

IDENTIFICATION OF OMEGA-3, 6 AND 9 FATTY ACIDS COMPOSITION AND LIPID CONTENT FROM MUSCLE TISSUE OF *OPHIONEREIS DUBIA* (Y-STRIPED BRITTLE STAR) IN QESHM ISLAND OF THE PERSIAN GULF

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ABSTRACT

The Omega-3, 6 and 9 fatty acids are important for promoting heart health, brain development and immune system function. In this investigation, the muscle tissue of *Ophionereis dubia* from Qeshm region of Persian Gulf in April 2015 were separately extracted for their lipid content especially Omega-3, 6 and 9 fatty acids Composition using the Blight & Dyer method. The components detected were saturated fatty acid Palmitic acid (20%) and stearic acid (14%), monounsaturated fatty acid Oleic acid (23%), polyunsaturated fatty acids Arachidonic acid (4.5%), Docosahexaenoic acid (5.5%) and Eicosapentaenoic acid (10.5%), and one ester including Palmitic acid-methylester (9.5%).

KEYWORDS: Omega-3, Omega-6, Omega-9, muscle, Qeshm, *Ophionereis dubia***INTRODUCTION**

Ophionereis dubia (Echinodermata: Ophiuroidea: Amphiuridae) is one of the most commercially important sea star species that lives under rocks and often aggregates in dense colonies along the coasts of the Indian and Pacific Oceans.^[3] This species feeds of detritus-feeder and minute animals. It is characterized by the disk being clearly offset from the arm. It often has a net-like pattern including irregular "Y" markings near the base of each arm. Arms long and thin and joined with a central plate with a stripe across it^[26] (Figure 1).

**Fig. 1-*Ophionereis dubia***

Omega-3 fatty acids are essential fats. The body can't make them from scratch but must get them from food. Omega-3 fatty acids are polyunsaturated fatty acids with a double bond (C=C) at the third carbon atom from the end of the carbon chain^[16]. They are found in oils from types of plants, fish and other animal sources^[19]. The

three main types of omega-3 fatty acids involved in human physiology are alpha-linolenic acid (ALA), Eicosapentaenoic acid (EPA), and Docosahexaenoic (DHA).^[1,22,23] Omega-3 fatty acids EPA and DHA have been shown to help prevent heart disease and stroke, may help control lupus, eczema, rheumatoid arthritis, and may play protective roles in cancer and other conditions.^[6,12,25] These fats appear to help the heart beat at a steady clip and not veer into a dangerous or potentially fatal erratic rhythm^[17,18,20]. Omega-3 fats also lower blood pressure and heart rate improve blood vessel function, lower triglycerides and may ease inflammation, which plays a role in the development of atherosclerosis.^[6, 10, 11] Omega-6 fatty acids are a family of polyunsaturated fatty acids that have in common a final carbon-carbon double bond in the n-6 position, that is, the sixth bond, counting from the methyl end.^[1, 2] Arachidonic acid is a polyunsaturated omega-6 fatty acid. Arachidonic acid is not one of the essential fatty acids. However, it does become essential if there is a deficiency in linoleic acid or if there is an inability to convert linoleic acid to arachidonic acid, Arachidonic acid is a precursor in the production of eicosanoids.^[9,23] Omega-9 fatty acids are a family of unsaturated fatty acids which have in common a final carbon-carbon double bond in the omega-9 position; that is, the ninth bonds from the methyl end of the fatty acid. Two omega-9 fatty acids important in industry are Oleic acid and Erucic acid.^[27] The objective of this study was to identify of the lipid content especially Omega-3, 6 and 9 fatty

acids of muscle tissue of *Ophionereis dubia* in Qeshm Island of the Persian Gulf.

MATERIAL AND METHODS

In this research, 30 *Ophionereis dubia* samples were obtained of Qeshm region in the Persian Gulf (Figure 2). *O. dubia* samples were collected during weekly dives off the southeast coast of Qeshm (32°22' E and 21°19' S) in April 2015. The samples were taken for lipid extraction and fatty acids analyses. Initially the muscle tissue of the specimens were weighed separately and mixed into a soft uniform mixture.

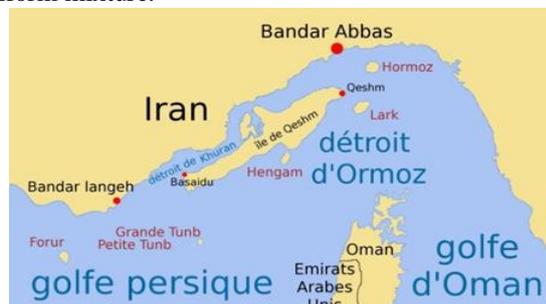


Fig. 2- Map of study area and location of sampling station in the Persian Gulf

Mixtures of chloroform and methanol were added as the lipid extract.^[4] This solvent system allows for extraction of both polar and non-polar compounds. The lower chloroform layer includes the lipids and the top methanol-water layer generally contains the polar components. The lipid in the chloroform layer is

removed using a rotary evaporator under vacuum, at temperature of 40 ° C. The weight of the lipid was determined.

The lipid extract obtained was injected into chromatograph equipment with a mass spectra detector (GC- MS). Components were identified by comparison of the retention time and mass spectra of the unknowns with those of authentic samples and also comparative analysis of Kovats index & using references of Eight Peaks.

RESULTS

This study investigated on the fatty acid composition and lipid content in the muscle tissue of *Ophionereis dubia*.

