Journal of the Hellenic Veterinary Medical Society

Vol 73, No 4 (2022)

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doi: [10.12681/jhvms.27821](https://doi.org/10.12681/jhvms.27821)

To cite this article:

Kocatepe, D., Turan, H., Köstekli, B., Altan, C., & Çorapci, B. (2023). Preliminary investigation of the nutritional composition of two commercial fish species: Rainbow trout (Oncorhynchus mykiss) and Atlantic salmon (Salmo salar). *Journal of the Hellenic Veterinary Medical Society*, *73*(4), 4817–4826. https://doi.org/10.12681/jhvms.27821

J HELLENIC VET MED SOC 2022, 73 (4): 4817-4826
ΠΕΚΕ 2022, 73 (4): 4817-4826

Research article
Ερευνητικό άρθρο

Preliminary investigation of the nutritional composition of two commercial fish species: Rainbow trout (*Oncorhynchus mykiss*) and Atlantic salmon (*Salmo salar*)

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ABSTRACT: In this study, it was aimed to compare of nutritional composition, cholesterol, transfatty acids, fatty acids, lipid quality index, vitamins (A, B9, B2, B12, D3), selenium (Se), and iron (Fe) contents between farmed Atlantic salmon and rainbow trout. Crude protein, crude fat, carbohydrate, and energy values of Atlantic salmon were slightly higher than rainbow trout while crude ash and moisture values were higher in rainbow trout ($p<0.05$). The cholesterol content of samples in rainbow trout and Atlantic salmon were found as 77.37±1.07 mg $100g^{-1}$and 99.45±2.72 mg $100g^{-1}$, respectively ($p<0.05$). Trans fatty acids of both species were found as<0.3 g $100g^{-1}$.ΣSFA value of rainbow trout was found higher than the Atlantic salmon, on the other hand, the ΣMUFA values were found higher in the Atlantic salmon ($p<0.05$). However, the ΣPUFA values were found similar for both fish species ($p>0.05$). In general, the results show that rainbow trout contains two times more EPA+DHA amount than Atlantic salmon. While vitamin A has been found higher in rainbow trout, other vitamins (B9, B2, B12, D3) have been higher in Atlantic salmon ($p<0.05$). Additionally, iron (Fe) and selenium (Se) contents in rainbow trout has been significantly higher than Atlantic salmon ($p<0.05$).

Keywords: Atlantic salmon; rainbow trout; lipids; vitamins; minerals.

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Date of initial submission: 16-08-2021
Date of acceptance: 21-06-2022

INTRODUCTION

The aquaculture sector is continuing to stand up for increasing requirement of protein across the world. In order to increase the consumption of aquaculture products and reaching the desired levels, more advertising activities and social information should be given. In 2018, the worldwide fisheries production has been 156.4 million tons of which 96.4 million tons originated from capture fisheries and the rest 82.1 million tons from aquaculture, while the average annual consumption per person reached 20.5 kg (population 7.6 billion). 164.1 billion USD was earned from fish exports. According to world fish trade is evaluated of based on species, 19% of the part belongs to salmons, trout, and smelts (FAO, 2020). In addition, largest producers in the aquaculture industry, the seafood trade is one of the main export items of many countries. China is the top exporter since 2002 and the third-largest importer since 2011. Norway, Russia, and Vietnam follow China in exports. The seafood exports from Turkey with 178 thousand tons in 2018, is the sixtieth in the world ranking (Republic of Turkey, Ministry of Agriculture and Forestry, 2020).

Atlantic salmon (*Salmo salar* L.) is fatty fish species that has fat in the edible part (Jensen et al. 2012). As known, Atlantic salmon is the only salmon species in the Atlantic Ocean and it is one of the main species in marine aquaculture in Europe. The Atlantic salmon producers in Europe, which have consisted of Norway, Ireland, Faroe Islands (Jensen et al., 2012). Atlantic salmon grown and exported in Norway is also called "Norwegian salmon" worldwide.

