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Determination of Total Lipid and Fatty Acid Composition of Pearl Mullet (*Chalcalburnus tarichi*, Pallas 1811)

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Abstract

Total lipid content and fatty acid composition of pearl mullet, which is an endemic species occurring in Lake Van, Eastern Anatolia, Turkey, and the streams feeding the Lake, were investigated. Average total lipid content of samples collected in September and November 2012 and January 2013 was 2.19g. Average ∑SFA, ∑MUFA and ∑PUFA were determined as 21.88% (0.41g/100g), 44.37% (0.85g/100g) and 29.19% (0.57g/100g), respectively. Predominant SFA and MUFA were Palmitic acid (16:0) 12.9% (0.25g/100g) and Oleic acid (18:1n-9) 27.2% (0.53g/100g) in order. Average ∑n-3 and DHA+EPA values were calculated as 23.88% (0.46g/100g), and 17.07% (0.33g/100g) respectively. Recommended as a good index in revealing the nutritional value of fish, n-3/n-6 ratio was calculated as 3.70g/100g in average. As a result, possessing especially high values of DHA and EPA, pearl mullet found to be a rich source of n-3.

Keywords: İnci kefali, pearl mullet, fatty acid, EPA, DHA.

İnci Kefalinin (*Chalcalburnus tarichi*, 1811) Toplam Lipit ve Yağ Asitleri Kompozisyonunun Belirlenmesi

Özet

Çalışmada Türkiye'nin Doğu Anadolu Bölgesinde yer alan Van Gölü ve bu gölü besleyen akarsularda endemik olarak yaşayan inci kefalinin toplam lipit ve yağ asitleri kompozisyonu belirlenmiştir. Örnekler Eylül-Kasım 2012 ve Ocak 2013 aylarında toplanmıştır ve bu üç aya ait ortalama toplam lipit miktarı 2,19g olarak hesaplanmıştır. Ortalama toplam doymuş yağ asitleri (∑SFA), tekli doymamış yağ asitleri (∑MUFA) ve çoklu doymamış yağ asitleri (∑PUFA) sırasıyla %21,88 (0,41g/100g), %44,37 (0,85g/100g) ve %29,19 (0,57g/100g) olarak belirlenmiştir. Palmitik asit (16:0) %12,9 (0,25g/100g) ve oleik asit (18:1n-9) %27,2 (0,53g/100g) dominant SFA ve MUFA'yı oluşturmaktadır. Ortalama ∑n-3 ve DHA+EPA değerleri sırasıyla %23,88 (0,46g/100g), ve %17,07 (0,33g/100g) olarak hesaplanmıştır. Balıklarda iyi bir indeks olarak tanımlanan n-3/n-6 oranı ise ortalama 3,70g/100g olarak belirlenmiştir. Sonuç olarak barındırdığı özellikle yüksek değerlerdeki DHA ve EPA miktarları ile inci kefali iyi bir n-3 kaynağı olarak belirlenmiştir.

Anahtar Kelimeler: İnci kefali, pearl mullet, yağ asitleri, EPA, DHA.

Introduction

Fish, containing high quality of protein, vitamin D, minerals such as iodine, taurine, selenium and omega-3 fatty acid, is an excellent food source.

Nowadays it is known that the essential fatty acid (EFAs) of the omega-6 series, especially linoleic acid (LA), C18:2n-6 and arachidonic acid (AA), C20:4n-6, and the omega-3 series especially linolenic acid (LNA), C18:3n-3, eicosapentaenoic acid (EPA), C20:5n-3 and docohexaenoic acid (DHA), C22:6n-3 are essential for development and growth, and they play a key role in the prevention and management of coronary heart diseases, hypertension, diabetes, arthritis, cancer and other inflammatory and autoimmune conditions (Gebauer *et al.*, 2006; Simpoulos, 2009). Rey G´omez-Serranillos *et al*. (2004) stated that 18:1 chould reduce blood total chlesterol and low density lipoprotein but not high density lipoprotein.

The amount of lipids and fatty acid composition in fish is known to be influenced by various factors in different species or within a species, such as geographical region, season, feeding habits and diet, age, sex, spawning period etc. Total lipid and fatty acid composition data are important for nutritionists and food scientists; to help them in dietary formulations, nutrient labeling, processing and

product development, pharmaceutics; production of medicine, aquaculturists; production of feed, rearing fish species etc. (Ackman, 1989). Fatty acid composition of different fish species from different regions are available in literature (Moreira *et al.*, 2001; Haliloğlu *et al.*, 2004; Özyurt *et al.*, 2007; Özoğul *et al.*, 2007; Thammapat *et al.*, 2010; Özden, 2010; Köse *et al.*, 2010; Tufan *et al.*, 2011; Jahkar *et al.*, 2012; Çakmak *et al*., 2012).

