

**FATTY ACID COMPOSITION OF GONAD TISSUE  
IN FEMALE AND MALE *Chondrostoma regium* (Heckel, 1843) LIVING IN  
CEYHAN RIVER, KAHRAMANMARAŞ-TURKEY**

**Cemil KARA**

**Mustafa ÇELİK**

Kahramanmaraş Sütçü İmam Üniversitesi, Faculty of Arts and Sciences  
Biology Department Kahramanmaraş, Turkey.

**ABSTRACT**

The prior to and after reproduction of total lipid content of the fatty acid composition in females and males of *Chondrostoma regium* at gonad tissue living in Ceyhan River was determined. Total lipid content of gonad in female were found to be higher significantly ( $P<0.05$ ) in the prereproductive season than after reproduction season. On the other hand, the total fatty acid content in gonad of female and male were found the similar trends of the total lipid. The results of gas chromatographic analysis revealed that fatty acid showed significant variation between seasons in both genders ( $P<0.05$ ,  $P<0.01$  and  $P<0.001$ ). It was also observed that the amount of fatty acids after the reproduction decreased in both genders. However, there was no significant changes in the ratio of unsaturated fatty acids.

**Key Words:**Total lipid, Fatty acid, *Chondrostoma regium*, Gonad, Ceyhan River

**SIR BARAJ GÖLÜ'NDE YAŞAYAN *Chondrostoma regium* (Heckel, 1843)'UN  
DIŞİ VE ERKEK BİREYLERİNİN GONADLARINDAKİ YAĞ ASİDİ  
BİLEŞİMLERİNİN SAPTANMASI**

**ÖZET**

Bu çalışmada, Sır Baraj Gölü'nde yaşayan *Chondrostoma regium* dişi ve erkek bireylerinin üreme öncesi ve sonrasında gonadlarındaki yağ asidi bileşimi tayin edildi. Dişi ve erkek bireylerin gonadlarındaki yağ asidi içeriği üreme dönemi öncesinde üreme dönemi sonrasına göre yüksek bulundu. Bireylerin yağ asidi bileşimindeki yağ asidi oranlarının dönemler arasında değişik varyasyonlar gösterdiği belirlendi ( $P<0.05$ ,  $P<0.01$ ,  $P<0.001$ ). Dişi ve erkek bireylerde yağ asitlerinin miktarının üreme sonrasında azaldığı, bazı doymamış yağ asidi oranlarında ise önemli değişme olmadığı belirlendi ( $P>0.05$ ).

**Anahtar Kelimeler:** Total lipid, Yağ asitleri, *Chondrostoma regium*, Gonad, Ceyhan Nehri.

**INTRODUCTION**

Fish are potential sources of food in nourishing of men. The good taste of fish flesh comes from their fat contents. The importance of these fats for organism comes

from highly unsaturated fats which they contain ( 1, 2, 3). Fish and fish oil fatty acids are currently under intense scientific investigation because of the numerous health benefits attributed to them (4).

Akpınar (5), in the study on seasonal change of female and male *Cyprinus carpio* L. found that main fatty acids in reproduction period decreased partially, besides long-chained highly unsaturated fatty acid considerably lessened. In another study on seasonal change of fatty acids of liver tissues of female and *Cyprinus carpio*. He found out that as in muscle tissues, main fatty acids in reproduction period decreased partly, while long-chained highly unsaturated fatty acids decreased considerably.

Biological studies of lipids as an energy source for metabolism in fish have revealed their importance during periods of stress (6). Jangard et.al., (7) pointed out that lipids were decreased in reproduction season, while, Cho et al., (8) put forward that lipids were completely digested by the fish and preferred carbohydrates as energy sources.

Yılmaz (9) suggested that stored lipids were changing during reproduction and nourishment periods; especially in reproduction seasons for the growth of gonads, lipids were mobilized from liver to muscles and gonads. Over the last 20 years, interest in the human consumption of fish has increased dramatically (10). Marketing of gonads as cavier became a branch of industry (11).