Large rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792) (1kg and above) farmed in the Southern Black Sea which commercially called "Turkish salmon" from April 2020 by Republic of Turkey Ministry of Agriculture and Forestry. The large rainbow trout, whose trade name is Turkish salmon, used in the study is a type of rainbow trout that is grown in cages in the Black Sea. Turkish salmon has an export growth rate of 96% and exports of 56.8 million dollars have been reported (Anonymous, 2021). Kaya Öztürk et al. (2019) reported that; Black Sea, the most suitable place for the rainbow trout culture. In the Black Sea, the juvenile raised to 20-30 g in the land facilities are transported to the cages when after the temperature is decreased in the autumn. Fish can be harvested with 500-600 g in May and June. Salmon and trout are important fish species that are exported worldwide. In the marine water, 9411 tons of rainbow trout have grown in Turkey in 2019 (Republic of Turkey, Ministry of Agriculture and Forestry, 2020).

Within the scope of the study, a preliminary investigation has been decided in order to compare the nutritional composition, lipid quality index, transfatty acids, vitamins, selenium, and iron content of large rainbow trout called Turkish salmon with Atlantic salmon which is an export product of many countries. It is also aimed that this study will be used as a starting reference point to further investigate the nutritional quality differences of the two species and to raise awareness of consumers on this issue.

MATERIALS AND METHODS

Materials

Rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792) (4-5 kg) was obtained from Kızılırmak Aquaculture Industry and Trade Limited Company operating in the Black Sea (41°44′ 13.99″N 35°18′ 47,00″E, 41°44′ 13.82″N 35°18′ 55.44″E).Rainbow trout used in the study was brought to the marine net cage systems of the fish farm. A total of five fresh (total 20.20 kg) large rainbow trout were provided.

Atlantic salmon used in the study was obtained from a private company in Samsun-Turkey. Atlantic salmon (*Salmo salar*) (4-5 kg) farmed in Norway and harvested (Harvest ID: 187139) in November 2020. A total of five fresh (Total 21.68 kg) Atlantic salmon were provided.

Sample Preparation.

The samples were transported to the laboratory by icing in polyethylene boxes. They were gutted, filleted and bones cleaned then skin removed. Afterwards, boneless, and skinless fillets were cut into the cuter and homogenized for analysis.

Proximate Composition Analysis and Energy Value of Samples

The AOAC (1995) methods were used for crude protein (CD) (Ref no:925.52), crude ash (CA) (923.03), and moisture (M) (Ref. No: 925.10) analyses of samples. Crude fat (CF) analysis was done according to the Soxhlet method (AOAC, 2005),and energy value was calculated from the Atwater method (Falch et al.,2010).

Fatty acid, trans fatty acids, cholesterol, selenium iron and vitamin analyses were carried out in an accredited laboratory (TUBITAK MAM).

Fatty Acid, Trans Fatty Acids, Cholesterol Contents and Lipid Quality Index of Samples

Analysis of fatty acids and transfatty acids were done according to the method of IUPAC IID19 (IUPAC, 1987).The chromatographic method was used for the cholesterol analysis (Fenton and Sim, 1991). The lipid quality index of rainbow trout and Atlantic salmon lipids were calculated using the following formulas (Ulbricht and Southgate, 1991; Santos- Silva et al., 2002).

Atherogenicity index-AI= [(C12:0 + (4*C14:0) + (C16:0)] / [(Σn6 + Σ n3 + ΣMUFA)]

Thrombogenicity index-TI= [(C14:0 + C16:0 + C18:0)] / [(0.5 * ΣMUFA) + (0.5 * Σn6) + (3 * Σn3) / (Σn6)]

Flesh Lipid Quality Index -FLQ (7) = 100* [(EPA%+DHA%) / (Total fatty acids%)]

Hypocholesterolemic/hypercholesterolemic (H/h) = (C18:1n-9 + C18:2n-6 + C20:4n-6 + C18:3n-3 + C20:5n-3 + C22:5n-3 + C22:6n-3) / (C14:0+C16:0)

Selenium and Iron Contents of Samples

For the determination of selenium by hydride generation atomic absorption spectrometry (HGAAS) after pressure digestion method was used (TS EN 14627, 2006). AOAC 999.10 (2005) official method which is atomic absorption spectrophotometry after microwave digestion was used for iron in samples.

