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Proximate and Fatty Acid Composition of the Keeled Mullet *(Liza carinata)* from the North East Mediterranean Sea

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Abstract

The proximate composition and the fatty acid profile of keeled mullet (*Liza carinata*) caught off the Yumurtalik Bay located on the North-East Mediterranean Sea were investigated. The average crude protein content of keeled mullet was found to be 17.18%, while the lipid content was determined as 1.53 %. The percentages of total saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and the polyunsaturated fatty acids (PUFA) were found as 41.64%, 16.78% and 26.96 %, respectively. Palmitic acid, stearic acid and lignoceric acid among the saturated fatty acids; palmitoleic acid and oleic acid among the monounsaturated fatty acids; and arachidonic acid, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) among the polyunsaturated fatty acids, were identified as the major fatty acids. The average EPA content was 10.99% whereas the average DHA content was 8.48%.

Key Words: *Liza carinata*, Proximate composition, Fatty acid, Yumurtalik Bay

INTRODUCTION

Mullets (family: Mugilidae) are one of the quite important species which are cultured in many countries and that are distributed in the worldwide, due to the facts that they have high tolerance for salinity and temperature, and that their flesh is of high quality. The family Mugilidae, which includes a total of 17 genus and 80 species in the world, has eight species in the Mediterranean Sea [1, 2].

Among these species, keeled mullet (*Liza carinata*) is a lessepsian immigrant species and has recently invaded a region in the Eastern Mediterranean ranging from the Red Sea to the Suez Canal [2]. Keeled mullet is a pelagic and euryhaline species which passes into lagoons and estuaries with thick vegetation in spring; and into deep coastal waters in winter. Spawning takes place between August and October. This species, which feeds on benthic algae and small molluscs, very well tolerates the temperature and salinity variations along the coast of Turkey [3].

Keeled mullet, which is caught off Iskenderun Bay and Mersin Bay, is a favourite for and consumed fresh by the local population; and most of the time, it is domestically marketed. Although numerous studies exist regarding the nutrient and fatty acid composition of other mullet species caught off various regions [4-10], the number of studies about the proximate and fatty acid composition of keeled mullet is rather insufficient. For this reason, the aim of the present study is to determine the proximate and fatty acid composition of keeled mullet.

MATERIALS AND METHODS

In this study, keeled mullets (*Liza carinata*, Valenciennes 1836) were caught from the Yumurtalik Bay located on the North-East Mediterranean Sea in January. Immediately after catching, they (with average length 14.53±0.32 cm and weight 33.18±1.58 g) were covered with ice in an insulated box and transferred to the laboratory on the same day. After the viscera were removed, the fish were filleted and homogenized.

The homogenized samples were subjected to moisture and ash analyses using the AOAC [11] methods. The crude protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method [11]. On the other hand, the lipid content was determined by the method of Bligh and Dyer [12].

The fatty acid methyl esters were prepared using the method proposed by Ichihara *et al.* [13] with a minor modification – through transmethylation making use of n-hexane and 2 M KOH in methanol. The fatty acids were analyzed by a GC Clarous 500 with auto sampler (Perkin-Elmer, USA) equipped with a flame ionization detector and a fused silica capillary SGE column (30 m x 0.32 mm ID x 0.25 µm BP20 0.25 UM, USA). The oven temperature was 140ºC, held 5 min, raised to 200ºC at 1ºC/min, while the injector and the detector temperatures were set at 220 and 280ºC, respectively. The sample size was 1 µl and the carrier gas was controlled at 16 ps. The split used was 1:100. Fatty acids were identified by comparing the retention times of FAME with the standard 37 component FAME mixture.

The statistical analysis was performed using the software SPSS (SPSS Inc., Chicago IL).

RESULTS AND DISCUSSION

Proximate Composition

Table 1 shows the proximate composition results of keeled mullet. The water, crude protein, lipid and crude ash contents were found to be 79.81%, 17.18%, 1.53% and 1.21%, respectively. Similarly, the protein, lipid, moisture and ash contents were determined, respectively, as 18.03-17.00%, 4.00-2.03%, 77-79.95% and 1.10-1.05% for *Liza carinata* and *Liza aurata* which caught from Iskenderun Bay [5]. In another seasonal study on *Liza aurata*, the protein, crude ash and moisture contents were found to show variations within, respectively, 16.09-18.40%, 1.13-1.37% and 78.45-79.83% [7]. A comparison reveals that the results of these studies are considerably close to those of ours. Ersoy [7] reported that the lipid content of *Liza aurata* manifested seasonal variation, with the lipid percentage being substantially low in December (0.13%) and much higher in September (4%). This shows parallelism with the finding in the present study that the lipid content of the keeled mullet caught in January was low.

