

Nutrition and Gender Effect on Body Composition of Rainbow Trout

(Oncorhynchus mykiss)

Beslenmenin ve Cinsiyetin Gökkuşığı Alabalığının (*Oncorhynchus Mykiss*) Vücut İçeriği Üzerine Etkisi

Abstract

In this study, body composition was compared between farmed female, farmed male, wild female and wild male rainbow trout; the latter escaped from farms to nature and fed natural food. The total crude protein, lipid, ash and moisture of fish meat were determined in analyses. It was found that there were big differences between body composition of cultured rainbow trout and wild rainbow trout and their male and female. While in cultured female trouts; crude protein, crude ash moisture and lipid ratios were found respectively as 19.41%, 1.78%, 73.62% and 3.73%; in cultured male trouts crude protein, crude ash moisture and lipid ratios were found respectively as 18.73%, 1.52%, 75.23% and 3.36% in wild female trouts; crude protein, crude ash moisture and lipid ratios were found respectively as 19.65%, 1.61%, 73.83% and 2.97% in wild male trouts; 19.11%, 1.39%, 75.09% and 2.53%.

In the result of this research; it was found that crude protein and lipid content of female rainbow trout were higher; but, moisture content was lower. In addition, it was determined that the body composition of rainbow trout varies according to sex, feed and habitat.

Keywords: Wild rainbow trout, Farmed rainbow trout, Body composition

Özet

Bu çalışmada çiftlikte yetiştirilen (erkek ve dişi) ve çiftliklerden doğaya kaçarak burada doğal besinlerle beslenen (erkek ve dişi) gökkuşığı alabalığının besin içerikleri karşılaştırılmıştır. Analizlerde balık etinin toplam ham protein, lipid, ham kül ve nem oranı belirlenmiştir. Çiftliklerde yetiştirilen gökkuşığı alabalıklarının ve doğal gökkuşığı alabalıklarının vücut kompozisyonu ile erkek ve dişilerin vücut kompozisyonları arasında farklılıklar olduğu bulunmuştur. Kültürel ortamda yetişen dişilerde ham protein, ham kül, nem ve lipid miktarı sırasıyla, %9.41, %1.78, %73.62 ve %3.73 kültür erkeklerde ise %18.73, %1.52, %75.23 ve %3.36, doğadan avlanan dişilerde; %19.65, %1.61, %73.83 ve 2.97% erkeklerde ise %19.11, %1.39, %75.09 ve %2.53 bulunmuştur.

Bu araştırmanın sonucunda; Dişi gökkuşığı alabalıklarının ham protein ve lipid içeriğinin daha yüksek olduğu; Ancak, nem içeriği daha düşük olduğu tespit edilmiştir. Ayrıca, gökkuşığı alabalıklarının vücut kompozisyonunun cinsiyete, beslenmesine ve yaşama ortamına göre değiştiği tespit edilmiştir.

Anahtar kelimeler: Doğal gökkuşığı alabalığı, Kültür gökkuşığı alabalığı, Vücut içeriği

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Introduction

Rainbow trout is native to the Pacific drainages of North America, ranging from Alaska to Mexico. Since 1874 it has been introduced to waters on all continents except Antarctica, for recreational angling and aquaculture purposes. Production greatly expanding in the 1950s as pelleted feeds were developed. Trout fisheries are maintained, or culture practised, in the upland catchments of many tropical and sub-tropical countries of Asia, East Africa and South America (FAO, 2016). The rainbow trout (*Oncorhynchus mykiss*) has been cultured since the early 1970s and Turkey has become one of the top trout producing countries in Europe with an annual production. On the other hand, it is also widely used as a farmed fish in many countries because of its rapid growth and high value as a food. It is economically important in the U.S.A., Japan, Europe, the Russian Federation and Canada (Yasmin et al. 2004).

Rainbow trout, part of the Salmonidae family (*Oncorhynchus mykiss*), is a commercially significant species consumed widely in Europe (Çaklı et al., 2006). It is a species of fish with an exceptionally fast growth rate and high nutritional value, leading to widespread cultivation in a variety of countries.

Due to the rich nutritional content, fish is an important food source in both developed and developing countries. Fish oils contain essential fatty acids and poly unsaturated fatty acids (PUFA), which are important for human health. This is an increasing demand from consumers for healthy, high quality, natural and fresh fish products.

The composition of the diet determines, to a large extent, the fat content of fish. The higher the ratio between the metabolizable energy and protein in the

diets, the higher the fat content in the tissue. Whole-body composition was also affected by season, water temperature and sexual maturation (Hepher, 1988).

Rainbow trout is one of the most commonly raised species in Turkey and around the world. Moreover, Turkey is one of the foremost trout producers of Europe. Rainbow trouts are being raised at almost every region of Turkey (Öz, 2016). Natural populations of trout which escape from farms to nature occur in these regions, It is important to investigate differences in proximate composition between wild and farmed fish due to variations in feeding conditions.

