



Short Communication

Evaluation of Omega-3 Fatty Acids Composition in Caspian Sea Pike Perch (*Sander lucioperca*)

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ABSTRACT

The fish oil in addition to useful food is a source of energy, rich in various types of polyunsaturated fatty acids including essential fatty acids like omega-3, keeps the blood cholesterol level low and thus helps in controlling the cardiovascular diseases. The present study was conducted to evaluate pike perch (*Sander lucioperca* L.) for its oil contents and presence of omega-3 (essential fatty acids). The results showed that the Pike Perch is a good source of polyunsaturated fatty acids and one of the best sources of omega-3. Average fat was 5.5% and total unsaturated fatty acids (UFA), omega-3 series and high unsaturated fatty acids (HUFA) were 63.63%, 8.46% and 8.31% respectively. By virtue for these attributes, the fish can be successfully used in preventing the cardiovascular diseases.

Key Words: Caspian Sea; Fatty acids; Omega-3; Pike perch; *Sander lucioperca*

INTRODUCTION

The flesh of fish contains desired amounts of protein, nutrient compositions and also valuable fat. Sea and freshwater fish, which constitute majority of water products, makes up an important part of animal food sources for humans. Fish is quite different from the other animal food sources, because they provide low energy and high-level proteins, which contain all essential amino acids. So they constitute beneficial nutritional sources (Ackman, 2005; Kandemir & Polat, 2007).

The abundance of the unsaturated fatty acids in fat is the most valuable characteristics of the fish (Hedayatifard & Moeini, 2007). Fats and oils are composed of different fatty acids and triesters of glycerol called triglycerides, which metabolize to generate energy. These fatty acids are obtained from dietary intake (Seidelin *et al.*, 1992; Gulzar & Zuber, 2000). In addition to energy purpose, every living cell needs essential fatty acids like omega-3 and omega-6. It has been observed that omega-3 essential fatty acids (EFAs) reduce the risk of atherosclerosis by lowering plasma triglyceride levels (Philipson *et al.*, 1985). Unsaturated omega-3 EFAs help in reducing the cholesterol level (Potter & Kiss, 1995) and stopping blood platelets from clinging to one another (Trubo & Carroll, 1997). It has been observed that fish oils are a good source of omega-3 EFAs (Ackman, 2005; Kandemir & Polat, 2007). Fish oils containing

omega-3 EFAs eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) show positive effect in prevention and therapy of cardiovascular diseases (Gulzar & Zuber, 2000, Hedayatifard & Moeini, 2003, 2007; Ackman, 2005). This study was conducted to determine the fatty acids composition of Caspian Sea fish pike perch *Sander lucioperca* (L.) with special emphasis on omega-3 essential fatty acid due to their importance from medical point of view.

MATERIALS AND METHODS

Seventy five numbers of pike perch (*Sander lucioperca* L.) were caught from the southern coasts of Caspian Sea in the Iranian waters. The samples were skinned, filleted and the oil was extracted by using chloroform and n-hexane 50:50 (V/V) (Shahid, 1987). The oils were analyzed for fatty acid profile by using gas liquid chromatograph (Shimadzu-A 14, Japan) with a flame ionization detector (FID) and attached to an integrator. The sample injected was 3 μ L with carrier gases He, H₂ and air 40, 40 and 500 mL min⁻¹ respectively, column temperature 190°C, injection port temperature 200°C and detection port temperature 210°C. Each sample was analyzed 3 times and its averages were calculated. The Tukey test and analysis of variation was used for the statistical analysis using the SPSS software.

RESULTS AND DISCUSSION

The variation in the amount of fatty acids in fish is affected by the fish species and their growth conditions (Hedayatifard & Moeini, 2007). Pike perch is one of the most valuable fishes due to its lipid and unsaturated fatty acid composition, (Table I; Fig. 1). Palmitic acid (C16:0) was a dominant saturated fatty acid (20.26%) in the pike perch fillet. The predominance of C16:0, C18:0, C18:1, C18:2 and C20:5 fatty acids in pike perch fillet may be attributed to the fish diets. Fatty acid composition of fish lipid was highly dependent on a number of factors, especially fish diets (Fowler *et al.*, 1994; Sathivel *et al.*, 2002; Şengü r *et al.*, 2003).

Levels of monoenoic fatty acids, such as, palmitoleic (C16:1) and oleic (C18:1) acids of the pike perch fillet oil were 4.56% and 39.39% respectively. The total monounsaturated fatty acid content was 43.95%. On the other hand, total polyunsaturated fatty acid content was 19.68% (Fig. 1). Average of fat in this fish was 5.5% and total unsaturated fatty acids (UFA), omega-3 series (n-3), omega-6 series (n-6) and high unsaturated fatty acids (HUFA) were 63.63%, 8.46%, 11.22% and 8.31%, respectively. The difference between ω-3 and ω-6 unsaturated fatty acids and between monoenoic and polyenoic fatty acids in the fillet were significant, statistically (P < 0.05).

