Effects of Habitats and Feeding Patterns on Fatty Acid Profile of Rainbow Trout (*Oncorhynchus mykiss*)

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Abstract

In this study, fatty acid profiles of rainbow trout, which has been bred in farms, and the trouts escaping from the farm to the nature (fish living in the canal between the farm and the Körkün Brook) and, which escaped from the farm and reached the Körkün Brook and fed here with natural nutrients have been compared. The rainbow trout obtained from the culture medium and the trout escaping from the farms to the nature were found to be significantly different in the fatty acid profile. The basic fatty acids of the samples taken from our research groups are; myristic acid (C14: O-), palmitic acid (C16: 0), palmitoleic acid (C16: 1), heptadecenoic acid (C17: 1), stearic acid (C18: 0), oleic acid (C18: 1 n9), linoleic acid (C18: 2 n6), vaccenic acid (C18: 1 n7), linolenic acid (C18: 3 n3), arashidic acid (C20: 0), arashidonic acid (C20: 4n6), eicosapentaenoic acid (C20: 5 n3), eruric acid (C22: 1 n9), docosahexaenoic acid (C22: 6 n3). In our study, saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids were determined respectively; 29.389-21.451%, 25.36-59.49% and 34.17-18.56%. As a result, the habitats and feeding of the fish affected the fatty acid profile of rainbow trout.

Key words: Culture trout, wild trout, fatty acid composition

Research article

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INTRODUCTION

Rainbow trout is one of the widely held cultured fish farming in the world and Turkey. According to FAO data, rainbow trout ranks 17th in 2016 among the fish species grown in the world and it ranks 2nd among the salmonidae family members after the Atlantic salmon. World rainbow trout production, which was 752 thousand tons / year in 2010, reached 814 thousand tons in 2016 (FAO, 2018). The most cultivated fish species in Turkey is the rainbow trout. When fisheries statistics are examined in Turkey it is easily seen that the farming of trout increased very quickly. Our trout production which was 44,533 tons / year in 2000 was 114,497 tons / year in 2018. 104,887 tons of this cultivation is produced in inland waters and 9,610 tons is bred in marine environments (TurkStat, 2019). Turkey meets 14.06% of the world production of rainbow trout which is 814 thousand tons with this production amounts, and this amount of production makes Turkey one of the world's largest trout producer.

Trout farming in Turkey first began in the enterprises established in terrestrial environments where the natural water resources exist. With the growth of the sector, trout farms have been moved to some rivers and dam lakes and even to marine environment. With the spread of trout farms in such areas, the number of trout escapes from farms to nature have increased considerably. Fish escaping from farms have become source of income for fishermen in many regions. According to TUIK data, 738 tons of trout fishing was carried out in 2010 and 282 tons in 2018. Among the provinces where hunting is made, some provinces such as Kayseri, Elazığ and Muğla where trout farms are intense attract attention.

In aquaculture, many studies have been carried out in order to increase growth, change the nutrient content and fatty acid profile of fish and extend shelf life (Acar et al., 2019; Öz, 2018a; Dikel et al., 2019; Öz, 2018b; Büyükdeveci et al., 2018; Öz et al.). The fatty acid profile of fish determines the quality of fish meat, especially the taste of fish meat (Dönmez and Tatar, 2001). The main components that determine the quality of fish meat are proteins and lipids. Also, The tasty of fish meat results from cardiovascular diseases, brain, nervous system and important pharmacological effects against cancer, lipid and unsaturated fatty acids in their body compositions (Shapiro, 1999). Many studies have been conducted to examine seasonal and habitual changes in the fatty acid profile of fish (Durmuş et al., 2014; Taşbozan et al., 2016). Fish meats, especially rainbow trout (*Oncorhynchus mykiss*), which are widely cultivated, contain highly unsaturated fatty acids. These high rates are largely related to the nutritional properties of fish (Boggio et al., 1985). In recent years, demand for aquaculture, which is the main source of ω-3 PUFAs, has been increasing dramatically. The most important natural source of EPA and DHA is fatty fish (Uçak et al., 2019).

In this study, it was aimed to determine the fatty acid profiles of rainbow trout living in different parts of the same water system and fed differently.

MATERIALS AND METHODS

Material

The fish used in the study were obtained from Öz Trout Production Enterprise located on the shore of the Körkün Brook, which is located in the Pozantı district of Adana province, from the canal providing water to this enterprise and from the Körkün Brook near the enterprise. The fish escaping from the farm were caught with the throw net from the Körkün Brook and the canal providing water to the enterprise and those of the same size group (300-350 grams) were analyzed. 300-350 grams of trout were brought from a special trout farm on the shore of the Körkün Brook and analyzed for fatty acid profiles.

Fatty Acid Analysis

Fatty acid methyl esters of extracted lipids have been made according to Ichibara et al. method (1996). 4ml of 2M KOH and 2ml of n heptane were added to 25mg of the extracted oil sample. The mixture was then vortexed at room temperature for 2 minutes and centrifuged at 4000 rpm for 10 minutes and the heptane layer was taken for analysis at GC. Fatty acid composition was performed using flame ionization detector (FID) and GC (Gas Chromatographic, Figure 3.4) with 30m x 0.32mm ID x 0.25µm film thickness SGE column auto sampling (Perkin Elmer, USA). The injector and detector temperatures were set to 220 ° C, then to 280 ° C, respectively. The oven temperature was maintained at 140 ° C for 5 minutes. Subsequently, it was brought to 200 ° C by increasing 4 ° C per minute and from 200 ° C to 220 by increasing 1 ° C per minute. The sample amount was 1ml and the carrier gas control was provided at 16ps. Split application was performed at 1:50 ratio. Fatty acids were identified by comparison of the FAME mixture of standard 37 components based on their arrival times. The results of the two GC analyze performed in the same way are expressed in% GC with ± standard deviation values.