There are plenty of fish species which exist naturally in the running waters and lakes of Turkey (12). *Chondrostoma regium*, a member of *Cyprinidae* family is the most important and dominant species in Ceyhan River at Kahramanmaraş-Turkey. The high abundance of this species in this river provides a potential sources of food for human consumption (12).

## MATERIALS AND METHODS

### Chemicals materials

Capric, Lauric, Myristic, Pentateconoic, Palmitic, Oleic, Linoleic, Linolenic, Arachidonic, Arachidic, Dokoheksanoic acids were purchased from Sigma Chemical Company in U.S.A.

### Sample Collection

The fish species of males and females *Chondrostoma regium* were collected in spring and summer seasons from various Ceyhan River locations, however studies some of studied of lipids and fatty acid contents sampling periods were performed before December, 1997 and after June, 1998 respectively.

### Lipid Extraction

Total lipids were extracted from *Chondrostoma regium* (body weight approximately 140 g) and gonads (3 g, withdrawn in 30-40 min after death) with chloroform-methanol (2:1, v/v) according to the method of Folch et. al. (13) as previously described by Christie (14). The gonad tissue samples were homogenized in a mixer (Warig mixer). Three grams of homogenized gonad tissue samples were mixed with chloroform-methanol (2:1v/v) in a mixer. Nonlipid contaminants in lipid extracts

were removed by 0.88% KCl. The extracts were evaporated in rotary evaporator flask and then stored at  $-25^{\circ}\text{C}$  until it was analysed.

#### **Determination of Total Lipids**

Total lipid was determined by the method of Frings et al. (15). Samples of 200  $\mu\text{l}$  were concentrated with  $\text{H}_2\text{SO}_4$  and heated in a boiling water bath for 10 min. Following the cooling step 10 ml of phosphovanilin reagent was added to the solution of extracted lipids and the mixture incubated in a  $37^{\circ}\text{C}$  water bath for 15 min.

#### **Fatty Acid Analysis**

Fatty acids in lipid extracts were converted to methyl esters by using 2% sulfuric acid prepared as volume in methanol (14). Fatty acid methyl ester forms were extracted three times with n-hexane. Fatty acid methyl esters were chromatographed isothermally at  $135-185^{\circ}\text{C}$  on a Shimadzu GC 14 B equipped with a flame ionization detector. Fatty acids were separation 10% DEGS coated on Chromosorb W (80-100 mesh) packed into a 2 m long x 2 mm internal diameter glass column. Separations were carried out with pure  $\text{N}_2$  carrier gas at 20 ml/min. Components were identified by comparisons of retention times with authentic standarts from Sigma Chemical Company.

#### **Statistical Analysis**

Gas chromatographic analyses of total fatty acid compositions were determined by both prior and post reproduction on both sexes. The collected values from groups were reported as mean $\pm$ SE. Statistical analysis was performed using SAS programe.

### **RESULT AND DISCUSSION**

*Chondrostoma regium* investigated which was collected from Ceyhan River in Kahramanmaraş region has the reproductive season starting from the beginning of March to the mid June.

The percentage of the total amounts of male and female gonads both prior and reproductive period were  $4.12\pm 0.27^*$ ,  $3.49\pm 0.85^*$  and  $4.87\pm 0.14^{**}$ ,  $2.69\pm 0.79^{**}$  respectively.

Total lipid amounts of gonads in December, 1997 males July, 1988 of females are different before and after the reproductive period. It is found that the total gonad lipid amounts in males and females becomes lower after the reproductive season. The decrease was observed mostly in females gonads ( $P<0.01$ ). The reason for that total lipids amounts in females after the reproductive season decreases because, that the large amount of lipids are stored in the ovarys during the development of embryos. Therefore, after the a genders the lipids amounts towards to decrease.

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\* $P>0.05$ , not significant

\*\* $P<0.01$ , slightly significant between groups.

After the egg release, the lipid amounts by this means starts to decrease. These results are similar of Medford et. al. (16) and Newsome et.al. (17).

