

Effect of Sex on The Nutritional Content of Some Fresh Water Fish Species (Carp-*Cyprinus carpio*, Pike-Sander *lucioeperca* and Pike perch-*Esox lucius*)

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Abstract

In this study, the muscle nutrient content of freshwater fish sold by fishermen in Aksaray province was determined. Carp (*Cyprinus carpio*), pikeperch (*Sander lucioeperca*), and pike (*Esox lucius*) fish used in the study were first sexed and then filleted. Crude protein (CP), Crude fat (CF), Crude ash (CA), and Moisture (M) amounts were determined from muscle tissue taken from the dorsal region of male and female fish. When the nutrient content of carp meat was analyzed, 18.25%, 1.46%, 1.26%, and 78.91% were found, respectively. The nutrient content of the muscle tissue of pikeperch was 18.08% (CP), 1.58% (CF), 1.09% (CA), and 79.14% (M), while the nutrient content of pike was 17.17% (CP), 1.59% (CF), 1.35% (CA) and 79.78% (M). In our study, in the evaluation made according to gender differences, the highest crude protein was measured in male pikeperch (18.49%), and the lowest crude protein ratio was measured in male pike (16.81%). When our fish were sorted according to their fat ratios, the highest crude fat was measured in male pikeperch (1.97%), and the lowest crude fat ratio was measured in female pikeperch (1.18%).

As a result, it was found that the nutrient content of the fish species analyzed in this study differed according to both species and gender.

Keywords: Proximate Composition, Carp, Pikeperch, Pike, Gender

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INTRODUCTION

In recent years, with the effect of epidemic diseases, consumers have started to give more importance to their nutrition, and thus the demand for seafood consumption is increasing. Furthermore, as the positive impact of seafood, especially fish oils, on human health are better known, people have begun to ask about the nutritional content of the fish they consume. This awareness of consumers has caused the fish species they prefer to change according to the seasons, as well as a change in fish consumption patterns. Knowing the nutritional content of fish and especially the crude fat ratios of fish is very important in terms of determining how to cook the fish, with which processing method it will be processed, with which spices or oils it will be cooked, and if it will not be consumed fresh and will be stored, the storage period (Öksüz et al., 2019; Öz and Uçak, 2021).

Many studies are conducted to determine the muscle nutrient content of fish (Öz and Dikel, 2022; Taşbozan et al., 2016; Öz, 2016; Öz et al., 2021; Nazari et al., 2017; Öz and Dikel 2015; Zare et al., 2021; Oz et al., 2018).

It is not always easy to reach fresh fish, especially in inland areas far from the sea, when fishing from the sea is prohibited. Consumers meet their aquaculture needs with fish from the cultural environment and frozen fishery products or fish caught from inland waters. Some regions' most popular and preferred fish are carp, pikeperch, and pike.

Carp (*Cyprinus carpio*) is an important freshwater fish species widely distributed due to its low water quality parameters and nutritional requirements. Carp is one of the most easily accessible fish species in many regions, as it is a fish species caught and farmed in inland waters (Öz & Üstüner, 2021). Pikeperch (*Sander lucioperca*) is a carnivorous freshwater fish in the Percidae family. It is also known by names such as freshwater perch, lake perch, white fish, white perch, German perch, and toothed fish, and its body length can reach 1.25 meters, and its weight can reach 19 kilograms (Başyigit, 2012). Pikeperch is a fish with high economic importance and is consumed with favor. It is considered an economically important species due to its low bones, rich nutritional content, and deliciousness (Çaklı, 2007). The pike (*Esox lucius* L, 1758) is an important Freshwater fish species that live in clean and densely vegetated lakes, stagnant ponds, and sub-basins of large rivers (Page & Burr, 2011). Pike, which has a carnivorous diet, is one of the economic species found in large quantities in Turkey's inland waters. The role of this species in the food chain, which is the food of humans and heron birds, is very important (Çelik, Kaya, & Yılmaz, 2012).

It is known that many factors affect the change in the muscle nutrient content of fish species. This study aimed to determine the nutrient content of carp, pikeperch, and pike, mostly hunted for human consumption in inland waters, by considering gender differences.

MATERIAL and METHOD

Preparation of Fish for Analysis

Our fish were supplied fresh from a fisherman operating in Aksaray. They were brought to the Aksaray University Veterinary Faculty Fisheries and Diseases Department laboratory in the cold chain and prepared for analysis. In our research, three fish hunted in the Central Anatolian Region and consumed lovingly in this region were used. The sexes of pikeperch (*Sander lucioperca*), carp (*Cyprinus carpio*), and pike (*Esox lucius*) used in the study were determined first, and then their fillets were removed and analyzed.