RESULTS AND DISCUSSION

The fatty acid profile of rainbow trout from three different environments used in our research is shown in Table 1. As a result of the research, the highest total SFA ratio (29.38%) was found in the samples taken from the Körkün Brook, while the lowest total SFA value (21.45%) was found in rainbow trout from the cultural medium. Similar to the total SFA values, the highest PUFA ratio (34.17%) was found in the fish caught from the Körkün Brook, while the lowest PUFA ratio (18.56%) was found in the farmed trout. Contrary to the total SFA and PUFA amounts, the highest total MUFA ratio (59.49%) was found in rainbow trout fed by commercial feeds from the cultural medium, while the lowest MUFA ratio (25.36%) was observed in rainbow trout hunted from the Körkün Brook.

In a previous study, the total SFA, MUFA and PUFA ratios of rainbow trout hunted from nature were as follows; 28.04 ± 0.54, 24.69 ± 0.73 and 35.07 ± 0.95 were found to be the same (Öz, and Dikel, 2015a). In a study conducted in the same region, total SFA, MUFA and PUFA ratios of brown trout (*Salmo trutta*) were as follows; 29.167, 21.583 and 31.213 (Öz, and Dikel, 2015b).

One of the most important reasons for the different fatty acid profiles in fish is their diet. The fatty acid profile of the feed on which the fish are fed is very important in shaping the fatty acid profile of the fish. Feeding patterns of fish and their environment are important for fatty acid profile and body content (Öz and Dikel 2015a; Yıldız et al. 2006; Öz, 2017; Şener et al. 2005).

In our study, EPA (C20: 5n3) values of the studied fish were found to be between 6,798 ± 0,31-1,926 ± 0,41 and DHA (C22: 6 n3) values ranged between 9,197 ± 0,71-10,151 ± 0,44. In a previous study, the EPA rate of trout from production farms was 1.93 ± 0.11 and the DHA rate was 5.69 ± 0.21 (Özyılmaz, 2019). In another study, similar to our study, the fatty acids of rainbow trout living in different environments were examined and the highest EPA ratio (8.74 ± 0.52) was found in the rainbow trout that escaped from the farms and was hunted from Seyhan dame lake while the lowest EPA ratio (3.14 ± 0.24) was found in the samples taken from the net cages. When DHA levels were examined, the highest rate (18.49 ± 1.66) was found in trout taken from net cages and the lowest rate (5.66 ± 0.87) was found in trout hunted from Seyhan dame lake (Taşbozan et al., 2016).

There are studies on the habitat of fish and especially the feed acid contents that change the fatty acid profile. In a study conducted in 2018, black cumin oil was added to trout feeds and their effects on growth performance and fatty acid profile after feeding period were investigated. In the study, total PUFA amounts of rainbow trout were found between 32.09 ± 2.02 and 38.56 ± 2.78 (Öz et al., 2018b).

As a result, in this study, fatty acid profiles of rainbow trout from three different environments were compared. In the analysis, it was found that the fatty acid profile of rainbow trout varied depending on the habitat and diet.

Table 1. Fatty acid profile of rainbow trout (*Oncorhynchus mykiss*) from three different environments

Fatty acids	The environment where fish are taken		
	The Körkün Brook	**Earth Lined Canal**	**Aquaculture**
C11:0	0,035±0,01	0,023±0,01	0,011±0,00
C12:0	0,208±0,03	0,145±0,01	0,029±0,00
C13:0	0,023±0,00	0,184±0,02	0,011±0,00
C14:0	2,287±0,10	1,871±0,12	1,271±0,21
C14:1	0,034±00	0,024±0,01	0,010±00
C15:0	0,291±0,03	0,223±0,08	0,165±0,02
C16:0	18,691±0,64	16,391±0,21	14,323±0,23
C16:1	7,312±0,39	4,801±0,28	2,021±0,26
C17:0	0,383±0,05	0,189±0,04	0,214±0,02
C17:1	0,321±0,12	0,228±0,08	0,131±0,02
C18:0	4,987±0,44	4,015±0,42	4,378±0,34
C18:1 n9	16,210±0,44	19,161±0,39	22,31±0,51
C18:1 n7	8,917±0,35	6,823±0,14	3,194±0,14
C18:2 n6	6,590±0,40	18,145±1,25	33,691±0,46
C18:3 n6	0,597±0,06	0,384±0,11	0,139±0,07
C18:4 n6	0,655±0,17	0,329±0,21	0,129±0,02
C20:0	0,137±0,01	0,129±0,07	0,146±0,01
C20:1	0,598±0,09	0,511±0,06	0,693±0,09
C20:2 cis	0,439±0,19	0,891±0,17	1,201±0,11
C20:3 n6	0,368±0,12	0,448±0,14	0,914±0,11
C20:4n6	1,14±0,18	0,892±0,11	0,794±0,18
C20:5 n3	6,798±0,31	4,341±0,47	1,926±0,41
C22:0	0,093±0,01	0,116±0,03	0,249±0,01
C22:1 n9	0,157±0,05	0,245±0,09	0,392±0,05
C22:2 cis	0,069±0,02	0,087±0,02	0,117±0,03
C23:0	0,110±0,02	0,095±0,04	0,063±0,02
C24:0	2,144±0,18	3,78±0,31	0,591±0,02
C22:6 n3	9,197±0,71	9,226±0,12	10,151±0,44
C24:1	0,131±0,03	0,164±0,04	0,243±0,01
∑SFA	29,389	27,161	21,451
∑MUFA	25,36	43,279	59,491
∑PUFA	34,173	23,421	18,565

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