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Seasonal distribution and biochemical composition of *Barbus* sp. in Ciftekavak Stream, Rize-Turkey.

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ABSTRACT

Seasonal variations in the biochemical composition of *Barbus* sp. sampled from Rize Çiftekavak Stream have been investigated between 2013 and 2014. The average total length and weight was recorded as 19.93±12.47 cm and 37.26±16.47 g, respectively for the fish sampled seasonally. Min-max crude fat, crude protein, crude ash, dry matter, pH, water activity (a_w) and color values were recorded as 1.17-2.72%, 15.54-18.35%, 1.37-1.60%, 19.00-22.26%, 6.39-6.58, 0.9927-0.9962, and L* (28.85-33.70), a* (4.10-6.58), b* (5.5-8.3), respectively. For the evaluations performed in the present study, the differences in terms of the analysis showed significances ($P < 0.05$).

Introduction

Natural resources in the world are not unlimited and are under threat due to human impacts on the nature. Human continue searching new food sources to sustain their life. Today, healthy and balanced diet is one of the most important issues of humanity (Samsun et al. 2006). Fish meat is considered as a dietary high value nutrient with high protein content and being rich in terms of energy. Nutrient composition and energetic value of fish meat may vary depending on different factors such as species, age and sex of fish, and seasons (Zencir et al. 2004).

Around 576 *Barbus* species have been reported in the world. Some of the Barbus species are distributed mainly in cold waters, while some others prefer warmer water environments. This species are usually seen in fast running waters with gravelly sandy grounds, however they also can be found in stagnant water streams sometimes. There are many species and sub-species of this genus which show economical value in the market. It has been reported that the *Barbus* genus was originated from Eastern Asia, widely distributed in Europe, Southwest Asia and North of Africa. Seven species and 6 sub-species of this genus inhabit in the waters around Turkey (Turan et al. 2005).

Due to the rapid development of the technology and growth of industries, water resources in the world are getting polluted and natural breeding of organism are being threaten as a result of environmental pollution. Besides, the serious increase of the world's human population also forces people towards more food supply (Turan et al. 2005). The aim of this study was to determine the seasonal variation in the biochemical composition of *Barbus* sp. distributed in Çiftekavak Stream, Rize-Turkey.

Material and methods

This study was conducted in Çiftekavak Stream, Rize-Turkey (41° 01' 54.25" N, 40° 28' 58.15" E) between in April 2013 and March 2014 (Figure 1). The samples were collected with elektro-shock method (Figure 2). Changes in

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Figure 1. Sampling Area (41° 01' 54.25" N, 40° 28' 58.15" E).

seasonal biochemical compositions of 120 *Barbus* specimens were examined and evaluated during the study.

Figure 2. Sampling point and method (Original).

Measurements of fish were taken with digital calipers (0.1 mm accuracy) and electronic scales (0,001 g accuracy). In this study, average length and weight of the barbs were 19.93±12.47 cm and 37.26±16.47 g, respectively. *Barbus* sp. has a slender and slightly compressed body, the mouth is ventral and horseshoe shape. It has a pair of medium sized barbels around its mouth. Body is dark on the back side, yellow on lateral and white on the ventral side. A lot of black irregular shaped spots are visible on along the body and fins (Figure 3).

Taxonomic position of *Barbus* sp.

Kingdom	: Animalia
Phylum	: Chordata
Superclass	: Actinopterygii
Order	: Cypriniformes
Family	: Cyprinidae
Genus	: *Barbus*
Species	: *Barbus* sp.

Figure 3. General body shape of *Barbus* sp. (Original).

Protein, fat, ash, a_w, dry matter, pH and color values of samples were determined in seasonal periods during the study. Water activity (a_w) values of samples were determined by Aqualab 4 TE device. The crude protein analyses were calculated on the wet material using the Kjeldahl method (Norwitz, 1970). Percent crude fat value was detected using the soxhlet methods (Norwitz, 1970). Moisture content was determined by oven drying of 5 g of fish meat at 105°C until a constant weight was obtained (Norwitz, 1970). Percent crude ash content was determined using a muffle furnace at 550°C (Norwitz, 1970). The pH values of fish were measured according to Curran et al. 1980 by a pH meter (Hanna, HI 3220). Color measurements were made by Konica Minolta CR 14 devices using homogenized samples. Statistical analysis were conducted on the average ± standard deviation (n:2-3) of the data obtained and treated by the least significant difference (LSD) test of SPSS 15.0 and the significance was defined at $P < 0.05$ (Sümbüloğlu and Sümbüloğlu, 2000).