Lake Van is the fourth largest terminal and the largest soda lake on earth with the surface area 3574km^2, total volume 607km^3 and maximum depth 450m, and it is the largest lake of Turkey. It is situated at 1648 m above sea level in eastern Anatolia, Turkey (Sarı, 2001). Lake Van water is highly alkaline 153 meq l−1 with a pH up to 9.8, salinity 22% (Landmann *et al.*, 1996).

The endemic, anadromous cyprinid pearl mullet is the only fish species known to occur in alkaline Lake Van (Eastern Anatolia, Turkey) (Danulat and Selçuk, 1992). It migrates to rivers for spawning in spring, returns to lake for feeding in winters. When reachs to total length 18-20cm, pearl mullet is caught by trammel nets. Reproduction begins middle of May continues up to middle of June (Çetinkaya and Elp, 1995). Similar to other members of Cyprinidae family, pearl mullet fed mainly on plankton (Selçuk, 1993). Chrinomids and copepods are the main sources of food of the fish (Akgül, 1980; Selçuk, 1993; Danulat and Selçuk, 1992; Sarı, 1997; 2001).

Pearl mullet is an economically important food source consumed by the people in Eastern Anatolia region. According to Turkish Statistical Institute (TUIK) 2012, annual catch value of pearl mullet was 11 382 tons in 2011 which meets 28% of total fresh water catch value in Turkey. It is consumed as fresh and salted (Ergun *et al.*, 1992). Gürgün (2006) stated that the consumption of pearl mullet is takes the first place with 59.1% among other species in localities around Lake Van. Meat yield of this species is average 63.73% (Özdemir *et al.*, 1985).

There are some studies on bio-ecological properties, length-weigh relationships and condition, growth, gonad development, egg, stock assessment, processing, meat yield of pearl mullet (Akgül, 1980; Özdemir, 1982; Akyurt *et al*., 1985; Çetinkaya and Elp, 1995; Danulat and Selçuk, 1992; Sarı, 1997; Odabaşoğlu, 1993; Küçüköner, 1990). There is no data exist in literature on fatty acid composition of pearl mullet except Ergun *et al*. (1992).

In this study it is aimed to investigate the total lipid and the fatty acid composition of pearl mullet which is the only fish species occurring in Lake Van and economically important species caught and consumed in large amounts by regional people.

Table 1. Total length and total weight of the pearl mullet samples used in this study (±standard deviation, n=50 monthly)

Months	Mean Total length (cm)	Mean Total weight (g)
September	18.49±0.37	94.05±4.64
November	19.93±1.10	88.08±7.06
January	20.14±2.44	97.02±12.32
Mean	19.52±1.05	93.05±3.93

Materials and Methods

Obtained from fish market in Van, in September-November 2012 and January 2013, fish samples (n=50, monthly) were introduced into polystyrene box with ice, transferred to the Central Fisheries Research Institute, processing laboratory. Reaching to the institute, length and weight measurements were taken (Scale with 0.1mm sensitivity was used for length measurement and Presica BJ4100D, max:4100g d:0,1g for weight measurement)

Total length and weigh of the samples were given in Table 1. After removing head, viscera, and skin, flesh was filleted. Filleted flesh homogenized with blender. This homogenate was used for total lipid analysis. AOAC, 1995 procedure was applied for lipid analysis and Ichihara *et al.* (1996) method for fatty acid composition analysis.

Lipid Analysis

Approximately 10g of homogenate was weighted into cartridge (Mettler Toledo AG245 Dual range Analytical Balance with Readability-0.1mg/0.01mg was used for weight) and dried in oven at 105°C for 2 hours. Removed from the oven cartridges were cooled to room temperature. Cotton was covered the mouth of the cartridges. After that cartridges were put into extraction tubes. Dried and weighted extraction balloons were attached to the extraction device. Diethyl ether used as solvent, added into tubes. Extraction completed approximately in 4-5 hours. Balloons were dried in oven for about 45 min. After cooling to room temperature in desiccator balloons were weighted.