The results are shown in Table 1. Chloroform phase is discussed in this research because the fat content of the muscle tissue is extracted with chloroform.^[4] The results showed that compounds identified in the muscle tissue of *Ophionereis dubia* are saturated fatty acids Palmitic acid (20%) and stearic acid (14%), Monounsaturated fatty acid Oleic acid (23%), polyunsaturated fatty acids Eicosapentaenoic acid (10.5%), Arachidonic acid (4.5%) and Docosahexaenoic acid (5.5%), one ester of fatty acid consist Palmitic acid-methylester (9.5%) Alkane including Heptadecane (1.3%) and Octadecane (1.7%). The amounts of alkanes are identified in muscle tissue that they are environmental pollution. The components identified by GC-MS analysis of the chloroform phase of muscle samples is shown the below table.

Table 1. The compound identified in the chloroform phase of liver tissue of *Salmo salar* from Chalus region in the south of the Caspian Sea.

Compound	MF	KI	% of total
Fatty acid			
Saturated fatty acid			
Palmitic acid (Hexadecanoic acid)	C ₁₆ H ₃₂ O ₂	1614	31.93
Monounsaturated fatty acid			
Oleic acid (9Z Octadecenoic Acid)	C ₁₈ H ₃₄ O ₂	1679	42.43
Poly-unsaturated fatty acid			
Eicosapentaenoic acid (EPA)	C ₂₂ H ₃₂ O ₂	1811	8.32
Docosahexaenoic acid (DHA)	C ₂₀ H ₃₀ O ₂	1819	5.68
Linoleic acid	C ₁₈ H ₃₂ O ₂	1802	6.02
Ester			
Palmitic acid – methylester (Hexadecanoic acid ,methyl ester)	C ₁₇ H ₃₄ O ₂	1546	4.01
Stearic acid- methylester (Octadecanoic acid,	C ₁₉ H ₃₈ O ₂	1619	1.28

methyl ester)			
Alkane			
Heptadecane	C ₁₇ H ₃₆	1823	0.54
Octadecane	C ₁₈ H ₃₈	1631	0.78

MF: Molecular Formula KI: Kovats Index

Table 2. The compound identified in the chloroform phase of muscle tissue of *Salmo salar* from Chalus region in the south of the Caspian Sea.

Compound	MF	KI	% of total
Fatty acid			
Saturated fatty acid			
Palmitic acid (Hexadecanoic acid)	C ₁₆ H ₃₂ O ₂	1614	30.34
Monounsaturated fatty acid			
Oleic acid (9Z Octadecenoic Acid)	C ₁₈ H ₃₄ O ₂	1679	38.80
Poly-unsaturated fatty acid			
Eicosapentaenoic acid (EPA)	C ₂₂ H ₃₂ O ₂	1811	9.12
Docosahexaenoic acid (DHA)	C ₂₀ H ₃₀ O ₂	1819	5.63
Linoleic acid	C ₁₈ H ₃₂ O ₂	1802	5.89
Ester			
Palmitic acid – methylester (Hexadecanoic acid ,methyl ester)	C ₁₇ H ₃₄ O ₂	1546	4.83
Stearic acid- methylester (Octadecanoic acid, methyl ester)	C ₁₉ H ₃₈ O ₂	1619	4.39
Alkane			
Heptadecane	C ₁₇ H ₃₆	1823	0.49
Octadecane	C ₁₈ H ₃₈	1631	1.52

MF: Molecular Formula KI: Kovats Index

DISCUSSION

In the present research, the results indicate that the dominant Omega-3, 6 and 9 fatty acids in the muscle tissue of *Ophionereis dubia* were Eicosapentaenoic acid (10.5%), Oleic acid (23%) and Arachidonic acid (4.5%). EPA is an Omega-3 polyunsaturated fatty acid that acts as a precursor for prostaglandin-3, thromboxane-3, leukotriene-5 groups and docosahexaenoic acid^[8, 22]. The human body converts alpha-linolenic acid (ALA) to EPA.^[13] This n-3 PUFA is known to have variety of health benefits against cardiovascular diseases (CVDs) including well-established hypo triglyceridemic and anti-inflammatory effects.^[11, 24] Also, various studies indicate promising antihypertensive, anticancer, antioxidant, antidepressant, antiaging and antiarthritis effects^[5, 12, 13, 14, 19, 21]. Among omega-3 fatty acids, it is thought that EPA in particular may possess some beneficial potential in mental conditions, such as schizophrenia.^[8, 21, 24] Eicosapentaenoic acid may be the active biological components of these effects, research has shown that they decrease risk of arrhythmias.^[6] which can lead to

sudden cardiac death, decrease triglyceride levels, decrease growth rate of atherosclerotic plaque and blood clots.^[10, 20] each of which tends to clog arteries and reduce low-density lipoprotein (LDL) cholesterol and triglyceride levels.^[17] Arachidonic acid is a type of omega-6 fatty acid that is involved in inflammation. Like other omega-6 fatty acids, arachidonic acid is essential to your health. Omega-6 fatty acids help maintain your brain function and regulate growth. Arachidonic acid in particular helps regulate neuronal activity. Arachidonic acid and its metabolites help regulate neurotransmitter release^[9, 23]. Oleic acid reduces blood pressure, increases fat burning to help with weight loss, protects cells from free radical damage, may prevent type 2 diabetes, prevents ulcerative colitis and generates brain myelin. Substitution of dietary saturated fat by oleic acid has been described to reduce the cardiovascular risk by reducing blood lipids, mainly cholesterol.^[27] In summary, Omega-3 long-chain PUFA, including EPA and DHA, are dietary fats with an array of health benefits. They are important throughout life and are a

dietary necessity found predominantly in fish and other seafood. Eating a diet that has a combination of Omega-3, Omega-6 and Omega-9 fatty acids will lower your risk of developing heart disease.

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