

Body Compositions and Fatty Acid Profile of *Salmo Trutta Macrostigma* Caught from Korkun Brook

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Abstract In this study, the body composition and fatty acid profiles of *Salmo trutta macrostigma* living under natural conditions in Anatolia were analyzed. The total crude protein, lipid, ash, dry matter and fatty acid profile of fish meat were determined. Crude protein, lipid, ash and moisture of *Salmo trutta macrostigma* were 19.92%, 3.461%, 1.18% and 75.11% respectively. The predominant fatty acids found in *Salmo trutta macrostigma* muscle were myristic acid (C14:0, 2.23), palmitic acid (C16:0; 18.81%), palmitoleic acid (C16:1, 8.82%), stearic acid (C18:0; 4.11%), oleic acid (C18:1 n9; 11.93%), linoleic acid (C18:2n6, 3.72%), linolenic acid (C18:3n3, 9.27%), eicosapentaenoic acid (EPA; C20:5 n3; 7.48%) and docosahexaenoic acid (DHA; C22:6n3; 7.69%). The Fatty acid composition analyses showed that wild *Salmo trutta macrostigma* consisted of 29.17% saturated (SFA), 21.58% monounsaturated (MUFAs) and, 31.21% polyunsaturated acids (PUFAs).

Keywords *Salmo Trutta Macrostigma*, Body Composition, Fatty Acid Profiles, Korkun Brook

1. Introduction

Salmo trutta macrostigma naturally contain omega-3 (n-3) fatty acids; especially, eicosapentaenoic acid (EPA, 20:5 n-3) and docosahexaenoic acid (DHA, 22:6 n-3) which have beneficial effects on human health. Due to this reason, the importance of lipids and fatty acid composition of fish has highly increased recently. Due to the fact that omega-3 polyunsaturated fatty acids (n-3 PUFAs) cannot be synthesised effectively by humans [1], the indirectly intake of n-3 PUFAs inadequate amounts from the diet. Recent studies have proved that n-3 PUFAs from fish oil (EPA and DHA) have a vital role in prevention and treatment of cardiovascular diseases, inflammation, aggression, depression, hypertension, autoimmune disorders and cancer [2].

Differences in lipid and fatty acid compositions between and within fish species depend on availability of food, the season, the habitat, sex, diet and age which can be even among the individuals of the same species [3].

Salmo trutta macrostigma, which occurs in the upper part of streams and rivers is scattered in North Africa, South Europe, West Asia and Anatolia. In particular, many Turkish fresh waters contain naturally such ecologically and economically significant subspecies. In Turkey, native *Salmo trutta macrostigma* population is decline due to a number of reasons such as illegal and heavy fishing pressure, reduced spawning success, degradation of spawning habitats, river damming and interspecific competition with introduced rainbow trout (*Oncorhynchus mykiss*) [4]. However, there is no study on the body composition and fatty acid profile of *Salmo trutta macrostigma* which naturally exist in Korkun Brook, with abundant habitat, in Toros Mountain in Turkey. Consequently, the main objective of this study was to attract attention of the fish farmers to the protection of this species by carrying out the proximate composition and fatty acid profiles of *Salmo trutta macrostigma* which is endangered in Korkun Brook and other brooks in Turkey. As a result of this study, fish farmers will be aware of the proximate composition of *Salmo trutta macrostigma* and cultivate this species to trade. Thus, the hunting force on the brown trout will decrease and this species will be easily increased thanks to farmers.

2. Materials and Methods

2.1. Fish Sampling

Salmo trutta macrostigma was caught from Korkun Brook, which is a mountain brook at 1250 meters in Pozanti, Adana, Turkey, in May 2010. The oxygen content of the water was 10.5 ± 0.23 mg l⁻¹ with a pH value of 8.2 ± 0.38 and temperature of 13 ± 0.40 °C. Fifteen fish (average weight 155 ± 10 gram) were caught and used for proximate and fatty acid analyses. Muscle samples were directly taken from the underneath of the dorsal fin.

2.2. Proximate Analysis

The fish samples were analyzed in triplicate for proximate composition: lipid content of sardine by the Bligh and Dyer [5] method, moisture and the ash content of fish by AOAC [6] method, total crude protein by Kjeldhal method [7].

2.3. FAME Analyses

Lipids were extracted according to Bligh and Dyer [5] method. Methyl esters were prepared by transmethylation using 2M KOH in methanol and *n*-heptane according to the method as described by Ichibara et al. [8] with minor modification. 10 mg of extracted oil was dissolved in 2ml *n*-heptane followed by 4ml of 2M methanolic KOH. The tube was then vortexed for 2 min at room temperature. After centrifugation at 4000 rpm for 10 min, hexane layer was taken for determination of fatty acid profile by Gas Chromatography.

2.4. Gas Chromatographic Condition

The fatty acid composition was analyzed by GC Clarus 500 with autosampler (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 140°C, held 5 min, raised to 200°C at rate of 4°C/min and held at 220°C at rate 1°C/min, while the injector and the detector temperature were set at 220°C and 280°C, respectively. The sample size was 1 µl and the carrier gas was controlled at 16 psi. a 1:100 split ratio was used. Fatty acids were identified by comparing the retention times of FAME with the standard 37 component FAME mixture. Samples were run in duplicate and the results were expressed in GC area % as a mean value and ± standard deviation.