Thus, the aim of the study was to investigate compare body composition of male and female rainbow trout living under natural and cultural conditions.

Materials and Methods

Fish and sampling

Wild *Oncorhynchus mykiss* (male and female), which escaped from fish farms to nature were caught from Körkün Brook, which is a mountain brook at 1300 meters in Pozanti, Adana, Turkey, on June 2015. Farmed male and female *Oncorhynchus mykiss* were obtained from a local fish farm (Oz Alabalik fish breeding facility) that is built near Körkün Brook and uses waters of this brook. The oxygen content of the water was 10.89 ± 0.28 mg/L with a pH value of 8.2 ± 0.38 and temperature of 13 ± 0.40 °C. Forty wild (20 male- 20 female) and Forty (20 male- 20 female) farmed fish (average weight 350 g) were used for proximate analyses. Triplicate samples for each fish were analyzed for body composition and fatty acid profile. During the study, commercial trout

feed obtained from a private company (Abalioglu, Denizli, Turkey) was used. The nutritional values of the trout feed used in this study as follows: Crude protein (42.00%), Lipid (22.00%), Crude cellulose (3.00%), Moisture (10.00%), Crude ash (12.00%) and Total energy (4350 kcal/kg).

Proximate analysis

The fish samples were analyzed in triplicate for proximate composition: lipid content of rainbow trout by the Bligh & Dyer (1959) method, moisture and the ash content of fish by AOAC (1990) method, total crude protein by Kjeldhal method (AOAC, 1984).

Results and Discussion

Table 1 show the ratio of body composition of farmed female, male rainbow trout and wild female and male rainbow trout, respectively. Cultured female trouts; crude protein, crude ash moisture and lipid ratios were found respectively as 19.41%, 1.78%, 73.62% and 3.73%; in cultured male trouts crude protein, crude ash moisture and lipid ratios were found respectively as 18.73%, 1.52%, 75.23% and 3.36% in wild female trouts; crude protein, crude ash moisture and lipid ratios were found respectively as 19.65%, 1.61%, 73.83% and 2.97% in wild male trouts; 19.11%, 1.39%, 75.09% and 2.53%.

The differences in the body compositions of wild and farmed rainbow trout were in significant ($p < 0.05$). The comparison of body composition of each group was given in Fig. 1. Korkmaz and Kırkagaç (2008) also reported the ratio of the crude protein, lipid, ash and moisture of rainbow trout as 20.33%, 4.1%, 1.22% and 74.18%, respectively. In the current study, slightly lower protein level for farmed trout was

found. The body compositions of rainbow trout and other species vary depending on their genotypic features and habitats. Moreover, the nutritional habits and diet influence these differences (Kiris & Dikel, 2002; Uysal, Caklı, & Celik, 2002; Sener & Yildiz, 2003; Yildiz, Sener, & Timur, 2006).

In the present study, the protein content of female rainbow trouts were found higher than male fish in both cultural and wild groups. Regarding rainbow trout, Tokur et al. (2006) reported the protein value as 22.96% and the lipid content as 2.71%. Furthermore, it has been reported that the nutritional values vary according to the feeding regime, feed composition, living area, harvest season, sex, size and environmental factor (Weatherup & McCracken, 1999; Rasmussen, 2001; Özden & Erkan, 2008).

In other studies made in the same area before, the crude protein rates of rainbow trout and *Salmo trutta macrostigma* were found as respectively 22.33 ± 0.31 , 19.92 ± 0.4 (Öz and Dikel, 2015; Öz and Dikel, 2015).

Korkmaz and Kırkagaç (2008) reported raw protein, oil, raw cinder and moisture content of rainbow trout as 20.33%, 4.1%, 1.22% and 74.18%, respectively. Kus (2012) identified the protein, lipid, cinder and moisture values for rainbow trout as 19.94%, 6.45%, 1.21% and 72.26%, respectively. Dikel (1999) reported raw protein, lipid, raw cinder and dry matter content for freshwater rainbow trout as 19.11 ± 0.26 , 0.96 ± 0.01 , 1.60 ± 0.02 , and 21.67 ± 0.10 respectively, and the raw protein, lipid, raw cinder and dry matter content for saltwater rainbow trout as 18.46 ± 0.41 , 1.45 ± 0.017 , 1.58 ± 0.005 , 21.50 ± 0.21 , respectively. As a result of our study, rainbow trout fed with black cumin oil supplements have higher raw protein, raw cinder, lipid and

proportion of dry matter when compared to the results reported in the studies mentioned.

In our research, the moisture content of both natural and cultured rainbow trout were found higher. Alemu, *et al.*, reported, sex was found to have no significant ($P > 0.05$) influence in terms of the four proximate components (moisture, protein, fat and ash) measured in Nile Tilapia fillet collected from Lake Zeway (Alemu, *et al.*, 2013). Different researchers have

reported that, moisture content of male fish higher than female fish (Islam and Joadder, 2005; Cornelia, 2012; Bhavan *et al.*, 2010; Nargis, 2006). As similar to present study, the moisture content of male Gilthead bream fish is higher than female (Wassef and Shehata, 1991). The lower moisture content in female Nile Tilapia can be attributed to muscles of female fish contain more organic materials and less water than male (Amer *et al.*, 1991).