The fatty acid compositions of gonads before and after the reproductive season are shown in Table 1. In gonad tissues, the amount of palmitic acid, total fatty acid, saturated, unsaturated fatty acids and total polyunsaturated fatty acids were found. According to these results fatty acids were higher on prereproductive season compared to post reproduction season. The results of gas chromatography analysis showed that palmitic (16:0) and oleic (18:1) acids formed a great part of fatty acid content in gonad tissue.

Additionally linoleic (18:2) and arachidonic (20:4) acids were found to be partially greater than long chain fatty acids such as docosahexaenoic (22:6) acids (as shown in Tables 1, Figures 1 and 2).

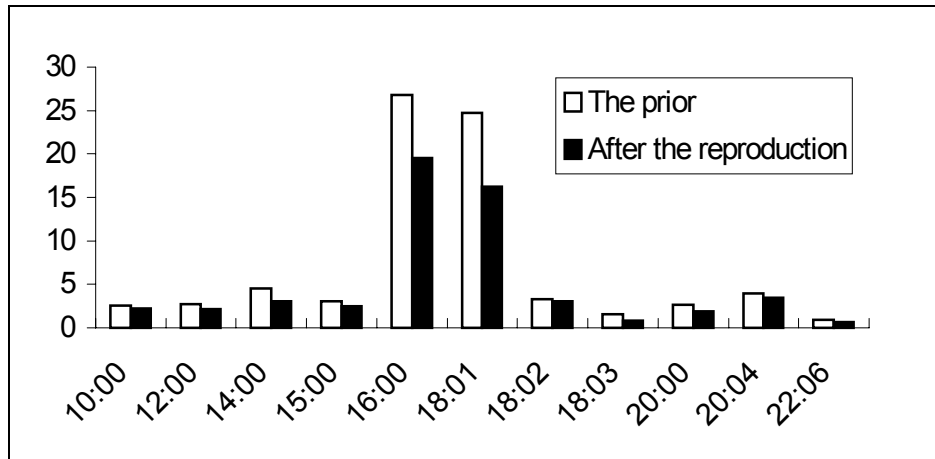
Table 1 Fatty acids composition in gonad female and male *Chondrostoma regium* were prior to and after reproduction (mg/3g).

Fatty acids	Female		Male	
	Prior	After reproduction	Prior	After reproduction
10:0	2.523±0.609	2.220±0.227	2.317±0.608	0.373±0.167
12:0	2.750±0.239	2.120±0.430	2.043±0.153	0.150±0.051
14:0	4.527±0.183	3.043±0.202	3.603±0.225	2.910±0.142
15:0	3.010±0.190	2.453±0.354	2.180±0.370	2.107±0.409
16:0	26.75±4.230	19.56±3.39	22.11±1.51	15.50±1.05
18:1	24.71±1.880	16.250±2.05	22.95±2.18	22.55±3.48
18:2	3.303±0.674	3.050±0.577	2.60±1.11	2.133±0.041
18:3	1.56±0.000	0.850±0.290	1.750±0.630	1.430±0.650
20:0	2.620±0.352	1.930±0.240	2.773±0.133	1.613±0.074
20:4	3.973±0.746	3.447±0.493	2.283±0.699	0.653±0.024
22:6	0.923±0.139	0.683±0.139	0.907±0.330	0.573±0.429
Σ	76.649±0.924	55.606±0.763	65.516±0.723	49.992±0.529
ΣSaturate	42.18±0.963	31.326±0.807	35.026±0.500	22.653±0.315
ΣUnsaturate	34.469±0.860	24.28±0.710	30.486±0.990	27.339±0.925
ΣMUFA	24.71±1.880	16.250±2.05	22.95±2.18	22.55±3.48
ΣPUFA	9.759±0.5220	8.03±0.374	7.54±0.692	4.789±0.286