Fatty acid Analysis

For the analysis of fatty acid methyl esters, 0.1g of lipid weighted into 5ml tube with screw cap, adding 2ml hexane it was dissolved, it followed by 0.2ml 2N methanolic KOH. Tube was vortexed 30 second and waited for a while, up to the upper layer clarified. Clarified hexane solution was put into vials and analyzed in duplicate by gas chromatography method (GC).

Gas Chromatography Condition

The fatty acid composition analysed by GC-17 A GC Shimadzu (with FID- flame ionization detector) capillary column Supelco Omega wax 320

(30mx0.32mm), oven temperature of column was 240°C, Helium (He) (30 ml/min) was the carrier gas. Temperature of detector was 250-260°C, temperature of injection block was 250°C. Flow rate of total gas was 50 ml, Split ratio was 1/25, range 1. Hexane was used as solvent and it was adjusted as pour 1µl sample for each time. Supelco™ 37 Component FAME Mix (Cat. No. 47885-U) was used as standard. Three replicate GC analyses were applied and the results were represents in GC area percent as mean values ±standard deviation. The absolute amount of fatty acid g/100 g edible muscle was calculated according to Greenfield and Southgate (2003).

Statistical Analysis

The obtained data were subjected to analysis of variance (ANOVA) and if significant differences were found, comparisons among means were carried out by using Tukey test ($P<0.05$) by JMP 5.0.1 (SAS Institute Inc., Cary, NC, USA) (Sokal and Rohlf, 1987). Data are presented (mean±sd) in Table 3 and Table 4.

Results and Discussion

The amount of lipids in fish is known to be influenced by several factors such as species, geographical region, season feeding habit and diet etc. However, nutritional differences are not only a consequence of inter-species differences, but also intra-species differences related to seasonality and degree of maturity (Gruger, 1967; Farkas, *et al.*, 1980; Özyurt and Polat, 2006; Saito *et al.*, 1999; Ackman, 1989; Nettleton, 1985).

Total lipid contents of pearl mullet which sampled in September, November and January were 1.66, 1.55 ve 3.35 g/100g respectively. January was significantly different from others ($P<0.05$). Average lipid content was calculated as 2.19g/100g (Table 2). This value shows that pearl mullet is a semi-fat fish (Polish Standard PN-A-86770, 1999). It was recorded in several articles that most of freshwater fish species were low in fat (Kinsella, 1987; Özoğul *et al.*, 2007; Çelik *et al.*, 2005).

According to the obtained results, pearl mullet flesh has fatty acid levels changing from 0.3% to 27%. The fatty acid composition of fish is presented in Table 3 (% of total fatty acid methyl esters (FAME)) and Table 4 (g/100g). Average total saturated fatty acid (∑SFA), monounsaturated fatty acid (∑MUFA) and polyunsaturated fatty acid (∑PUFA) were 21.88% (0.41g/100g), 44.37% (0.85g/100g) and 29.19% (0.57g/100g), respectively. Value (%) of SFA in September was differed from others significantly ($P<0.05$). Palmitic acid (16:0) was the prominent SFA contributing approximately 60% of the total saturated fatty acid. Average total value of (16:0) was calculated as 12.9% (0.25g/100g). Palmitic acid was followed by stearic acid (18:0) (3.73%, 0.07g/100g) and mryistic acid (14:0) (3.12%, 0.06g/100g). There is only one research on fatty acid composition of pearl mullet studied by Ergun *et al.*, 1992 but their resuts are different from our resutlts, they found 16:0 as 9.23%. They only studied on 36 samples of September 1992, and used (Folch *et al.*, 1957) method for total lipid analysis and different methods (Anonim, (1973): Beckman GC-55 and GC-65 Gas Chromatographs Operator's Manual etc.) for analysis of fatty acid methyl esters. These effects may be caused the differences with our results. Özyurt *et al.*, (2007) studied on *Liza ramada* which is in the same family with pearl mullet, they determined 16:0 as approximately 60% of total SFA for 3 age groups which are similar to our results. Çakmak *et al.* (2012) found SFA for *V.vimba tenelle* and *C. capoeta* as 23.45% and 21.36% respectively, as belonging the same family fishes living in Lake Sugla these results are also similar to our results.