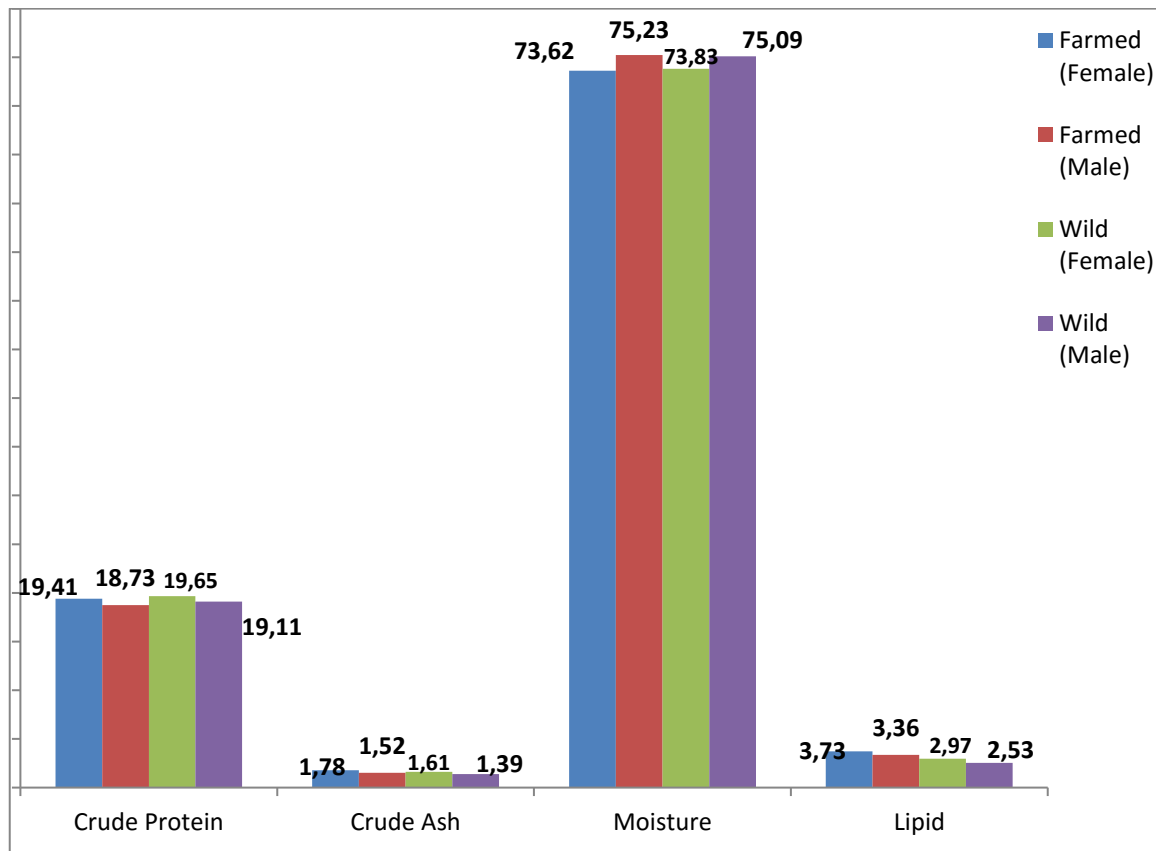


Figure 1. The comparison of body composition of wild and farmed rainbow trout.

Figür 1. Doğal ve kültür gökkuşağı alabalığının besin içeriklerinin karşılaştırılması

Table 1. The ratio of body composition of farmed female, male rainbow trout and wild female and male rainbow trout.
Tablo 1. Kültür dişi ve erkek gökkuşağı alabalığı ile doğal erkek ve dişi gökkuşağı alabalığının besin içeriklerinin karşılaştırılması

Body Composition	Farmed(Female)	Farmed(Male)	Wild(Female)	Wild(Male)
Crude Protein	19.41±0.20 ^a	18.73±0.12 ^b	19.65±0.22 ^a	19.11±0.08 ^b
Crude Ash	1.78±0.09 ^a	1.52±0.06 ^a	1.61±0.08 ^a	1.39±0.04 ^b
Moisture	73.62±0.14 ^b	75.23±0.28 ^a	73.83±0.36 ^b	75.09±0.41 ^a
Lipid	3.73±0.11 ^a	3.36±0.06 ^b	2.97±0.04 ^c	2.53±0.08 ^d

Each value indicates the average ± standard deviation (n=18*3). The averages expressed using different letters in each row are significantly different (p<0.05). n=18*3 for each group.

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