cholesterols. Fish lipids are very beneficial to the health of the consumers. The nations used fish as the main part of their food intake, they almost never suffered from heart attacks. The lipid composition of the food eaten by the fish is probably the most important influence on the lipid composition of the fish itself. The extent to which polyunsaturated fatty acids can be synthesized by the fish from less unsaturated fatty acids in the diet varies with the species. The addition of carbon atom to the chain and desaturation (increase in the number of double bonds) of C18:3 fatty acid administered to marine teleost, the cod (*Gadus morhua*) were both slight. These findings of the previous research by the stated scientists express that fish lipid including freshwater fish and marine fish contains considerable quantities of polyunsaturated fatty acids some of which are n-3 polyunsaturated fatty acids. Such fatty acid composition varies depending on some influencing factors. Fish, both freshwater and marine, can convert less unsaturated fatty acids to polyunsaturated fatty acids. Most of the aquatic animals mainly fish and prawn possess this capacity.

In the present research we obtained the results which are supported by the previous results and have a basis to our result. We conducted this research on salt water prawn i.e. marine prawn (*Penaeus monodon*), which is a marine invertebrate. Shows the same pattern of fatty acid composition, unsaturated fatty acid, polyunsaturated fatty acids in winter, spring and summer. Among the factors which influence the fatty acid composition of prawn and fish the type and availability of feed e.g. plankton is most important. The reason of seasonal variation in fatty acid composition in *Penaeus monodon* is that the natural feed in water varies greatly in different seasons. So, feed intake of prawn is different in various seasons by quantity and type of feed e.g. plankton.

Table 3: Polyphenol and antioxidant capacity of *Penaeus monodon* in winter season.

Prawn species	Parameter	Result
Penaeus monodon	Poly-phenol	20.3 µmol/100 g DW
	Antioxidant capacity	115.3 µg/g

The poly-phenol and antioxidant capacity of the flesh of *Penaeus monodon* in winter season has been stated in Table 3. Poly-phenol of the flesh of *Penaeus monodon* was 20.3 µmol/100 g DW. Antioxidant capacity of the flesh of *Penaeus monodon* was 115.3µg/g. Both poly-phenol and antioxidants are effective against many diseases including cancer. Poly-phenols are directly active against cancer. Antioxidants are effective against free radicals i.e. active oxygen in human body. Free radicals are formed in human body as a result of some biological phenomenon which are necessary for life but free radicals are harmful. Antioxidants inhibit the generation of free radicals from the oxidation of other molecules by inhibiting oxidizing chain reactions. Living tissues protect themselves from the oxidative damages caused by free radicals in a number of ways**,** including the scavenging actions of some natural antioxidants e.g. tocopherol, phenolic compounds and ascorbic acids.[17-18] In addition to endogenous defenses, consumption of dietary antioxidants plays an important role in protecting against free radicals i.e. active oxygen.[19-20] Antioxidant activity is a fundamental property for human life.[21-22] A good number of research has been conducted on plant origin food, soft drinks, vegetables, fruits.[23-24] But very little is known about prawn and fish. Khanum et. al. (1998) conducted a research study on the radical scavenging activity of antioxidants of some fishes of Japan and Bangladesh.[25] Mansur et. al. (2002) conducted some research on the effect of processing and storage on the radical scavenging activity of antioxidants of horse mackerel and sardine.[26] Present research was conducted on the flesh (oven dried) of salt water prawn (*Penaeus monodon*). We have previously conducted experiments on the poly-phenol and antioxidant capacity of freshwater prawn (*Macrobrachium rosenbergii*) which we have reported in our previous publication. On comparison of results of freshwater prawn and saltwater prawn it was found that freshwater prawn (*Macrobrachium rosenbergii*) possesses more poly-phenol as well as more antioxidants than that of salt water prawn (*Penaeus monodon*). The reason may be the freshwater prawn flesh contains more phenolic compounds, and the lipid contained more fat soluble vitamin particularly Vit. A, Vit. E and Vit. D.

CONCLUSION

On the basis of the results of the present series of experiments of the current research it may be concluded that flesh of salt water prawn (Giant tiger prawn, *Penaeus monodon*) possess almost all amino acids including essential amino acids in appreciable quantities. Amino acids of *Penaeus monodon* vary considerably in winter, spring and summer. Lipid of the flesh of *Penaeus monodon* possessed saturated and unsaturated fatty acids. Unsaturated fatty acids, which are more beneficial to human health, were up to 60%. Among the unsaturated fatty acids some were polyunsaturated fatty acids and some were n-3 polyunsaturated fatty acids including DHA and EPA. All of the saturated fatty acids and unsaturated fatty acids showed seasonal variation in winter, spring and summer. In spring the contents (%) of the fatty acids were highest with a few exceptions in *Penaeus monodon*. In the winter season the anticancer capacity of the flesh of *Penaeus monodon* was reasonable which was indicated by poly-phenol and antioxidant capacity.

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