Vitamin Analysis of Samples

In the analysis of Retinol (Vit. A), the peak area of the saponified extract obtained in the HPLC FL detector was measured (AOAC, 2000).

For Riboflavin (Vit. B2) analysis, samples are kept in an autoclave at 121°C in 0.1 N hydrochloric acid for 30 minutes, then they are subjected to enzymatic incubation at 45°C and the peak area given on the HPLC FL detector is a measure (Eitenmiller et al., 2016)

For folic acid (Vit. B9) analyses, R-BioPharm Vitafast Folic acid, microbiological microtiter plate test to quantitate folic acid kits used.It is the measurement of the peak area of the extract taken into the buffer solution in the UV detector after separation in the immune affinity column (R-Biopharma, 2020).

A quantitative method was used for cyanocobalamin (Vit. B12) in samples determined by enzymatic incubation at 37°C and the determination of the peak area given by the HPLC UV detector after separation in the immune affinity column (R- Biopharma, 2011).

For cholecalciferol (Vit. D3) analysis, the sample was taken into the appropriate solvent after saponification extraction and the extract was determined on normal and reverse phase analytical HPLC (CEN, 1999).

Statistical Analysis

Data were expressed as mean ± standard deviation. All analyses were performed in 2 replicates with 3 parallel. All statistical tests were performed as a 5% significance level using MINITAB17. The Shapiro Wilk's and Levene's tests were used for normality and equality of variance of the data's. The significant variation was highlighted by One way-ANOVA. $p>0.05$ was not significant, $p<0.05$ was statistically significant.

RESULTS

Proximate Composition of Rainbow Trout and Atlantic Salmon

The proximate composition of rainbow trout and Atlantic salmon muscle are shown in Table 1. The contents of the various nutrients in the samples were extraordinarily different. Atlantic salmon crude protein (CP), crude fat (CF) and carbohydrate contents were slightly higher than rainbow trout, in addition to the difference were obvious ($p<0.05$). Only the content of crude ash (CA) and moisture (M) in rainbow trout was significantly higher than Atlantic salmon ($p<0.05$). The energy values of rainbow trout were lower than Atlantic salmon ($p<0.05$).

Table 1. Proximate compositions (%) and energy values (Kcal 100g-^{1}) of rainbow troutand Atlantic salmon

	Rainbow trout	Atlantic salmon
CP	17.27±0.17^{B}	18.55±0.05^{A}
CL	15.21±0.32^{B}	17.09±0.00^{A}
M	64.33±0.41^{A}	60.84±1.08^{B}
CA	2.47±0.47^{A}	1.80±0.17^{B}
Carbohydrate	0.92±0.84^{B}	1.72±1.27^{A}
Energy	210.42±2.88^{B}	234.9±5.00^{A}

-CP: crude protein; CL: crude lipid; M: moisture, CA: crude ash
-The different letters in the columns indicate statistically significant differences among the mean values relative to samples at $p\leq 0.05$ level

Cholesterol, Trans Fatty Acids, Fatty Acids Contents of Rainbow Trout and Atlantic Salmon

The fatty acid composition, cholesterol and trans-fatty acid composition of rainbow trout and Atlantic salmon are shown in Table2. The content of saturated fatty acids (SFA) in rainbow trout and Atlantic salmon was 25.44% and 16.17%, respectively ($p<0.05$). The C16:0 was the most abundant SFA in two samples. There was a significant difference in the contents of all SFAs ($p<0.05$).C18:1n9c andC16:1n7 were the most abundant monosaturated fatty acids (MUFA) in samples, and the highest C18:1n9c approximately 40% in Atlantic salmon. The content of C16:1n7 in the rainbow trout was higher than Atlantic salmon ($p<0.05$). The C22:1n-9 content of Atlantic salmon was about three times more than rainbow trout ($p<005$). The total polyunsaturated fatty acids (PUFA) content of the samples was very close, and there was no significant difference ($p>0.05$). C18:2n6c, C22:6n-3cis-4,7,10,13,16,19 and C 18:3n3 were the dominant components of PUFA in rainbow trout. However, the dominant components of Atlantic salmon PUFAs were; C18:2n6c, C18:3n3 and C22:6n-3cis-4,7,10,13,16,19, respectively. The C18:3n3 content of Atlantic salmon was significantly higher than rainbow trout ($p<0.05$). The most C20:5n3 (EPA) and C22:6n3 (DHA) were found in rainbow trout ($p<0.05$).