Nutritional Content Analysis

Crude protein analyzes were performed according to the Kjeldahl method using 1 g of homogenized sample (AOAC, 1998). Lipid analysis was performed according to the method applied by Bligh and Dyer (1959). Porcelain crucibles used in crude ash analysis were dried in an oven at 103 °C for 2 hours, cooled in a desiccator, and tared on a 0.1 mg sensitive precision balance. 3.3-5 g of the homogenized sample was weighed into the crucibles, and these samples were burned at +550 °C for 4 hours until their color turned light gray. Then, after cooling to room temperature in a desiccator, they were weighed on a precision balance (AOAC, 1990). Moisture analysis was based on the method applied by AOAC (1990).

Statistical Analysis

The data obtained at the study's end were evaluated using the SPSS 15.0 package program. Duncan's multiple comparison test ($P < 0.05$ significance level) One-way ANOVA was applied to compare the data obtained as a result of the analysis of carp, pikeperch, and pike fish obtained fresh from fishermen.

RESULTS and DISCUSSION

In our research, the nutritional contents of male and female individuals of three freshwater fish species, which are the most sold by fishermen in Aksaray province and obtained through hunting, were determined. The results are given in Table 1.

Table 1. The nutritional content of Pike, Carp, and Pikeperch meat

Fish species and gender	Crude protein	Lipid	Crude ash	Moisture
Pike (♂)	16,81±0,49 ^C	1,69±0,01 ^B	1,40±0,01 ^A	79,98±0,46 ^A
Pike (♀)	17,54±0,06 ^B	1,50±0,05 ^C	1,31±0,01 ^B	79,58±0,06 ^A
Pikeperch (♂)	18,50±0,22 ^A	1,98±0,08 ^A	1,02±0,00 ^E	78,44±0,28 ^B
Pikeperch (♀)	17,68±0,13 ^B	1,19±0,02 ^D	1,17±0,02 ^D	79,84±0,12 ^A
Carp (♂)	18,43±0,20 ^A	1,72±0,03 ^B	1,27±0,01 ^C	78,44±0,27 ^B
Carp (♀)	18,08±0,23 ^{AB}	1,21±0,02 ^D	1,25±0,01 ^C	79,39±0,22 ^A

Crude protein, crude fat, crude ash, and moisture content of pike meat were found to be 16.81-17.54%, 1.69-1.50%, 1.40-1.31%, and 79.98-79.58% in males and females, respectively. Crude protein, crude fat, crude ash, and moisture content of pikeperch meat were calculated as 18.50-17.68%, 1.98-1.19%, 1.02-1.17%, and 78.44-79.84% for males and females, respectively. In this study, crude protein, crude fat, crude ash, and moisture content of carp meat were 18.43-18.08%, 1.72-1.21%, 1.27-1.25%, and 78.44-79.39% for males and females, respectively (Figure 1 and Figure 2).

