Fatty acids composition and lipid content from muscle tissue of clam *Amiantis umbonella* (Bivalve) in the Persian Gulf Coasts (Bushehr)

Abdolhossein Rustaiyan[1], Keivandokht Samiee[2], Mina Ghanbary Bonjar[3]

[1]Department of Chemistry, Science & Research Branch, Islamic Azad University, P.O. Box 14515-775, Tehran, Iran
[2]Faculty of Biologic al Sciences, Shahid Beheshti University, Tehran, Iran
[3]Department of Marine Sciences and Technology, North Tehran Branch, Islamic Azad University, Tehran, Iran
a.rustaiyan@yahoo.it

Abstract: In this investigation, the muscle tissue of *Amiantis umbonella* from the coastal waters of Bushehr, Iran in May 2013 were separately extracted for their lipid content especially omega-3 fatty acids composition using the method of Blight & Dyer. The compounds were determined by Gas Chromatography-Mass Spectrometry (GC- MS). The components detected in both male and female species. Some of the compounds identified in both sexes, including saturated fatty acids Palmitic acid and Stearic acid, monounsaturated fatty acid Oleic acid, polyunsaturated fatty acid alpha - Linolenic acid (ALA), two methyl esters of fatty acids including Octadecanoic acid, methyl ester and Hexadecanoic acid, methyl ester. The dominant fatty acids identified in both sexes were alpha- Linolenic acid (ALA) and Palmitic acid.
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1. Introduction

Mollusca are one of the largest animal phyla after Arthropoda. The class Bivalve is the second largest molluscan class. The class Bivalvia includes the clams, oysters, mussels, and scallop (Miller & Harley, 2001). *Amiantis umbonella* is a species of the family Veneridae. Biodiversity of Persian Gulf molluscs especially bivalvia, potential is considerable. Bivalvia applications include food, medicinal, decorative, research, pearl building and industrial consumptions (Park & C.W, 2002; Gosling, 2003). Clams are commercial important species in the world and are also significant bioindicators in the marine environment. *Amiantis umbonella* is localized and found more in wide tidal areas of eastern coasts of Bushehr (Figure1).

Figure1. *Amiantis umbonella*

Omega-3 fatty acids are fats commonly found in marine and plant oils. They are polyunsaturated fatty acids with a double bond (C=C) at the third carbon atom from the end of the carbon chain. The fatty acids have two ends, the acid (-COOH) end, which is considered the beginning of the chain, thus "alpha", and the methyl (CH_3) end, which is considered the "tail" of the chain, thus "omega". Though mammals cannot synthesize omega−3 fatty acids, they have a limited ability to form the long-chain omega−3 fatty acids eicosapentaenoic acid (EPA, 20 carbons and 5 double bonds) and docosahexaenoic acid (DHA, 22 carbons and 6 double bonds) when the diet includes the shorter-chained omega-3 fatty acid α-linolenic acid (ALA, 18 carbons and 3 double bonds) (Thomas, 2002).

Omega-3 fatty acids are thought to protect against heart disease (Allen & Harris, 2001; Reiffel & McDonald, 2006), inflammation (David, *et al*., 2005), types of cancer (Hardman, 2002; Schonberg et al., 2006; Simon et al., 2009), diabetes (Stirban et al., 2010**)**, Alzheimer's disease (Cunnane *et al*., 2009), and macular degeneration (a leading cause of vision loss).

Omega-3 fatty acids are critical for proper brain development and neurological function in developing babies, too (Bousquet et al., 2008). Omega-3 fatty acids are often classed as "essential fatty acids," meaning that they are necessary for our health and that our bodies are unable to produce them. In fact, the body is unable to manufacture *one* kind of omega-3 fatty acid known as alpha linolenic acid (LNA or ALA), but it can make the other types, eicosapentaeonic acid (EPA) and docoshexaeonic acid (DHA), by converting LNA, though only a small percentage of LNA is able to be converted (Simopoulos, 2002; David & Michael, 2005).

The objective of this study was to identify of the lipid content especially omega-3 fatty acids composition of muscle tissue of *Amiantis umbonella* in the south of Iran (Bushehr).

2. Material and Methods

In this research, 30 *Amiantis umbonella* samples were obtained from the coastal waters of Bushehr in the south of Iran (Figure 2). Initially the liver and muscle tissues were weighed separately and mixed into a soft uniform mixture.

Figure2. Map of sampling station from the coastal waters of Bushehr in the south of Iran

Mixtures of chloroform and methanol were added as the lipid extract (Blight & Dyer, 1959).

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 peak.

3. Results

This study investigated on the fatty acid composition and lipid content in the muscle tissue of female and male *Amiantis umbonella.*

The results are shown in Tables 1 and 2. Chloroform phase is discussed in this research because the fat content of the muscle tissue is extracted with chloroform (Blight & Dyer, 1959). The components identified by GC-MS analysis of the chloroform phase of the samples from female species is shown the below table.