Hedayatifard and Yousefian (2010), investigated fatty acid profile of golden mullet (*Liza aurata*) which is one of the mullet species, inhabiting Caspain Sea. The study was carried out in winter 2007, and they found ΣSFA, ΣMUFA and ΣPUFA as 35.19%, 53.49%, and 7.13%, respectively. Similarly, Cengiz *et al.* (2010), examined fatty acid compositions of some fresh water fish species living in Tigris River, Turkey, Abu mullet (*Liza abu*) was one of the studied species, ΣSFA, ΣMUFA and ΣPUFA values of this species were 48.94%, 41.34%, and 9.75% in order. Köse *et al.* (2010), investigated fatty acid profile and proximate composition of Pacific mullet (*Mugil so-iuy*) caught in the Black Sea. According to the results of their study, they found overall total values of SFA, MUFA, PUFA in muscle samples as 29.59, 29.26, 18.06% respectively. Although belonging to the same family with pearl mullet; Golden mullet, Abu mullet and Pacific mullet demonstrated different fatty acid profiles. As a result, our findings showed that pearl mullet is a better source of PUFA than these three fish species.

Oleic acid (18:1n-9) was the dominant fatty acid among all fatty acid and corresponded 60% of MUFA, average value of it was 27.2% (0.53g/100g). Oleic acid was recorded as the predominant fatty acid in *C. carpio* (Dönmez, 2009). It was recorded in many previous studies that high ratio of 18:1n-9 is one of the distinguishing features of freshwater fish species, (Moreira *et al.*, 2001; Güler *et al.*, 2008; Haliloğlu *et al.*, 2004; Rahman *et al.*, 1995; Özogul *et al*., 2007a).

Table 2. Changes of total lipid values of muscle of pearl mullet (w/w %)

Months	Total Lipid
September	1.66±0.07
November	1.55±0.04
January	3.35±0.55
Mean	2.19±1.07

±standard deviation (n:3)

Table 3. Fatty acid composition in edible muscle of pearl mullet (% total FAME)

Fatty Acids	September	November	January	Mean
14:0	3.27±0.03a	3.16±0.01ab	2.93±0.13b	3.12±0.17
15:0	0.35±0.01a	0.34±0.02a	0.35±0.01a	0.35±0.01
16:0	13.74±0.02a	12.53±0.00ab	11.86±0.50b	12.90±0.88
17:0	0.97±0.01a	0.88±0.01b	0.85±0.03b	0.90±0.06
18:0	4.18±0.05a	3.66±0.01b	3.37±0.16b	3.73±0.37
20:0	0.66±0.01a	0.60±0.01b	0.55±0.02b	0.60±0.05
22:0	0.47±0.02a	0.45±0.00a	0.49±0.03a	0.47±0.02
∑SFA	23.63±0.15a	21.61±0.30b	20.40±1.30b	21.88±1.11
15:1n-5	0.32±0.01a	0.31±0.01a	0.32±0.01a	0.32±0.01
16:1. n-7	13.33±0.28a	13.36±0.01a	13.18±0.34a	13.29±0.21
17:1n-8	0.64±0.02a	0.63±0.01a	0.63±0.01a	0.63±0.01
18:1. n-9	26.34±0.06a	27.61±0.01b	26.48±0.70b	26.81±4.20
20:1. n-11	0.83±0.00a	0.92±0.00a	0.71±0.11a	0.82±0.11
22:1. n-9	1.74±0.00a	1.98±0.00ab	2.16±0.16b	1.96±0.20
24:1. n-9	0.54±0.05a	0.51±0.00a	0.57±0.08a	0.54±0.05
∑MUFA	43.74±0.24a	45.32±0.02a	44.05±1.09a	44.37±0.88
18:2. n-6	3.47±0.01a	3.14±0.01b	2.67±0.06c	3.09±0.36
18:3. n-3	0.61±0.01a	0.86±0.00b	0.83±0.04b	0.77±0.12
18:3. n-6	1.41±0.01a	1.67±0.01b	1.51±0.08ab	1.53±0.12
20:4. n-6	1.60±0.00a	1.69±0.01a	1.74±0.11a	1.68±0.08
20:5. n-3	9.11±0.01a	8.81±0.03a	8.49±0.52a	8.80±0.36
22:5. n-3	5.27±0.02a	5.13±0.06a	5.35±0.42a	5.25±0.22
22:6. n-3	8.89±0.04a	7.81±0.08a	7.57±0.32a	8.09±0.69
∑PUFA	30.34±0.04a	29.09±0.16a	28.16±0.41a	29.19±0.68
Others	2.29±0.13a	3.98±0.44a	7.39±4.53a	4.56±1.31a
∑n-3	23.88±0.06a	22.61±0.17a	22.24±0.41a	22.91±1.06
∑n-6	6.47±0.01a	6.50±0.01a	5.91±0.25a	6.30±0.31
∑n-3/n-6	3.70±0.02a	3.48±0.12a	3.76±0.04a	3.63±0.01
∑n-6/n-3	0.27±0.00a	0.29±0.00a	0.27±0.01a	0.27±0.01
DHA+EPA	18.00±0.05a	16.62±0.11a	16.64±0.37a	17.07±0.74
PUFA/SFA	1.32±0.05a	1.38±0.01b	1.39±0.03b	1.37±0.03b