Table 2. Fatty acid compositions of Rainbow trout and Atlantic salmon lipids (g/100g)

Fatty acids	*Rainbow trout*	*Atlantic salmon*
C8:0	0.00 ± 0.00^{B}	0.03 ± 0.00^{A}
C12:0	0.06 ± 0.00^{B}	0.07 ± 0.00^{A}
C13:0	0.02 ± 0.00^{A}	0.00 ± 0.00^{B}
C14:0	2.53 ± 0.01^{B}	2.83 ± 0.02^{A}
C15:0	0.28 ± 0.00^{A}	0.18 ± 0.00^{B}
C16:0	17.28 ± 0.02^{A}	10.13 ± 0.02^{B}
C17:0	0.24 ± 0.00^{A}	0.14 ± 0.00^{B}
C18:0	4.71 ± 0.03^{A}	2.41 ± 0.01^{B}
C20:0	0.26 ± 0.01^{B}	0.30 ± 0.00^{A}
C22:0	0.05 ± 0.00^{B}	0.08 ± 0.00^{A}
C24:0	0.02 ± 0.00^{A}	0.00 ± 0.00^{B}
ΣSFA	25.44 ± 0.06^{A}	16.17 ± 0.01^{B}
C14:1	0.04 ± 0.00^{A}	0.00 ± 0.00^{B}
C16:1n7	4.58 ± 0.01^{A}	3.24 ± 0.01^{B}
C18:1n9c	30.37 ± 0.01^{B}	40.44 ± 0.04^{A}
C18:1n9t	0.05 ± 0.00^{A}	0.03 ± 0.00^{B}
C20:1 cis 11	1.42 ± 0.01^{B}	2.22 ± 0.01^{A}
C22:1n-9	0.12 ± 0.00^{B}	0.35 ± 0.00^{A}
C24:1n-9	0.11 ± 0.00^{A}	0.10 ± 0.00^{B}
ΣMUFA	36.69 ± 0.01^{B}	46.37 ± 0.05^{A}
C18:2n6c	17.21 ± 0.01^{A}	15.29 ± 0.02^{B}
C18:3n3	2.46 ± 0.00^{B}	6.65 ± 0.01^{A}
C18:3n6	0.13 ± 0.00^{B}	0.15 ± 0.00^{A}
C20:2 cis 11.14	1.36 ± 0.00^{B}	1.42 ± 0.00^{A}
C20:4n6	0.35 ± 0.00^{B}	1.46 ± 0.00^{A}
C20:3n6 cis-8.11.14	0.30 ± 0.00^{A}	0.14 ± 0.00^{B}
C20:3n3 cis-11.14.17	0.19 ± 0.00^{A}	0.18 ± 0.00^{B}
C22:5n3 cis-7.10.13.16.19	0.00 ± 0.00^{B}	0.84 ± 0.02^{A}
C20:5n3 cis 5.8.11.14.17	1.89 ± 0.01^{A}	0.68 ± 0.00^{B}
C22:2 cis13.16	0.43 ± 0.01^{A}	0.00 ± 0.00^{B}
C22:6n-3cis-4.7.10.13.16.19	4.88 ± 0.00^{A}	2.24 ± 0.10^{B}
ΣPUFA	29.20 ± 0.02^{A}	29.03 ± 0.09^{A}
Σω3	9.43 ± 0.01^{B}	10.58 ± 0.11^{A}
Σω6	19.77 ± 0.01^{A}	18.46 ± 0.02^{B}
Total Fatty acids	91.33 ± 0.03^{B}	91.57 ± 0.02^{A}
Undefined	8.67 ± 0.00	8.44 ± 0.02
Σω9	30.65 ± 0.02^{B}	40.92 ± 0.09^{A}
Cholesterol (mg 100g-1)	77.37 ± 1.07^{B}	99.45 ± 2.72^{A}
Trans fatty acids (g 100g-1)	$<0.3^{A}$	$<0.3^{A}$

The different letters in the columns indicate statistically significant differences among the mean values relative to samples at $p\leq 0.05$ level

Approximately 41%and 31% of the total fatty acids detected are omega 9 (**ω9**) fatty acids in Atlantic salmon and rainbow trout respectively. The total omega 6 (**ω6**) contents of samples were higher than omega 3 (**ω3**) fatty acids.