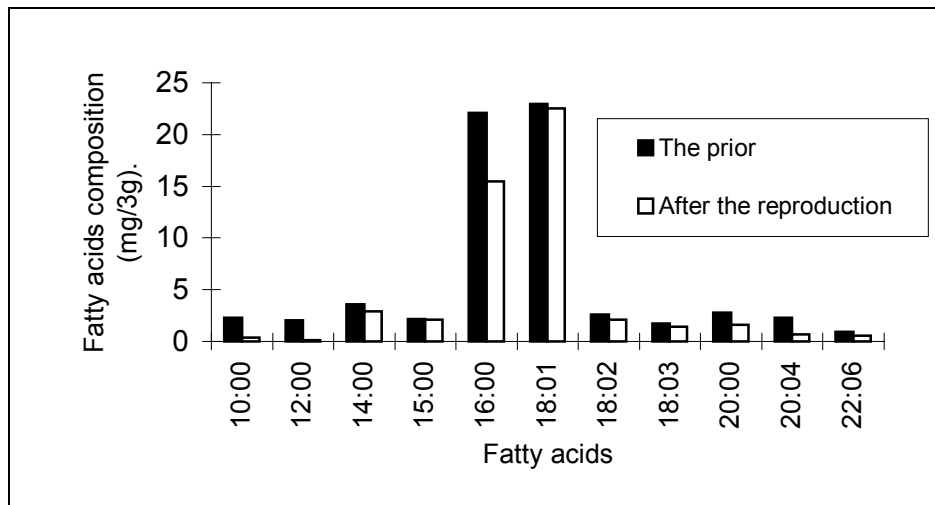
(MUFA: Monoenoic Unsaturate Fatty Acid, PUFA: Polienoic Unsaturate Fatty Acid)

Palmitic acid (16:0) and oleic acid (18:1) are the most common fatty acids in male and female gonads. The fatty acids such as capric acid, lauric acid (12:0) and docohexaenoic acid (22:6) are found very low according to the others.

Ackman and Eaton (18) pointed out that palmitic (16:0) acid was key metabolite in fish and that its level was not influenced by diet. They also reported that in Atlantic herring oils, palmitic acid (16:0) accounted for almost 60% of the total saturated fatty acids.



Figures 1. The change of the fatty acid of the *Chondrostoma regium* females prior and after reproduction.



Figures 2. The change of the fatty acid of the *Chondrostoma regium* males prior and after reproduction.

The amount of saturated fatty acids in the gonads of female *Chondrostoma regium* decreased after the reproduction ( $P < 0,01$ ). Saturated fatty acids were seen quite lower in male *Chondrostoma regium* after reproduction as compared with prereproduction at ( $P < 0,001$ ). In female *Chondrostoma regium*'s unsaturated fatty acids were found lower as compared with pre-reproduction ( $P < 0,05$ ), while it was not change in male *Chondrostoma regium* at ( $P > 0,05$ ).

The amount of fatty acids in female gonads after the reproductive season is lower than the pre-reproductive season. However, the decrease is even higher in male gonads. It was also found that the amounts of  $\Sigma$ MUFA and  $\Sigma$ PUFA in male and female gonads were not significantly changed pre- and post reproduction seasons and unsaturated monoenoic acid and polyenoic fatty acids in gonads did not reveal any differences not only in both sexes but also in their growth periods. By Hazel (19) explained that, this is due to the heat of freshwater habitat.

In addition, female *Chondrostoma regium* consumes total fatty acids in their gonads more than male *Chondrostoma regium* during prereproduction. The similar result was also found by Yılmaz (20) and Tocher et al. (21) studies. They reported that fatty acids were accumulated in egg cells for embryos to grow, that especially polyenoic fatty acids were used in the growth of embryos.

Gallagher et al. (22) observed that there was a decrease in the ratio of total lipid and fatty acids in *Micropogonias undulatus* at the end of the reproduction season. Mute et al., (23) noticed the similar situation. Our results were parallel with the consistent of the results of these researchers. We observed (June, 1998) that the amounts of fatty acids were decreased in *Chondrostoma regium* at the end of reproduction season also.

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