ΣSFA; Total saturated fatty acids. ΣMUFA; total monounsaturated fatty acids. ΣPUFA;total polyunsaturated fatty acids Mean±SD values in the same line followed by different letters (a.b.c) are significantly different (P<0.05). n:3

Oleic acid was followed by (16:1n-7) with average 13.29% (0.26g/100g). Ackman (1989) defined that highest values of palmitoleic acid (16:1n-7) is one of the characteristics of freshwater fish species. Our results are in agreement with the literature in this regard. EPA has the highest proportion (average 8.80%, 0.17g/100g) among PUFA. It was followed by DHA, DPA, LA (18:2n-6) and AA (20:4n-6) average 8.31% (0.16g/100g), 5.25% (0.10g/100g), 3.09(0,06g/100g) and 1.68% (0.045g/100g) in order. In this research, the PUFA contents generally higher than the SFA. A minimum value of PUFA/SFA ratio recommended as 0.45 (HMSO, 1994) to prevent cardiovascular diseases. In this study, average ratio of PUFA/SFA was calculated as 1.37 which is higher than recommendation HSMO, (1994). Özoğul *et al.* (2007a) recorded that PUFA/SFA ratio is between 0.78 to 1.56 in frestwater fish. The results that obtained in our study are appropriate with this explanation and some other research results (Çelik *et al.*, 2005; Güler *et al.*, 2008)

Average omega-3 PUFA and DHA+EPA values were calculated as 23.88% (0.46g/100g), and %17.07 (0.33g/100g) respectively. Hedayatifard and Yousefian (2010) found Σn-3 content of golden mullet as 6.62%. Cengiz *et al*., (2010) determined Σn-3 content of abu mullet as 3.90%. When comparing with these results, present study indicates that pearl mullet is a good source of n-3 fatty acids. Küçükgülmez *et al.* (2011), investigated proximate composition and fatty acid composition of keeled mullet (*Liza carinata*) from the north east Mediterranean Sea, in January, they found ΣPUFA and DHA+EPA as 26.96% and 19.47%, in order. These ruslts were approximately similar to present studies results. Güler *et al*. (2008) calculated DHA+EPA as 11.2% in carp (*Cyprinus carpio,* L) living in Lake Beyşehir in winter season, on the other hand, Csengeri and Farkas (1993) determined DHA+EPA as 15.3%. Özyurt *et al.* (2007) founded DHA+EPA as 0.39g/100g and 0.29g/100g in thinlip grey mullet, for ages 2 and 4 respectively. Our results were in accordance with these results. At present, there are several series of recommendations regarding the consumption of omega-3 FAs, developed by scientific societies and national and international organizations. Many countries have recommended daily EPA and DHA intake levels ranging from 500 mg/day in France to 1-2 g/day in Norway (Gomez *et al.*, 2011). World Health Organization (WHO) recommends the consumption of DHA+EPA between 0.3-0.5 g/day (Kris-Etherton *et al.*, 2013). The

Tablo 4. Fatty acid composition of edible meat of pearl mullet (g/100g)