Lipid Quality Index (LQI) of Rainbow Trout and Atlantic Salmon Lipids

The LQI of samples was shown in Table 3. It is generally accepted that the high ω3/ω6 ratio is related to health. The ω3/ω6 ratio of Atlantic salmon was higher than rainbow trout ($p<0.05$).

It was observed that DHA is the most abundant ω3 fatty acids in rainbow trout, on the other hand, alpha-linolenic acid (ALA) was the most abundant ω3 fatty acids in Atlantic salmon. The amount of EPA+DHA of rainbow trout was more than twice that of Atlantic salmon.

AI (Atherogenicity index) and TI (Thrombogenicity index) might better characterize the atherogenic and thrombogenic potential of fatty acids than other indices (Ulbricht and Southgate, 1991). AI and TI indices of rainbow trout was higher than Atlantic salmon. In this study, the H/h (Hypocholesterolemic/hypercholesterolemic) ratio was 2.89 and 5.21 in rainbow trout and Atlantic salmon. The FLQ (Flesh Lipid Quality Index) index of the rainbow trout was the highest ($p<0.05$).

Table 3. LQI of Rainbow trout and Atlantic salmon lipids (g/100g)

	Rainbow trout	Atlantic salmon
ω3/ω6	0.48 ± 0.00^{B}	0.57 ± 0.01^{A}
ω6/ω3	2.10 ± 0.00^{A}	1.75 ± 0.02^{B}
PUFA/SFA	1.15 ± 0.00^{B}	1.80 ± 0.01^{A}
EPA+DHA (g/100g)	2.06	1.00
AI	0.42 ± 0.00^{A}	0.29 ± 0.00^{B}
TI	0.83 ± 0.00^{A}	0.45 ± 0.00^{B}
FLQ	7.42 ± 0.02^{A}	3.18 ± 0.10^{B}
H / h	2.89 ± 0.01^{B}	5.21 ± 0.01^{A}

-The different letters in the columns indicate statistically significant differences among the mean values relative to samples at $p\leq0.05$ level

Vitamins, Iron and Selenium Contents of Rainbow Trout and Atlantic Salmon

Five vitamins and two minerals were analysed in the fish samples (Table 4). The content of vit. A in rainbow trout was higher than Atlantic salmon ($p<0.05$). However, the vit. B9, B12 and D3 content of Atlantic salmon were significantly higher than rainbow trout ($p<0.05$). Although the vit.B2 of the samples were close to each other, they were significantly different ($p<0.05$).

The contents of iron (Fe) and selenium (Se) in rainbow trout significantly higher than Atlantic salmon ($p<0.05$).

Table 4. Vitamins, Fe and Se contents of rainbow trout and Atlantic salmon

	Rainbow trout	Atlantic salmon
Vit. A (μg $100g^{-1}$)	15.35 ± 0.10^{A}	14.88 ± 2.08^{B}
Vit. B9 (μg $100g^{-1}$)	21.90 ± 1.80^{B}	29.00 ± 0.24^{A}
Vit. B2 (mg $100g^{-1}$)	0.07 ± 0.00^{B}	0.09 ± 0.00^{A}
Vit. B12 (μg $100g^{-1}$)	2.42 ± 0.02^{B}	7.56 ± 0.19^{A}
Vit. D3 (μg $100g^{-1}$)	4.95 ± 0.08^{B}	8.08 ± 0.16^{A}
Fe (mg kg^{-1})	17.69 ± 0.02^{A}	$<2.5^{B}$
Se (mg kg^{-1})	2.76 ± 0.02^{A}	0.20 ± 0.03^{B}

-The different letters in the columns indicate statistically significant differences among the mean values relative to samples at $p\leq0.05$ level

