Lipid content and Fatty acid composition in Muscle Tissue of *Perca fluviatilis* in the South of the Caspian Sea

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Abstract: This study was aimed to gain knowledge on lipid content and fatty acid composition in muscle tissue of *Perca fluviatilis* from the port of Anzali in the south of the Caspian Sea, Iran in Sep 2012 using the method of Blight & Dyer (1959).The Compounds were identified using Gas Chromatography-Mass Spectrometry (GC-MS). The components detected in both male and female species, including saturated fatty acids (SFA) Palmitic acid and Stearic acid, monounsaturated fatty acid (MUFA) Oleic acid, polyunsaturated fatty acids (PUFA) docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA).The fatty acid composition of muscle tissue in *Perca fluviatilis* was characterized by a high percent of docosahexaenoic acid (DHA).
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1. Introduction

Perca fluviatilis, commonly known as the European perch, is a predatory species of perch found in Europe and Asia. It is a freshwater fish(Persson et al,2002) and in some areas it is known as the red fin perch or English perch (Burnett et al., 2002). They live in a wide variety of habitats, but usually prefer slow-flowing waters such as lakes, dams, swamps and slow moving streams and rivers (Morgan et al., 2002). European perch belong to the family Percidae and they are greenish with red pelvic, anal and caudal fins (McDowall, 2000). They have five to nine dark vertical bars on their sides (Figure 1).

Figure1. *Perca fluviatilis*

Perca fluviatilis is important for feeding and recreational fishing (Brian et al., 2010).

The Caspian Sea is the largest enclosed body of water on Earth by area, variously classed as the world's largest lake or a full-fledged sea and is bounded to the northwest by Russia, to the west by Azerbaijan, to the south by Iran, to the southeast by Turkmenistan, and to the northeast by kazakhstan (Amirahmadi, 2000). The Southern Caspian Sea is the deepest, with oceanic depths of over 1,000 meters. There are over 120 *fish* species in the southern part of the *Caspian Sea (Henri et al., 2004).* Fat and fatty acids are very important on human health (Landmark & Alm, 2006). Long chain n-3 polyunsaturated fatty acids (PUFA) cannot be synthesized by human bodies (Anneken et al., 2006) and should be supplied by the diet (Gulere et al., 2008) The most important source of long chain PUFA (Omega -3 fatty acid) with up to 5 to 6 double bonds (eicosapentaenoic acid and docosahexaenoic acid) are fish (Ress et al., 2006) and seafood (Stolyhwo et al., 2006). Fish were able to elongate and desaturate the 18:3 n-3 precursors into eicosapentaenoic acid and docosahexaenoic acid (Xu & Kestemont, 2002). Polyunsaturated fatty acids of n-3 family can reduce triacylogliceride (TAG), total cholesterol levels (Clandinin et al., 2005), the risk of heart disease (Landmark & Alm, 2006), cancer risk (Lord & Bralley, 2002). The main objective of the present study was to identify of the lipid content especially fatty acids in muscle tissue of *Perca fluviatilis* as one the source of omega-3 fatty acids in the south of the Caspian Sea.

2. Material and Methods

In this study, 30 perch samples were obtained of Anzali region in the south of Caspian Sea (Figure 2).

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 non- polar components. The

lipid in the chloroform layer is isolated using a separating funnel and then the solvent 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. It should be noted that the extraction and identification was performed separately for both sexes.

Figure2. Map of study area and location of sampling station in the South of the Caspian Sea.

3. Results

In the present study we investigated the Lipid content and fatty acid composition of the muscle tissue in both male and female species from *Perca fluviatilis* in the chloroform phase (Blight & Dyer, 1959).Results of this analysis are indicated in Tables 1 and 2.

Table1. The compound identified in the chloroform phase of muscle tissue from female *Perca fluviatilis* in the South of the Caspian Sea

Compound	MF	KI	% of total
Fatty acid			
Saturated fatty acid Palmitic acid (Hexadecanoic acid)	$C_{16}H_{32}O_2$	1853	19.9
Stearic acid (Octadecanoic Acid)	$C_{18}H_{36}O_2$	1921	9.25
Monounsaturated fatty Acid Oleic acid (9ZOctaecenoic Acid)	$C_{18}H_{34}O_2$	2093	23.64
Polyunsaturated fatty Acid Docosahexaenoic acid (DHA)	$C_{22}H_{32}O_2$	1942	25.25
Eicosapentaenoic acid (EPA)	$C_{20}H_{30}O_2$	1951	9.96
Ester			
Palmitic acid –methylester (Hexadecanoic acid, methyl ester)	$C_{17}H_{34}O_2$	1876	5.6
Stearic acid-methylester (Octadecanoic acid, methyl ester)	$C_{19}H_{38}O_2$	1934	3.63
Esterols			
Cholesterol (Cholesta-5en-3-ol (3.β)	$C_{27}H_{46}O_2$	1924	1.2
Alkane			
Hexadecane	$C_{16}H_{34}$	1610	1.57