3. Results and Discussion

Table 1 shows body composition of *Salmo trutta macrostigma* from Korkun Brook in Turkey. The average values of protein, lipid, ash and moisture contents of *Salmo trutta macrostigma* muscle were 19.92%, 3.46%, 1.18% and 75.11% respectively. Zmijewski et al. [9] analyzed *Abramis brama L* and *Esox lucius* and found the protein, crude ash, lipid and moisture as 18.83%, 1.01%, 2.52% and 77.64%, respectively [9]. When compared with these species, we found comparatively higher values in *Salmo trutta macrostigma*. In addition, Orban et al. [10], investigated the proximate composition of *Perca fluviatilis* and values of protein, lipid, crude ash and moisture content were found as 17.89%, 0.90%, 1.21%, 80.28%, respectively [10]. However, the results of our findings show that the values of protein, lipid and dry matter are higher than *Perca fluviatilis*; but crude ash is lower than this species. In an earlier study found that protein (19.06%), ash (1.62%), moisture (75.08%) and lipid (3.51%) of farmed rainbow trout cultured near the

Korkun Brook [11]. As a result of the proximate composition analyses, *Salmo trutta macrostigma* was found to be more nutritive than other economically important fresh water species; wild *Sander lucioperca*, *Abramis brama* and *Esox lucius*, even farmed rainbow trout that is breeding in Korkun Brooks water.

Table 1. Body composition of *Salmo trutta macrostigma*.

Proximate analysis	%
Crude protein	19,92±0,4
Lipid	3,46±0,2
Crude ash	1,18±0,1
Moisture	75,11±0,8
Total	99,67

n=5

Table 2. Fatty acids profiles of *Salmo trutta macrostigma*.

Fatty acids (%)	<i>Salmo trutta macrostigma</i>
C10:0	0,02±0,1
C11:0	0,036±0,02
C12:0	0,135±0,04
C13:0	0,038±0,002
C14:0	2,33±0,1
C15:0	0,11±0,04
C16:0	18,81±0,4
C17:0	0,408±0,014
C18:0	4,11±0,23
C20:0	0,357±0,09
C22:0	0,088±0,001
C23:0	0,115±0,01
C24:0	2,61±0,09
∑SFA	29,167
C14:1	0,253±0,04
C16:1	8,82±0,23
C17:1	0,09±0,01
C18:1 N9	11,93±0,85
C20:1	0,13±0,01
C22:1 N9	0,06±0,002
C24:1	0,3±0,004
∑MUFA	21,583
C18:2 N6	3,72±0,09
C18:3 N6	0,625±0,2
C18:3 N3	9,28±0,52
C20:2 CIS	0,21±0,02
C20:3 N6	0,66±0,02
C20:3 N3	0,66±0,01
C20:4 N6	0,808±0,1
C20:5 N3	7,48±0,12
C22:2 CIS	0,08±0,002
C22:6 N3	7,69±0,45
PUFA	31,213
PUFA/SFA	1,070
∑ N6	5,81
∑ N3	25,77
N6/N3	0,22
DHA/EPA	1,02
Unidentified	18,037

n=5

Fatty acid profile of muscle of the *Salmo trutta macrostigma* is presented in Table 2. It shows 30 fatty acids identified from *Salmo trutta macrostigma*. The most abundant fatty acid in muscle was Palmitic acid (C16:0, 18.81%). The other major SFA were Miristic acid (C14:0, 2.33%), Pentadecanoic acid (C15:0, 0.11%), Margaric acid (C17:0, 0.408%), Stearic acid (C18:0, 4.11%), Arachidic acid (C20:0, 0.357%) and Lignoceric acid (C24:0, 2.61%). Akpınar et.al., [3] determined fatty acid profile of *Salmo trutta macrostigma* and he found more Palmitic acid (21.6%), Miristic acid (2.20%) and Stearic acid (5.64%) than our results. However, C15:0, C17:0, C20:0 and C24:0 weren't identified. The total SFA of our sample fish was 29.167% while Akpınar et. al. [3] reported total SFA as 29.04%. This finding seems to agree with our SFA result; but Aras et. al. [12] found total SFA (31.23%) which is a bit higher than our results. To sum up, these results support the fact that our study is in agreement with previous studies on *Salmo trutta macrostigma* in terms of SFA.

Oleic acid (C18:1 n-9) was the major monounsaturated fatty acid (MUFA) with the level of 11.93% in our sample. The second major MUFA Palmitoleic acid (C16:1 n-9) was identified as 8.82%, and the total MUFA was found 21.58% in *salmo trutta macrostigma*. However Akpınar et. al [3] and Aras et. al [12] found the total MUFA 37.50%- 24.68% in *Salmo trutta macrostigma* muscles in different river systems.

The major fatty acids identified as PUFA were alpha-linolenic acid (C18:3n3), Docosahexaenoic acid (DHA, 22:6n3) and Eicosapentaenoic acid (EPA, 20:5n3). The levels of alpha-linolenic acid, DHA and EPA were found 9.28%, 7.63% and 7.48%, respectively and our total PUFA was found with the value of 38.213%.

EPA is the most important essential fatty acid of the n3 series in the human diet because it is the precursor to the 3-series eicosanoids. It was reported that DHA decreases the concentration of low density lipoprotein, cholesterol in plasma [13]. The results of EPA and DHA values of our sample *Salmo trutta macrostigma* were at high levels, which increase the value of this species for human diets. In this study, it was determined that the fatty acid profiles of *Salmo trutta macrostigma* depending on the habitats and water quality. Furthermore, its proximate content of n3 polyunsaturated fatty acid, especially EPA and DHA makes it attractive for human health.

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