DISCUSSION

Fish and other seafood products have a high nutritional value regarding beneficial amounts of protein, lipids as well as essential nutrients (Tilami and Samples, 2018). The nutritional composition of seafood varies depending on many factors. In many previous studies, the effects of factors such as the type of fish, the environment in which it grows, the fishing season, fishing style, environmental factors, length and weight, handling after harvest, transport, storage or purging of the fish, slaughter method, gender and age have been revealed (Alasalvar et al., 2002; Tilami and Samples, 2018; Kaya Öztürk et al., 2019). The most important feature of aquaculture fish is that the desired changes in the nutritional composition of the final product can be changed by feeding. In the study, the nutritional content of rainbow trout and Atlantic salmon was completely different from each other. This difference was an expected result. The crude protein (CP), crude lipid(CL) and crude ash(CA) content of large rainbow trout (1.3kg) produced in the Black Sea region was reported as 20.18, 12.29 and 2.75%, respectively (Kaya Öztürk et al., 2019). Similarly, Karimian-Khosroshahi et al. (2016) found the rainbow trout's (1-1.2kg) CP, CL and moisture amounts were as 18.59, 3.58 and 72.33%, respectively. In our study, while the CP and CA content were like the literature, the amount of CL was higher for rainbow trout. The CP, CL and moisture content of Atlantic salmon used in our study is higher compared to the literature (Jensen et al., 2012). The energy content of rainbow trout was lower than that of Atlantic salmon, mainly because of its lower CL content.

To keep the blood cholesterol level at normal levels, cholesterol intake in foods should be maintained at a daily level below 300 mg (U.S. DHHS, 2010). Therefore, attention should be paid to the cholesterol content of the foods taken in the daily diet. Seafood contains a lower value of cholesterol than other meat products. Compared to MUFAs, PUFAs are more effective in lowering the cholesterol ratio in the body (Demirci, 2003). Therefore, rainbow trout, which was both high in PUFA and low in cholesterol, can be recommended to those who are fed a diet with low cholesterol and who care about heart health.

Trans fatty acids have been a typical part of the Western diet, and they may play a part in the development of childhood allergies also seems worth pursuing in Japon (Weiland et al., 1999). Pfalzgraf et al., (1994) notified that the amount of transfatty acids in foods that may contain hydrogenated oils ranged from 0 to 34.9%. The maximum amount of trans fatty acid that can be taken daily in a 2000 kcal diet is limited to 2 g/day (Simopoulos et al., 1999). It is an important result that the transfatty acid content of the samples in the study was quite low compared to these limit values.

The distribution of fatty acids composition is important in the nutritional functions of fish. Along with the different types of fatty acids, it contains, fish lipids are also important in terms of the amount of essential fatty acids. In our study, the total fatty acid contents of the samples were listed as ΣMUFA>ΣPUFA>ΣSFA. This ranking was similar to that given by Jensen et al., (2012) for Atlantic salmon. Similar to our study, Nechev et al., (2021) reported the C16:0 content of Atlantic salmon as 11.88%. C18:1n9 fatty acid is the predominant ω9 in both samples. It has been emphasized that this fatty acid is dominant in the large rainbow trout and Atlantic salmon by different researchers (Kaya Öztürk et al., 2019; Nechev et al., 2021) Kaya Öztürk et al. (2019) stated, the reason for the high ω9 in especially Atlantic salmon can be explained by over-adding the vegetable oil sources in the diets. Hundal et al. (2021); increasing the use of ω6 fatty acids for Atlantic salmon will cause an increase in EPA and DHA requirement in the future. Rainbow trout ω6 content was higher than Atlantic salmon, it may be suggested to enrich the ω3 source for the feed used in fish feeding.