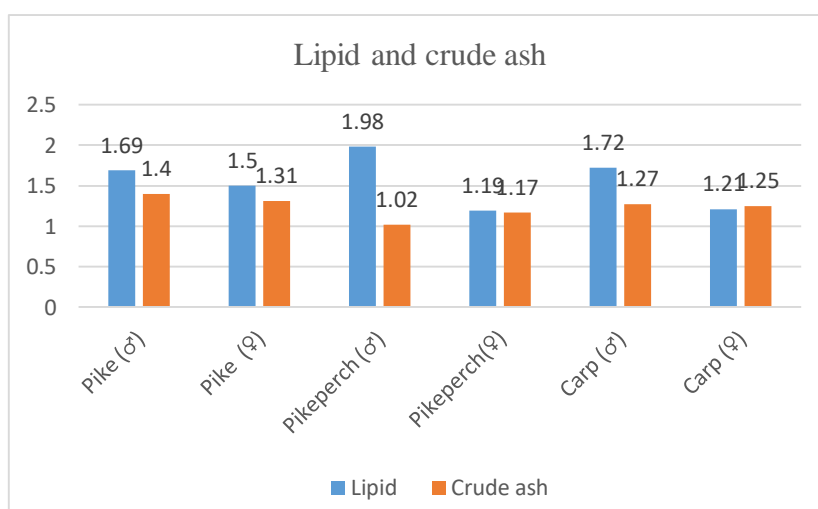


Figure 1. Crude fat and crude ash ratios of Pike, Carp, and Pikeperch meat

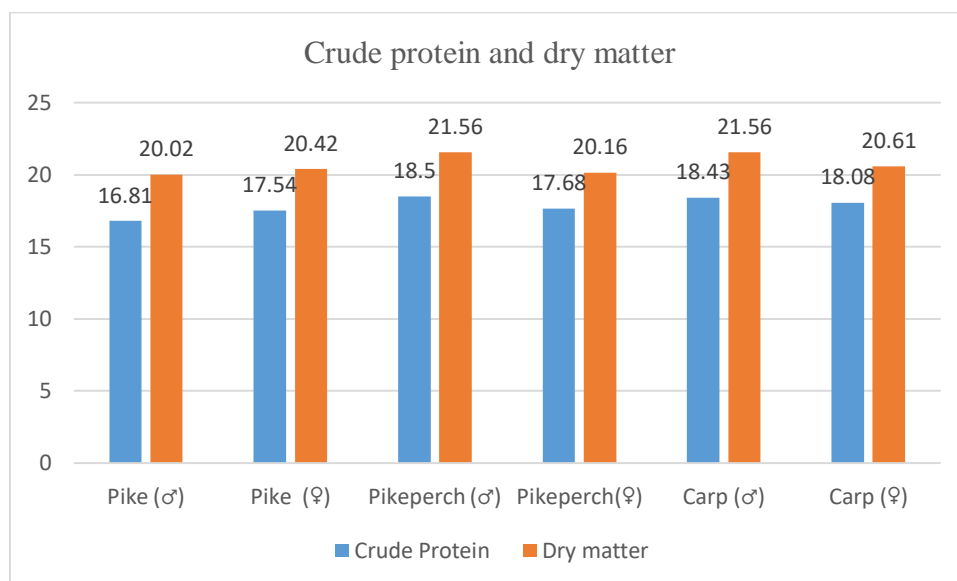


Figure 2. Crude protein and dry matter content of Pike, Carp, and Pikeperch meat

In the species-based evaluation without considering the gender separation, the highest crude protein was measured in carp (18.25%), and the lowest crude protein ratio was measured in pike (17.17%). When our fish species were ranked according to their fat ratios, the highest crude fat was found in pike (1.60%), and the lowest crude oil ratio was in carp (1.46%). The highest protein rate was calculated in the males of the pikeperch fish (18.50%), and the lowest protein ratio was calculated in the males of the pike (16.81%). When the moisture content of the meat taken from three freshwater fish species was examined, the highest moisture content was calculated in male pikes and the lowest moisture content in the meat of pikeperch. In our study, in the analyzes made from the samples taken from our fish meat, the highest fat rate was found in male pike perch, while the lowest fat rate was found in female carp meat. In our study, the highest fat rate was found in the meat of male pike, while the lowest fat rate was found in the meat of female carp.

Fish species are analyzed in four different groups according to their fat content. Fish with less than 2% fat is classified as lean fish, fish with 2-4% fat is classified as low-fat fish, fish with 4-8% fat are classified as medium-fat fish, and fish with more than 8% fat are classified as high-fat fish (Ackman, 1990). According to this grouping, the carp, pike, and pike perch we used in our research are lean fish. In a previous study conducted in Turkish waters, the oil rate of carp was found to be 3.33%, and it was evaluated as a low-fat fish. In the same study, the fat ratio of pike perch (1.73%) was similar to our research results and was shown in the low-fat fish class of pike perch (Öksüz et al., 2019).

Orban et al. (2007) reported crude protein as 17.89%, crude fat as 0.90, crude ash as 1.21%, and moisture as 80.28% in a study they conducted to determine the nutritional content of pike perch (*Perca fluviatilis*) caught from three different lakes. A study conducted in Beyşehir lake investigated the nutritional composition of Carp and Pikeperch fish. In the study, the crude protein rate of carp meat was reported as 17.40%, the crude ash rate was 1.12%, the moisture rate was 78.87%, and the crude fat rate was 3.33%. In the same study, it was reported that the crude protein rate of pikeperch meat was 18.97%, the crude ash rate was 1.04%, the moisture rate was 79.43%, and the crude oil rate was 1.73% (Öksüz et al., 2019).

In a study conducted by Ljubojevic et al., (2013) in December, the moisture content of carp was found to be 73.6%, crude protein 15.64%, crude fat 10.07%, and crude ash 1.14%, while these values were reported as 77.85%, 19.27%, 1.8%, and 1.04%, respectively in pikeperch (Ljubojevic et al., 2013). In the carp caught from the Danube river, the protein rate was 16.69%, and the fat rate was 7.3% (Ljubojević et al., 2017). In a study examining whether the nutritional content of pike varies according to gender and living environment, it was reported that the moisture rate was 74.42-80.30%, the crude protein rate was 17.44-22.33%, the crude ash rate was 1.27%-1.40%, and the crude fat rate was between 0.69-1.89% (Modzelewska- Kapitula et al., 2017).

CONCLUSION

The results obtained in this study are very consistent with the literature. The values obtained are lower than in some studies, higher than in some studies, and very close to the results of some studies. When the reasons for these differences are examined, one of the most important factors is the season and the environment in which the fish live. In general, it was determined that the fish were more oily in the samples made in the autumn and before the winter season, and the oil rate of the fish was low in the analyses made at the end of the winter, that is, in the first spring, as in our study. As a result, the nutritional contents of males and females of three fish species, mostly caught and consumed with pleasure in fresh waters, were extracted and evaluated. It was concluded that the nutrient content of fish varies between species as well as by gender.

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