Table 1.The compound identified in the chloroform phase of muscle tissue of female *Amiantis umbonella* from the coastal waters of Bushehr in the south of Iran

Compound	MF	KI	% of total
Fatty acid			
Saturated fatty acid			
Palmitic acid (Hexadecanoic acid)	$C_{16}H_{32}O_2$	1645	34.86
Stearic acid	$C_{18}H_{36}O_2$	1629	7.60
Monounsaturated fatty acid			
Oleic acid (9Z Octaecenoic acid)	$C_{18}H_{34}O_2$	1685	21.25
Poly- unsaturated fatty acid			
Alpha-Linolenic acid	$C_{18}H_{30}O_2$	1934	14.53
Ester			
Palmitic acid–methylester (Hexadecanoic acid, methyl ester)	$C_{17}H_{34}O_2$	1578	10.76
Stearic acid-methylester (Octadecanoic acid, methyl ester)	$C_{19}H_{38}O_2$	1589	6.10
Alkane			
Dodecane	$C_{12}H_{26}$	1151	1.60
Tetradecane	$C_{14}H_{30}$	378	1.62
Pentadecane	$C_{15}H_{32}$	928	1.87
Hexadecane	$C_{16}H_{34}$	1615	1.58
Octadecane	$C_{18}H_{38}$	1923	2.01
Icosane	$C_{20}H_{42}$	549	2.93

MF: Molecular Formula; KI: Kovats Index

Table 2 shows the components identified by GC-MS analysis of the samples from male species.

Table 2. The compound identified in the chloroform phase of muscle tissue of male *Amiantis umbonella* from the coastal waters of Bushehr in the south of Iran

Compound	MF	KI	% of total
Fatty acid			
Saturated fatty acid			
Palmitic acid (Hexadecanoic acid)	$C_{16}H_{32}O_2$	1645	34.86
Stearic acid	$C_{18}H_{36}O_2$	1629	7.60
Monounsaturated fatty acid			
Oleic acid (9Z Octaecenoic Acid)	$C_{18}H_{34}O_2$	1685	21.25
Poly- unsaturated fatty acid			
Alpha-Linolenic Acid	$C_{18}H_{32}O_2$	1934	14.53
Ester			
Palmitic acid –methylester (Hexadecanoic acid ,methyl ester)	$C_{17}H_{34}O_2$	1578	10.76
Stearic acid-methylester (Octadecanoic acid, methyl ester)	$C_{19}H_{38}O_2$	1589	6.10
Alkane			
Dodecane	$C_{12}H_{26}$	1151	1.60
Tetradecane	$C_{14}H_{30}$	378	1.62
Pentadecane	$C_{15}H_{32}$	928	1.87
Hexadecane	$C_{16}H_{34}$	1615	1.58
Octadecane	$C_{18}H_{38}$	1923	2.01
Icosane	$C_{20}H_{42}$	549	2.93

MF: Molecular Formula; KI: Kovats Index

According to this study, most compounds identified are common between the two sexes such as saturated fatty acids Palmitic acid (34.86 % in female and male 34.98 %) and Stearic acid (7.60 % in female and male 7.69 %), Monounsaturated fatty acid Oleic acid (13.9 % in female and male 14.54 %), polyunsaturated fatty acid Alpha Linolenic acid (15.17 % in female and male 15.63 %), two esters of fatty acid consist Palmitic acid –methyl ester (10.76 % in female and male 10.87 %) and Stearic acid-methyl ester (6.10 % in female and male 5.57 %), Dodecane (1.60 % in female and male 1.48 %), Tetradecane (1.62 % in female and male 1.32 %), Pentadecane (1.87 % in female and male 1.68 %), Hexadecane (1.58 % in female and male 1.49 %), Octadecane (2.01 % in female and male 1.93 %) and Icosane (2.93 % in female and male 2.82 %). Amounts of alkanes are identified in the muscle tissue which is regarded as environmental pollution.

4. Discussions

Results of in this study showed that the muscle tissue of female and male *Amiantis umbonella* is rich in fatty acids especially Palmitic acid (34.86 % in female and male 34.98 %) and Omega-3 alpha-Linolenic acid (15.17 % in female and male 15.63 %). Palmitic acid is classified as a saturated fatty acid.

It is the most common fatty acid found in animals, plants and microorganisms (Gunstone et al., 2007). According to the World Health Organization consumption of palmitic acid increases the risk of developing cardiovascular diseases (Diet, 2003). Retinyl palmitate is an antioxidant and a source of vitamin A added to low fat milk to replace the vitamin content lost through the removal of milk fat. Palmitate is attached to the alcohol form of vitamin A, retinol, to make vitamin A stable in milk. Recently, a longacting antipsychotic medication, paliperidone palmitate (marketed as INVEGA Sustenna), used in the treatment of schizophrenia, has been synthesized using an oily palmitate ester as a long-acting release carrier medium when injected intramuscularly. Palmitic acid is mainly used to produce soaps, cosmetics, and release agents. In industry, the dominant use of Palmitic acid is as its sodium salt (Anneken et al., 2006). Alpha-linolenic acid (ALA) is considered essential fatty acid because it cannot be synthesized by humans. The long-chain omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), can be synthesized from ALA. Several prospective cohort studies have examined the relationship between dietary ALA intake and the risk of coronary heart disease (CHD). Studies have shown that Omega-3 fatty acids help lower triglycerides (Hardman, 2002; Kato et al., 2002; Bousquet et al., 2008), lower blood pressure (Calo et al., 2005; Teres et al., 2008), reduce the risk of blood clots (Frenoux et al., 2001), improve the health of arteries (Grimm et al., 2002; Gil, 2002) and reduce the amount of arterial plaque, which narrows arteries, reduces symptoms of depression (Harbige and Fischer , 2001;Rees et al., 2006; Song& Zhao, 2007 Cunnaneet al., 2009) and causes heart disease (Stampfer, *et al.,* 2000; Kris-Etherton et al., 2001; Reiffel & McDonald, 2006; Chattipakorn et al., 2009).

The results of this research indicated that *Amiantis umbonella* is a health as seafood and it is also suitable in the processing industry.

Corresponding Author:
Dr. Abdolhossein Rustaiyan
Department of Chemistry
Science and Research Branch
Islamic Azad University
P.O.Box 14515-775
Tehran/Iran
E-mail: arustaiyan@yahoo.it

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