Comparison the fatty acids in pike perch and the other fish defines the relation of its changes with the fish species, age and their life conditions (Table II). From this comparison, it was evident that Pike Perch *Sander lucioperca* can be successfully used for the cure/prevention of cardiovascular diseases. Omega-3 EFAs also play an important role in decreasing blood pressure and plasma rigidity, slow the breast and other types of cancer, after a 5–weeks administration of 4 – 8 capsules of fish oil corresponding to 1.26 to 2.5 g daily (Bach *et al.*, 1989).

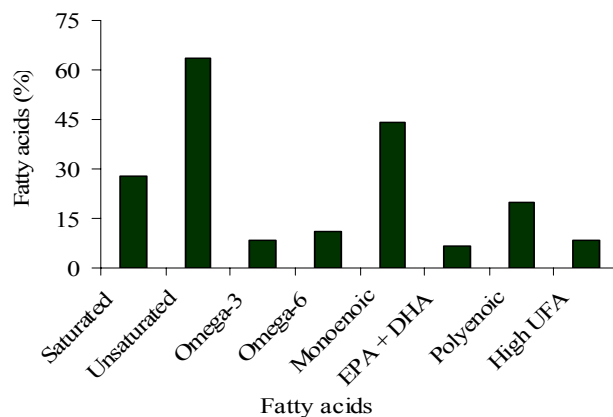
In conclusion, fatty acid compositions of pike perch fillet was the most abundant in fatty acids in fish and roe oil samples. This research work provided a very useful data about fatty acid composition (omega-3 essential fatty acids) and opened new avenues for further research in this field for the benefits of human beings.

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Table I. Fatty acid composition of Casian sea Pike Perch (g 100 g⁻¹ lipid)

Fatty Acids	Name	Concentration (%)	± SD
C14:0	Miristic	1.90	0.22
C16:0	Palmitic	20.26	1.13
C16:1	Palmitoleic	4.56	1.09
C18:0	Stearic	5.57	1.43
C18:1 ω-9	Oleic	39.39	0.14
C18:2 ω-6	Linoleic	9.35	0.24
C18:3 ω-3	α-Linolenic	1.84	1.26
C20:0	Arachidic	0.76	0.33
C20:4 ω-6	Arachidonic	1.69	0.34
C20:5 ω-3	EPA	6.02	0.31
C22:6 ω-3	DHA	0.60	0.32
Total		92.21	-

Fig. 1. Average of fatty acids series of Caspian Sea Pike Perch tissue (g 100 g⁻¹ lipid)



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Table II, The fatty acids composition in Caspian Sea Pike Perch and some bony fishes (g 100 g⁻¹ lipid)

Fish and shellfish	C14:0	C16:0	C16:1	C18:0	C18:1	C18:2	C18:3	C20:4	C20:5	C22:6	Reference
<i>Sander lucioperca</i>	1.90	20.26	4.56	5.57	39.39	9.35	1.84	1.69	6.02	0.6	Present study
<i>Acipenser stellatus</i>	1.83	7.39	20.16	1.44	43.71	3.39	7.75	0.51	5.36	3.53	Hedayatifard & Moeini, 2007
<i>Acipenser persicus</i>	1.77	6.73	17.75	1.23	45.11	3.59	2.80	2.16	4.75	2.21	Hedayatifard & Moeini, 2003
<i>Mastacembelus armatus</i>	0.80	22.08	-	-	28.02	10.56	-	-	-	1.99	Gulzar & Zuber, 2000
<i>Labeo calbasuo</i>	14.70	-	39.08	43.86	-	-	-	-	-	0.89	Gulzar & Zuber, 2000
<i>Cyprinus carpio</i>	1.42	15.71	5.00	5.71	20.00	5.71	1.42	2.85	5.71	4.28	Aggelousis & Lazos, 1991
<i>Salmo salar</i>	2.40	11.20	3.80	4.50	24.00	3.10	5.20	4.7	5.70	19.8	Exler, 1987
<i>Onchorhynchus mykiss</i>	2.72	12.40	2.27	10.59	21.78	2.72	2.42	2.87	3.02	8.01	Exler, 1987
<i>Liza aurata</i>	5.42	14.39	2.14	17.22	17.09	5.96	8.72	1.49	2.44	3.52	Hedayatifard <i>et al.</i> , 2002
<i>Mugil cephalus</i>	3.30	20.30	13.90	1.70	10.80	1.60	0.30	3.60	0.70	1.60	Şengü r <i>et al.</i> , 2003

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