MF: Molecular Formula KI: Kovats Index

Results of this research indicate that compounds identified are common between the two sexes such as saturated fatty acids Palmitic acid (19.9% in female and male 20.1%) and Stearic acid (9.25% in female and male 9.36%), monounsaturated fatty acid Oleic acid (23.64% in female and male 23.78%), polyunsaturated fatty acids docosahexaenoic acid (25.25% in female and male 25.38%) and eicosapentaenoic acid (9.96% in female and male 10.2%), two esters of fatty acid consist Palmitic acid –methylester (5.6% in female and male 5.7%), and Stearic acid-methylester (3.63% in female and male 3.7%), Cholesterol (1.2% in female and male 1.4%) and Hexadecane(1.57% in female and male 0.38%).

Table2. The compound identified in the chloroform phase of muscle tissue from male *Perca fluviatilis* in the South of the Caspian Sea

Compound	MF	KI	% of total
Fatty acid			
Saturated fatty acid Palmitic acid (Hexadecanoic acid)	$C_{16}H_{32}O_2$	1853	20.1
Stearic acid (Octadecanoic Acid)	$C_{18}H_{36}O_2$	1921	9.36
Monounsaturated fatty Acid Oleic acid (9ZOctaecenoic Acid)	$C_{18}H_{34}O_2$	2093	23.78
Polyunsaturated fatty Acid Docosahexaenoic acid (DHA)	$C_{22}H_{32}O_2$	1942	25.38
Eicosapentaenoic acid (EPA)	$C_{20}H_{30}O_2$	1951	10.2
Ester			
Palmitic acid – methylester (Hexadecanoic acid, methyl ester)	$C_{17}H_{34}O_2$	1876	5.7
Stearic acid-methylester (Octadecanoic acid, methyl ester)	$C_{19}H_{38}O_2$	1936	3.7
Esterols			
Cholesterol (Cholesta-5en-3-ol (3.β)	$C_{27}H_{46}O_2$	1924	1.4
Alkane			
Hexadecane	$C_{16}H_{34}$	1610	0.38

MF: Molecular Formula KI: Kovats Index

4. Discussions

Results of in this study showed that the muscle tissues of female and male *Perca fluviatilis* are rich in Omega-3 fatty acid docosahexaenoic (25.25-25.38%). Docosahexaenoic acid (DHA) is a primary structural component of the human brain cerebral cortex, sperm, testicles and retina. It can be synthesized from alpha-linolenic acid or obtained directly from maternal milk or fish oil (Guesnet & Alessandri, 2011). Researches show that Docosahexaenoic acid (DHA) reduce inflammation

(Kato et al., 2002) and may help lower risk of chronic diseases such as heart disease,cancer, arthritis (Shaikh, 2008) and Alzheimer's disease (Quinn, 2010). Comparison of the results of this study and similar studies by Xu & Kestemont (2002) ,Blanchard et al (2005) and Orban et al (2007) on *Perca fluviatilis* indicated that the dominant fatty acid was docosahexaenoic acid (DHA).

This supports the effectiveness of using seafood such as *Perca fluviatilis* in health.

In the present study, the next dominant fatty acid was Oleic acid (23.64-23.78%). Oleic acid is essential to the human body but technically not an essential fatty acid, because humans can manufacture a limited amount. Other essential fatty acids would have to be present for the body to be able to produce oleic acid. Oleic acid also known, as Omega 9 fatty acid, is a mono-unsaturated fatty acid that is found in almost all natural fats. Oleic acid lowers the risk of a heart attack, arteriosclerosis, and aids in cancer prevention (Teres et al., 2008).

In similar studies Jankawska et al (2010) and Reffel et al (2006) found that the dominant monounsaturated fatty acid in *Perca fluviatilis* was Oleic acid.

In this research, Palmitic acid is the next dominant fatty acid (19.9-20.1%) and it is one of the most common saturated fatty acids found in animals and plants. Recently, a long-acting antipsychotic medication, paliperidone palmitate (marketed as INVEGA Sustenna), used in the treatment of schizophrenia, has been synthesized using the oily palmitate ester as a long-acting release carrier medium when injected intramuscularly.Also Retinyl palmitate is a synthetic alternate for retinyl acetate in vitamin A supplements, and is available in oily or dry forms (Anneke et al, 2006). In similar studies,Mairess et al (2006) ,Jankawska et al (2010) and Reffel et al (2006) found that the dominant saturated fatty acid in *Perca fluviatilis* was palmitic acid. The amounts of alkanes are identified in male and female species; this is environmental pollution in the area.

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