Results and Discussion

The biochemical analysis results of 120 *Barbus* sp. caught from Çiftekavak Stream, Rize-Turkey are shown in Figure 4, 5, 6, 7.

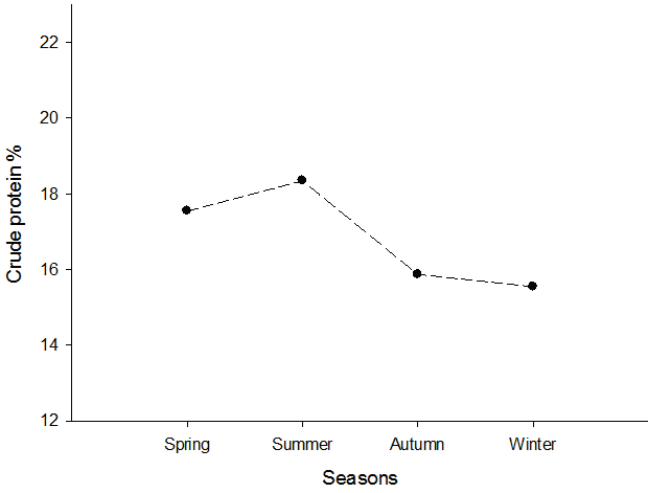

Figure 4. Seasonal crude protein (%) contents of *Barbus* sp.

The crude protein values in the spring, summer, autumn and winter periods were found as 17.54%, 18.35%, 15.87%, and 15.54%, respectively (Figure 4). In terms of seasons no significant difference was found in the statistical analyzes ($P > 0.05$). Crude fat values were calculated as 1.49% in

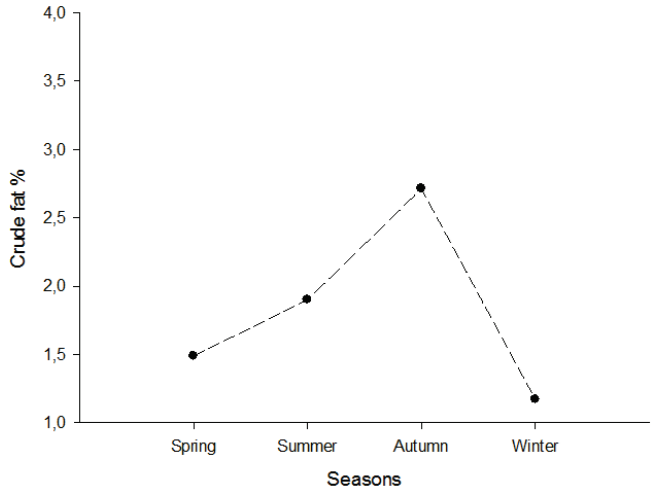

Figure 5. Seasonal crude fat (%) contents of *Barbus* sp.

spring, 1.90% in summer, 2.72% in autumn and 1.17% in winter and did not differ significantly ($P > 0.05$) among the seasons (Figure 5). According to analysis results made in spring, summer, autumn and winter, the dry matter values were found as 20.14%, 22.26%, 21.72%, and 19.00%, respectively (Figure 6). The difference between the seasons was not found significant at 5 percent level ($P > 0.05$). The percent crude ash was found at minimum level in spring with a value of 1.37 and maximum in summer and autumn both with values of 1.60. No significant differences ($P > 0.05$) were found among seasons (Figure 7).

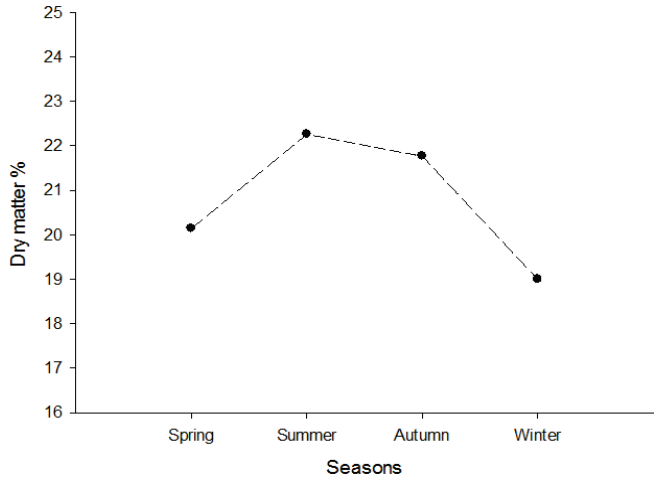

Figure 6. Seasonal dry matter (%) contents of *Barbus* sp.