Increasing health problems with increasing fast-food eating habits have led people to a more natural diet.As known a diet that is rich in long-chain ω3 fatty acids (≥ (20)) have beneficial effects on human health (Williams, 2000; Rice, 2009). Fish lipid contains a high percentage of unsaturated fatty acids compared to other meat lipids. However, the essential fatty acid content (especially ω3) of naturally in ocean fish is higher than that of aquaculture produces fish (Simopoulos, 2002). C22:6n3 is the most abundant ω3 fatty acids in fish (Karimian-Khosroshahi, 2016). However, in some fish species, ω3 may be predominant in ALA, as in the Atlantic salmon in our study. Gogus and Smith (2010) report that ALA is mostly found in plants and is converted into EPA and DHA in the human body. But EPA and DHA found in marine sources such as fish, mussel, oyster, shrimp. In a 2000 kcal diet, the recommended daily intake of ALA is 2.22 gday^{-1} (Simopoulos et al., 1999). When 200 grams of rainbow trout and Atlantic salmon are consumed, 30% and 36% of this ratio are met.

ω3 PUFAs serve as energy substrates and membrane component and play an essential role in maintaining undisturbed neurobiological functions (Lange et al., 2019). Rice (2009) reported that; fish farmers very were aware of the need to ensure a high ω3 level in their finished product, and so they careful to feed their fish on a diet rich in ω3.

When the LQI data of the study were examined, the evaluation of the fatty acids of both fish species can be revealed more clearly. While the importance of PUFAs in terms of health is not discussed, the ω3/ω6 or ω6/ω3 ratio of the samples should be evaluated. As known high intake of ω6 PUFA, affect human health negatively; for example; cardiovascular disease, diabetes, hypertension, depression, neurological dysfunction, immune disorders, cholesterol, (Williams, 2000; Simopoulos, 2002; Rice, 2009,), the consumption of oily fish has the effect of lowering blood pressure (Bernstein et al., 2019) and reducing cholesterol (Lim et al., 2012), and improvement cardiovascular function and reduced risk of death from coronary heart disease (Mozaffarian and Rimm, 2006; FAO/WHO, 2011). In the western diets, ω6/ω3 ratio has reached 15-20 and this rate should be as minimum as possible (Simopoulos 2001, Simopoulos, 2002) and the intake of ω6/ω3 ratio of 1 to 4 is generally recommended by different research (Simopoulos 2001; Simopoulos, 2002; Konukoğlu, 2008). The ω6/ω3 ratio of the large rainbow trout produced in the

Black Sea has been given as 1.53 (Kaya Öztürk et al., 2019). In our study, the reason for determining the higher rate may be related to fish size. Considering food consumption habits, it is very difficult to reach the specified ω6/ω3 ratio. However, this balance can be achieved with more consumption of ω3 fatty acids containing foods.

The recommended minimum PUFA/SFA ratio in terms of fatty acids is 0.45 (HMSO UK, 1994), and the ratios of both samples were above this minimum value. This shows that the samples had healthy lipids that contain a lot of PUFAs.

In present study, the EPA+DHA content of Atlantic salmon was less than half of the rainbow trout. Jensen et al. (2012) also reported that the EPA+DHA amount of Atlantic salmon was 0.83 g $100g^{-1}$. Additionally, the content of EPA+DHA in salmon was reported as 1.2 g $100g^{-1}$ (Nostbakken et al., 2021). BNF (1992) recommends 0.2g of EPA+DHA per day for people who pay attention to a healthy diet. Large rainbow trout more than meets the daily EPA+DHA requirement.

The FLQ of foods is an index that shows the dietetic quality of lipids and their effect on coronary diseases. The higher value of this index is an indicator of the higher quality of the dietary lipid source (Senso et al., 2007). When evaluated from this point of view, it was seen that the FLQ of rainbow trout was 2 times higher than Atlantic salmon. The samples meet this need more. Additionally, the high value of the H/h ratio represents high -quality lipids (Kocatepe et al., 2019) and it was related to be more beneficial for human health (Fernandes et al., 2014) and no differences between spring and winter, also between summer and autumn in some fish species (zander) (Çağlak and Karslı 2017). The H / h values of the samples were above 1. Kaya Öztürk et al. (2019) stated this ratio as 3.47 for large rainbow trout.AI and TI should not be more than 1 for human health (Chavez-Mendoza et al., 2014; Luczynska et al.,2017) and the lower values of this index show the better nutritional quality of fatty acids (Karimian-Khasroshahi, 2016). For large rainbow trout AI, TI values were reports as 0.31, 0.26 (Kaya Öztürk et al., 2019) and 0.82, 0.28 (Karimian-Khasroshahi, 2016).