Table 1: Proximate Composition of the Keeled Mullet (*Liza carinata*)"

Component	%
Moisture	79.81±0.21
Crude protein	17.18±0.90
Lipid	1.53±0.08
Crude ash	1.21±0.04

The values are expressed as mean SD, n=3

Fatty Acid Profile

The fatty acid profile of keeled mullet is presented in Table 2. According to this profile, total saturated fatty acids were of highest percentage (41.64%), followed by total polyunsaturated (26.96%) and monounsaturated (16.78%) fatty acids.

Palmitic acid (C16:0), stearic acid (C18:0) and lignoceric acid (C24:0) among the saturated fatty acids; palmitoleic acid (C16:1 n-7) and oleic acid (C18:1 n-9) among the monounsaturated fatty acids; and arachidonic acid (C20:4 n-6), eicosapentaenoic acid (EPA, C20:5 n-3) and docosahexaenoic acid (DHA, C22:6 n-3) among the polyunsaturated fatty acids were the predominant fatty acids. Although no other study was encountered regarding the fatty acid profile of keeled mullet, Özyurt *et al.* [8] determined the primary fatty acids of thinlip grey mullet (*Liza ramada*) to be palmitic acid, stearic acid, oleic acid, arachidonic acid, eicosapentaenoic acid and docosahexaenoic acid. On the other hand, it was reported in another study that the dominant fatty acids of flathead grey mullet (*Mugil cephalus*) were palmitic acid, palmitoleic acid, oleic acid and octadecatetraenoic acid [6]. In addition to the present study, many other researchers have reported for various fish species that the amounts and types of fatty acids are affected by factors such as seasonal changes, species, sex, size, food availability, geographic location and reproductive status, as well as water temperature and salinity [14-16]. For this reason, the studies conducted in various parts of the world on various species could yield different results.

Table 2: Fatty Acid Profile of the Keeled Mullet (*Liza carinata*) (% of Total Fatty Acids)"

Fatty acids	%
C12:0	0.25±0.06
C14:0	3.95±0.28
C15:0	3.07±0.06
C16:0	20.80±0.09
C17:0	1.06±0.08
C18:0	7.50±0.69
C20:0	0.25±0.00
C23:0	0.22±0.00
C24:0	4.56±0.42
ΣSFA	**41.64±0.66**
C14:1 n-9	0.04±0.00
C15:1 n-9	0.30±0.01
C16:1 n-7	9.70±0.67
C17:1 n-9	1.36±0.10
C18:1 n-9	4.13±0.29
C20:1 n-9	1.04±0.00
C22:1 n-9	0.23±0.16
ΣMUFA	**16.78±1.23**
C18:2 n-6 c	0.96±0.18
C18:3 n-6	0.56±0.11
C20:2 n-6	0.11±0.01
C20:4 n-6	4.81±0.40
C22:2 n-6	0.08±0.01
C18:3 n-3	0.72±0.01
C20:3 n-3	0.28±0.01
C20:5 n-3	10.99±0.35
C22:6 n-3	8.48±0.14
ΣPUFA	**26.96±0.63**
n3/n6	**3.15**
Unknown	14.62

The values are expressed as mean SD, n=3.
ΣSFA, total saturated fatty acids; ΣMUFA, total monounsaturated fatty acids;
ΣPUFA, total polyunsaturated fatty acids.

EPA and DHA, which are especially very important for human health, are found in keeled mullet with percentages 10.99% and 8.48%, respectively. Results of clinical and epidemiological research suggest that EPA and DHA, found only in fish and sea food, possess extremely beneficial properties for the prevention of human coronary artery disease [17]. Thus, EPA and DHA contents should certainly be taken into account for healthy human nutrition.

In the present study, the ratio n3/n6, which is an important parameter in determining the nutritional quality of food, was found as 3.15. This ratio is the most important indicator of fish lipid quality, which also reflects the quality of fish as a food product [18]. Dyerberg [19] noted that an increase in the ratio n3/n6 PUFA would increase the availability of n3 PUFAs which are beneficial for human health.

The present results indicate that, in terms of nutrient composition and fatty acid profile, the favourably consumed keeled mullet, which is caught off in the North-East Mediterranean Sea and supplied to the market, is a healthy nutritional source. With the increasing number of conscious consumers today, the research of healthy food, especially that of n-3 fatty acid-rich food, has accelerated. As a matter of fact, the results of this study imply that regular consumption of this n-3 fatty acid-rich fish species is certainly recommended.

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