In an earlier study, Duman and Duman (1996) reported the average dry matter as 21.34%, protein level as 14.18%, fat content as 2.51% and ash as 1.29% for the barb (*Barbus rajanorum mystaceus*) caught in the Keban Dam Lake, Turkey. In another study conducted on *Barbus rajanorum mystaceus* the min. and max. values for protein, dry matter, fat and ash were reported as 17.10-18.51%,19.80-22.94%, 0.92-2.01%, and 1.09-1.36%, respectively (Çelik et al. 1990).

Another study reported the seasonal dry matter, ash, fat, protein, a_w values for the chub (*Squalius cephalus*) as 35.6%, 1.24%, 14.03%, 19.93%, 0.953% in autumn, 26.65%, 1.53%, 14.23%, 20.13%, 0.951 in winter, 34.01%, 1.24%,

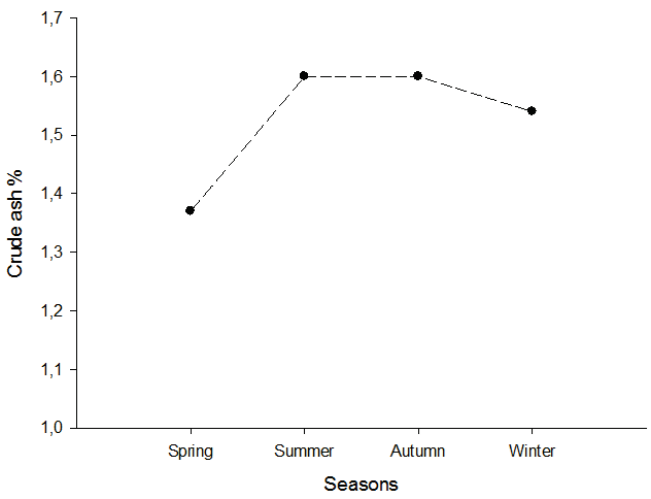

Figure 7. Seasonal crude ash (%) contents of *Barbus* sp.

12.76%, 17.85%, 0.952 in spring, 34.51%, 1.15%, 15.38%, 17.01%, 0.954 in summer, respectively (Karaton and İnanlı, 2011). In our study, dry matter content of barb showed similarities with the data of Duman and Duman (1996) and Çelik et al. (1990), but showed difference from the data reported for chub by (Karaton and İnanlı, 2011). In terms of crude protein content the results of the present study were found similar with those reported in the previous studies.

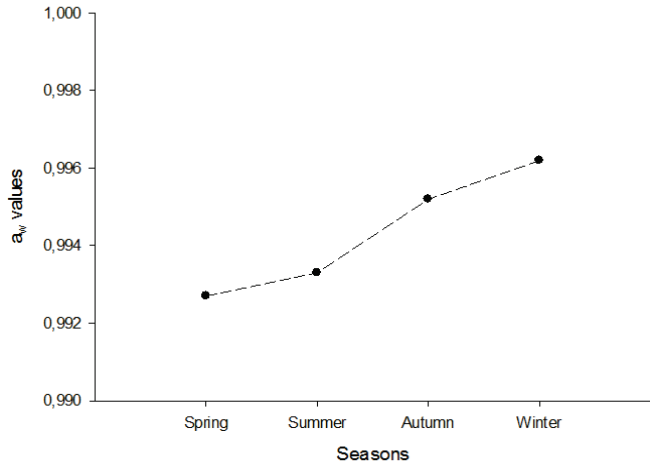

Figure 8. Seasonal water activity (a_w) values of *Barbus* sp.

Crude fat levels which differ according to the seasons in our study were found very low compared with the findings of Karaton and İnanlı (2011). However, both the results in the present study in terms of fat levels and those reported in earlier studies on barbs gave similar results. The ash values were calculated between 1.37 and 1.60% in the present study were different with those of Duman and Duman (1996), but similar to the results of Çelik et al. (1990) and Karaton and İnanlı (2011).

