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Seasonal Variation in Major Minerals (Ca, P, K, Mg) and Proximate Composition in Flesh of Mesopotamian Catfish (*Silurus triostegus* Heckel, 1843) from Turkey

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Authors' contributions

This work was carried out in collaboration between all authors. Author MPO designed the study, wrote the protocol and wrote the first draft of the manuscript. Author İAO collected the samples, worked in the practical part. Author MG performed the statistical analysis and managed the literature searches. All authors read and approved the final manuscript.

Short Communication

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ABSTRACT

In this study, the seasonal variation on selected major minerals (Ca, P, K, Mg) and proximate composition of Mesopotamian catfish (*Silurus triostegus* Heckel, 1843) were investigated. Fish samples used in this research were obtained seasonally from Atatürk Dam Lake within the boundries of Turkey (37ºC45N' latitude/38ºC17E' longitude) via fishing. The mean value of Ca, P, K and Mg were determined as 92.59±9.81µg/g, 1447.56±117.38µg/g, 2762.50±418.00µg/g and 227.26±39.79µg/g (wet weight) respectively. The highest mineral contents were identified in summer. The highest crude protein was observed in autumn (18.88%) and the lowest in winter (16.88%).The average lipid content was identified between 4.22-6.56% and the highest value was observed in winter. The results showed significant differences between the four seasons ($P<0.05$) in major minerals and proximate composition.

Keywords: Mesopotamian catfish; Silurus triostegus; minerals; proximate composition.

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1. INTRODUCTION

Fish protein and mineral contents are recognised for their nutritional and functional properties in human diet. There is growing evidence that fish lipids are good for the heart and blood vessels and control for cardiovascular diseases. Therefore eating fish or taking fish oil, both freshwater and marine, is being encouraged [1]. There are two types of minerals: major minerals (Calcium, Phosphorus, Potassium, Magnesium etc.) which are essential to human health and play an important roles in biological systems required in higher amounts in the body and trace minerals (Iron, Zinc, Copper, Chromium etc), which amount to less than a teaspoon of a person's body weight [2-4]. The Information about some proximate parameters such as protein, lipids, carbohydrate, moisture and ash is often necessary to ensure that they meet the dietary requirements, food regulations and commercial specifications [5-8]. The mineral and proximate composition of fish varies greatly from one species and one individual to another depending on age, sex, environment, season, area of catch and processing method [4,9].

Mesopotamian catfish (*S. triostegus*) is one of the leading fish species from the Atatürk Dam Lake of Turkey (The Atatürk Dam Lake is one of the largest earth-and-rock filled dams in the world and has a high fishing potential) with great importance in economy and people who live in Southeastern Anatolia consume this fish abundantly [10-12]. There is no previous report on the major minerals and proximate composition of Mesopotamian catfish (*S. triostegus*). Therefore, the present study is aimed to see the seasonal variation in selected minerals and proximate composition in Mesopotamian catfish.

2. MATERIALS AND METHODS

2.1 Fish Samples

S. triostegus used in this research were obtained seasonally from Atatürk Dam Lake within the boundries of Turkey (37℃ 45N' latitude/38℃ 17 E' longitude) via fishing. Fish samples were stored in ice and transported to the laboratory on the same day. After removing the head, fins, scales, skin and all inner organs, fish muscle was washed with distilled water and placed in a polyethylene bag and kept at -20ºC until the analyses. A total of 40 (5 pairs of *S. triostegus* in each season) fish samples were used in the research.

2.2 Chemical Analysis

The flesh samples were transported with dry ice to the Industrial Services Laboratories of TUBITAK–MAM (The Scientific and Technological Research Council of Turkey, Marmara Reasearch Centre). The mineral analysis was carried out as described by Association of Official Analytical Chemists [13] using Atomic Absorption Spectrophotometer. 0.5g of fish muscle (wet weight) was weighed and placed in a teflon digestion vessel with 6ml of concentrated (65%) nitric acid (HNO_3) and 1.5ml 30% hydrogen peroxide (H_2O_2) and digested in microwave digestion system (Milestone Ethos PLUS). The major minerals determined were calcium (Ca), phosphorus (P), potassium (K) and magnesium (Mg). The concentrations were expressed as µg/g wet weight of tissue in organisms.

The protein analysis of flesh samples was carried out according to the Kjeldahl Method [14], and the fat estimation was done according to the Acid Hydrolosis Soxtec System [14], the moisture analysis was made by dehydrating the homogenized samples to a fixed weight with

an incubator [14] and the raw ash was measured after burning the samples at 550ºC [14] The energy calculation of samples were evaluated with the Method of Watt and Merril [15].

2.3 Statistical Analysis

For data analysis, standard deviation and one-way ANOVA were employed by using SPSS 15.0 Windows software and Duncan's test was used in the evaluation between the means Significance of differences was defined at P≤0.05. The mean values were obtained from 3 experiments and reported as X±SD [16].

3. RESULTS AND DISCUSSION

The results of seasonal changes in major minerals of Mesopotamian catfish are shown in Table 1. The results showed significant differences between the four seasons (p<0.05) in major minerals.