Fatty Acids	September	November	January	Mean
14:0	0.05±0.00a	0.04±0.00 a	0.09±0.00 a	0.06±0.02 a
15:0	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a
16:0	0.21±0.00 a	0.17±0.00 a	0.36±0.02b	0.25±0.09c
17:0	0.01±0.00 a	0.01±0.00 a	0.03±0.00 a	0.02±0.01 a
18:0	0.06±0.00 a	0.05±0.00 a	0.10±0.00 a	0.07±0.03 a
20:0	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a
22:0	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a
ΣSFA	0.35±0.00a	0.30±0.00b	0.59±0.03c	0.41±0.15d
15:1n-5	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a	0.01±0.00 a
16:1. n-7	0.20±0.00a	0.19±0.00a	0.40±0.01b	0.26±0.11c
17:1n-8	0.01±0.00a	0.01±0.00a	0.01±0.00a	0.01±0.00a
18:1. n-9	0.39±0.00a	0.39±0.00a	0.80±0.00b	0.53±0.11c
20:1. n-11	0.01±0.00a	0.01±0.00a	0.02±0.00b	0.02±0.00b
22:1. n-9	0.03±0.00a	0.03±0.00a	0.06±0.00b	0.04±0.02a
24:1. n-9	0.01±0.00a	0.01±0.00a	0.02±0.00a	0.01±0.01a
ΣMUFA	0.65±0.00a	0.64±0.00a	1.31±0.05b	0.86±0.35c
18:2. n-6	0.05±0.00a	0.04±0.00a	0.08±0.00a	0.06±0.02a
18:3. n-3	0.01±0.00a	0.01±0.00a	0.02±0.00a	0.02±0.01a
18:3. n-6	0.02±0.00a	0.02±0.00a	0.05±0.00b	0.03±0.01ab
20:4. n-6	0.02±0.00	0.02±0.00	0.05±0.00	0.03±0.01
20:5. n-3	0.14±0.00a	0.12±0.00a	0.26±0.02b	0.17±0.07a
22:5. n-3	0.08±0.00a	0.07±0.00a	0.16±0.01b	0.10±0.05a
22:6. n-3	0.13±0.00ab	0.11±0.00b	0.23±0.02c	0.16±0.06a
ΣPUFA	0.45±0.00a	0.40±0.00a	0.85±0.06b	0.57±0.22a
Σn-3	0.40±0.00	0.32±0.00	0.67±0.05	0.46±0.17
Σn-6	0.10±0.00	0.10±0.00	0.17±0.01	0.12±0.04

ΣSFA; Total saturated fatty acids. ΣMUFA; total monounsaturated fatty acids.ΣPUFA;total polyunsaturated fatty acids Mean±SD values in the same line followed by different letters (a.b.c) are significantly different (P<0.05), n:3

recommended omega-3 PUFA in a day is 0.45 g (Testi *et al.,* 2006). According to our results pearl mullet is a good source of omega-3 and DHA+EPA. Nutritionists emphasis the importance of keeping low n-6/n-3 ratio in diet for the prevention of atherosclerosis and many chronic diseases (Simpolous, 2009; Polak-Juszczak and Komar-Szymczak, 2009). Also, HMSO (1994) reported that the ideal rate of n-6/n-3 in diet should be maximum 4.0 the values higher then this one would be detrimental for the health and may promote cardiovascular diseases. In our study, average Σn-6/n-3 was found as 0.27. Comparing to some marine fish species studied by Özoğul and Özoğul (2007a) bogue (*boops boops*) (0.05), mullet (*mugil cephalus)* (0.12), sardine *(sardinella aurita)* (0.11) and scad *(trachurus mediterraneous)* (0.04) and some fresh water species studied by Uysal *et al.,* (2008) *Barbus plebejus escherichi* (0.37) *Capoeta capoeta capoeta* (0.37) *and Rutilus rutilus* (0.56) n-6/n-3 ratio of our study was higher than marine species, lower than freshwater species, as a result, being under the maximum recommended value, consumption of pearl mullet has an advantageous impact on maintaining the necessary dietary n-6/n-3 ratio at the recommended level. Revealing the nutritional value of fish, n-3/n-6 is recommended as a good index (Pigott and Tucker, 1990). An increase in n-3/n-6 rate is essential in the human diet to aid prevention of coronary hearth diseases by reducing plasma lipids and to reduce cancer risk (Kinsella, *et al.,* 1990). Also it seems

effective in preventing shock syndrome and cardiomyopathy (Bell *et al.,* 1991). N-3/n-6 ratio was calculated as 3.70 in our study. Küçükgülmez *et. al* (2011) calculated n-3/n-6 ratio as 3.15 for keeled mullet inhabiting in North East Mediterranean Sea, our result is in accordance with this study. Güler *et al.,* (2008) found n-3/n-6 ratio as 1.06 on carp (*Cyprinus carpio,* L) in winter season.

As considering the facts that the only fish species occuring in Lake Van, pearl mullet is an economically important fish species being a valuable protein source with 11 382 tons annual catch value, consumption ratio as 59.1% among other fish species, in the Eastern Anatolia region. It was very important to find out the total lipid and fatty acid composition of this fish. Consuming in high amounts by the regional people, it is a good source in human healthy diet especially having good amounts of omega-3, especially DHA, EPA and ratios of n-3/n-6 and PUFA/SFA that included in the recommendations made by national and international foundations and researches.

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