Water activity values of fish in spring, summer, autumn and winter were determined as 0.9927, 0.9933, 0.9952 and 0.9962, respectively (Figure 8). Significant differences were found among seasons ($P < 0.05$). Our study showed differences when comparing with Karaton and İnanlı (2011) in terms of a_w data.

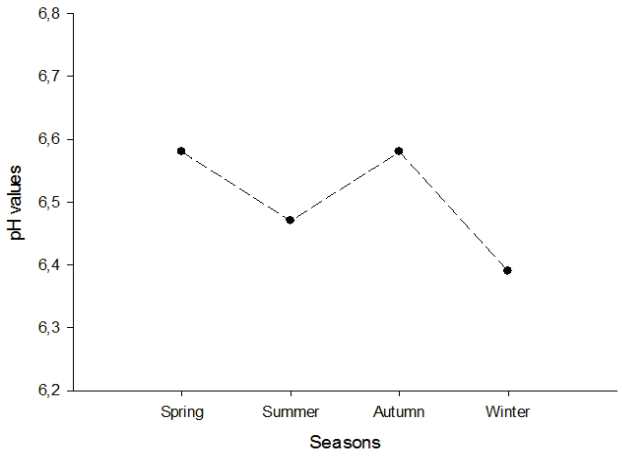

Figure 9. Seasonal pH values of *Barbus* sp.

As shown in Figure 9, pH values in spring, summer, autumn and winter were found as 6.58, 6.47, 6.58, and 6.39 ($P > 0.05$). pH values in some earlier studies were reported as 6.36 (Patır and Duman, 2006), 5.75 (Berik and Kahraman, 2010) and 6.69 (Yılmaz et al. 2002). When comparing to our findings, Berik and Kahraman (2010) reported lower pH values while similar values with our results were found in the other studies mentioned above.

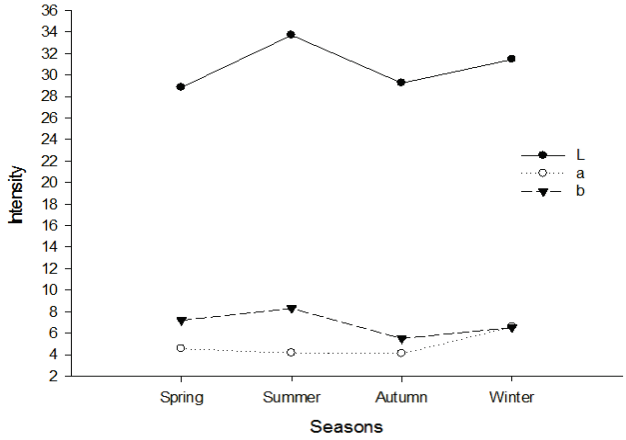

Figure 10. Seasonal color (L*, a*, b*) intensity of *Barbus* sp.

L*, a*, b* values for color analysis were assessed and the L* values were found as 28.85 in spring, 33.7 in summer, 29.25 in autumn and 31.45 in winter. The values for a* were determined as maximum (6.58) in winter and minimum (4.10) in autumn. The b* values in spring, summer, autumn and winter were found as 7.20, 8.30, 5.50, and 6.52, respectively (Figure 10). According to the statistical evaluation in terms of seasons, L* and a* values did not show significant differences ($P > 0.05$), while b* values showed statistically significances ($P < 0.05$) among seasons. The seasonal color measurements of barbs were performed, but these couldn't be compared to any study for this species. Şimşek (2011) reported the color values of trout as 62.3 of L*, 5.44 of a* and 11.03 of b*. We obtained L* and b* values lower than the findings of Şimşek (2011) for trout, but a* values in both studies were similar.

It clearly can be seen that seasonal changes in body compositions of fish varies dependending on species, sex, seasons and region.

Conclusion

As a result of the biochemical analysis, crude protein, crude fat, crude ash and moisture values of barbs were found between 18.54-21.35%, 1.17-2.71%, 1.37-1.60%, 77.74-81%, respectively. The differences among seasons may be due to the reproductive period and gender. Based on the results of this study, it can be said that barbs have significant animal protein content for consumers.

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