Table 1. Seasonal changes in major mineral contents of Mesopotamian catfish (µg/g wet weight)

Seasons	Ca	P	K	Mg
Spring	*95.93*±0.*59*^{c}	1469.45±4.05^{b}	2955.67±5.03^{c}	210.53±0.47^{b}
Summer	103.56±0.06^{d}	1557.25±31.68^{c}	3132.67±2.51^{d}	265.23±1.07^{d}
Autumn	90.66±0.66^{b}	1482.18±53.99^{b}	2790.00±3.00^{b}	254.07±0.55^{c}
Winter	80.21±0.55^{a}	1281.36±33.63^{a}	2171.67±4.72^{a}	179.20±0.20^{a}
Avarage	**92.59±9.81**	**1447.56±117.38**	**2762.50±418.00**	**227.26±39.79**

Data are expressed as mean±SD of triplicate measurements Different superscripts in a column show significant differences between samples (p<0.05)

It is observed that during the summer period, Mesopotamian catfish showed the highest Ca(103.56µg/g), P(1557.25µg/g), K(3132.67µg/g) and Mg(265.23µg/g) levels. On the opposite, mineral content in winter were the lowest registered as 80.21µg/g, 1281.36µg/g, 2171.67µg/g and 179.20µg/g respectively.

The results of seasonal proximate analysis in the flesh of Mesopotamian catfish are shown in Table 2. The results showed significant differences between the four seasons (p<0.05) in proximate composition.

Table 2. Seasonal changes in proximate composition of Mesopotamian catfish

Seasons	Crude Proteing/100g	Lipid g/100g	Moisture g/100g	Ash g/100g	Energy kcal/100g
Spring	17.54±0.14^{a}	4.35±0.00^{a}	77.15±0.00^{a}	0.93±0.00^{a}	109
Summer	17.44±0.00^{b}	4.22±0.00^{b}	77.39±0.00^{b}	0.91±0.00^{b}	108
Autumn	18.88±0.03^{c}	4.35±0.00^{a}	75.90±0.01^{c}	0.83±0.00^{c}	115
Winter	16.88±0.00^{d}	6.56±0.00^{c}	75.80±0.00^{d}	0.67±0.00^{d}	127
Avarage	**17.68±0.84**	**4.87±1.12**	**76.56±0.82**	**0.84±0.11**	**114.75±8.73**

Data are expressed as mean±SD of triplicate measurements Different superscripts in a column show significant differences between samples (p<0.05)

The highest crude protein value in Mesopotamian catfish was observed in autumn (18.88%) and the lowest in winter (16.88%). It was observed that the avarage protein content was

17.68%. Spawning and feeding habits are thought to be the main cause of the seasonal variations in major minerals and proximate composition in flesh of Mesopotamian catfish.

Ozyurt et al. [17] also reported variation in mineral content of *Sander lucioperca*, *Cyprinus carpio* and *Silurus glanis.* K contents of these species were 3547.0µg/g, 3581.0µg/g and 3059.0µg/g respectively. Their Mg contents were 374.30µg/g, 342.10µg/g and 271.10µg/g respectively. When the concentration of K and Mg in this study were compared with other some other freshwater fish species from Turkey, it was noted that *S. triostegus* had low quantities of K and Mg than *S. lucioperca*, *C. carpio* and *S. glanis*. Similarly, the avarage Ca and P contents in the present study were identified as lower than those reported previously for some freshwater species from Atatürk Dam Lake such as *Barbus grypus* and *Oncorhynchus mykiss* [18,19]. At the same time all seasons showed Ca values lower than 250 µg/g, which is the medium Ca value in fish as reported by Martinez-Valverde et al. [20].

The observed range of ash content Table 2. also indicated that the species is poor in minerals. Because the ash values is also lower (for *B. grypus* 1.06g/100g, *Mastacembelus mastacembelus* 1.38g/100g, *O. mykiss* 1.36g/100g*, S. lucioperca* 0.98g/100g, *C. carpio* 1.17g/100g and *S. glanis* 0.97g/100g*)* than that reported by other authors [20-22].

The maximum protein content (18.88%) were lower than or similar to the other economical freshwater fish species from Atatürk Dam Lake such as *B. grypus* (19.34%), *M. mastacembelus* (19.88%), *O. mykiss* (19.60%) [18,19,21] and other freshwater species such as *Brycon cephalus* (20.03%), *Brycon microlepis* (19.83%), *Brycon orbygnyanus* (18.94%) *S. lucioperca* (16.93-18.81%), *Channa lucius* (19.9%), *Perca fluviatilis* (18.43%), *Tinca tinca* (16.53-19.72%), *Vimba vimba tenella*, *Tilapia* spp. (18.02%) which have also been studied in Turkish inland waters [22-27].

The lipid content was identified to differ between 4.22-6.56% and the highest value was observed in winter (6.56%). Considering that, energy levels are associated with fat content, the energy value was also at the highest in the winter (127kcal/100g). Similar results are reported in *B. grypus* from Atatürk Dam Lake, [22] with the highest energy energy and lipid content in winter period. On the other hand, the avarage lipid content (4.87%) was high in the present study when compared with other freshwater species from Atatürk Dam Lake such as *Barbus grypus* (4.04%), *M. mastacembelus* (2.10%), *O. mykiss* (4.43%) and other freshwater species from inland water of Turkey such as *T. tinca* (0.61%-2.46%), *C. carpio* (0.88%), *S. lucioperca* (0.10-0.28%) and *S. glanis* (0.54%) *V. vimba tenella* (2.41%), *Tilapia* spp. (2.65%) [21-27].

4. CONCLUSION

The results of this study showed that Mesopotamian catfish from Atatürk Dam Lake (Turkey, Adiyaman) has rich lipid content, a low amount of major minerals and protein content when compared with other economical freshwater species from Turkey. However, the highest levels of the major minerals in Mesopotamian catfish (*S*. *triostegus*) were recorded in summer period.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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