The main sources of vitamins that play a regulatory role are fruits and vegetables. On the other hand, meat products are important sources of water-soluble vit. A and D and B. Fish also contains higher levels of vit. A, B2, B9, B12 and D3 compared to other vitamins. The form of vit. D in fish is vit. D3 (cholecalciferol), which is also the form being produced in the skin from 7-dehydrocholestrol when exposed to UV light (Holick, 2008; Norman, 2008). Retinol is pale, yellowish, liquid, which is extremely sensitive to light, heat and oxygen and the reference nutrient intake (RNI) for vit. A for adults is 600-700 µg day^{-1}(Rice, 2009).A for adults is 600-700 µg day-1 (Rice, 2009). Consumption of one serving (200g) of large rainbow trout meets 1.65% of the recommended daily requirement of vitamin D3 for adults, while consumption of Atlantic salmon meets 2.69%.

Vitamin B deficiency is a cause of neurological disability and impairment globally (Reynolds, 2006; Kumar, 2010). Therefore, attention should be paid to the consumption of protein foods, which are a source of B vitamins. Vit. B values of rainbow trout were generally lower than Atlantic salmon. The daily requirement for B12 for adults is 2 µg day^{-1} (Demirci, 2003). Both types of fish more than meet this requirement. Vit. D content between 0.5 and 30 µg/100g fish muscle in various species (Mattila et al. 1994). The vit. D content of the samples in this study was within the specified range. The general recommendation is to ingest at least 1000IU vit. D per day, which corresponds to 25 µg (Holick, 2008). 200 grams of rainbow trout meets about half of this need. Vit. D3 value in Atlantic salmon is similar to that of Nostbakken et al. (2021).

Se is an important mineral in terms of health, which participates in the structure of many enzymes in the body and has a regulatory role. In particular, its effect of reducing heavy metal toxicity is important in maintaining the benefit-damage balance, which is discussed in fish consumption by people. Se is an important factor in preventing mercury damage, which is one of the most important pollutants in aquatic environments. Selenium intake lowers MeHg toxicity (Ralston et al., 2008; Ralston and Raymond, 2010). Different values for Se uptake are reported by different authorities; according to the data of WHO/FAO (2004), 26 $\mu gday^{-1}$ in women and 33 µg day^{-1} in men, and this value was reported as 70 µg / day in adults by EFSA (2014). Reyes et al., (2009) reported that the Se content of fish ranged from 0.1 to µg day^{-1}. In addition, they stated that the highest Se content belongs to Tuna with 5.6 µg day^{-1}. It was seen that rainbow trout was rich in Se compared to both Atlantic salmon and literatures.

Fe is a mineral that is important in oxygen storage and transport in the human body. 10-15% of the Fe made with food is absorbed. The daily requirement of an adult is approximately 1-2 mg day^{-1}. While 10% of the iron in the normal diet is absorbed, the amount to be filled is 10-15 mg (Demirci, 2003). When 200 grams of rainbow trout was consumed, approximately 3.5 mg of Fe was taken into the body, which was much higher than Atlantic salmon.

CONCLUSIONS

This research provides basic information about large rainbow trout named as Turkish Salmon which can be added to the current. The data can also be used as a guideline for promoting Turkish salmon consumption and exporting sector.

As a result, the nutritional composition of rainbow trout and Atlantic salmon is completely different from each other. In terms of fatty acids, the difference between ΣSFAs and ΣMUFAs and the similarity between ΣPUFAs has drawn attention. The amount of EPA+DHA of large rainbow trout is more than twice that of Atlantic salmon. More studies are needed on large rainbow trout which is low in vitamin content compared to Atlantic salmon and higher in Se and Fe content.

CONFLICT OF INTEREST

The authors declare that for this article they have no actual, potential, or perceived the conflict of interests.

ACKNOWLEDGMENTS

We would like to thank Kızılırmak Aquaculture Industry and Trade Limited Company, Samsun and Sinop Provinces Aquaculture Producers' Association for providing the Rainbow trout and Atlantic salmon used in the study.

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