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SEASONAL CHANGES IN BLOOD SERUM OF TROUT FEMALES

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SEZONOWE ZMIANY W SUROWICY KRWI SAMIC TROCI

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The lipids, total and non-esterified cholesterol, total protein and the activity of malate-dehydrogenase (MDH) were determined in blood serum of trout females with gonads of III stage maturity, according to Mayer's scale, and during spawning period. The decrease of lipids by 42%, of total protein by 18% and the increase of total cholesterol content by 29% and of non-esterified cholesterol by 140% occurred during the spawning. Increased also the activity of malate-dehydrogenase.

INTRODUCTION

The problem of salmon fish migration for spawning is related to their physiological and morphological changes. Considerable decrease of body weight (up to 25%) with simultaneous increase of gonads occur beyond the physico-chemical changes. The changes are of biologic aspect, but they are of certain importance for fish processing.

The present work was aimed to determine the interrelationship between development of gonads of Baltic trout females and the content in their blood serum of lipids, total and non-esterified cholesterol, total protein and malate-dehydrogenase (MDH).

Subjected to investigations were 32 females of trout caught in Rega river near of Trzebiatów, at distance of 18 km from Rega outlet to Baltic.

## METHOD

The blood for analysis was taken by 10-15 ml from heart through the tunicle of body. In June, the blood originated from females with gonads of III stage maturity, according to Mayer's scale, and in December from spawning females.

The lipids from blood serum were extracted by method of Blight and Dyer (1959); total and non-esterificated cholesterol - by Francys and Amadon's (1968) method; total protein - by Kjedahl's micromethod; the activity of malate-dehydrogenase was determined spectrophotometrically with Boeringer test LC-L Cat. No: 15981 TMAA.

## RESULTS

Presented on table below are the results of blood serum analysis of 16 females with gonads of III stage maturity, according to Mayer's scale, and of 16 spawning females.

Table 1

The content of lipids, cholesterol, total protein, and activity of malate - dehydrogenase MDH (in blood serum of trout females). *Salmo trutta* L. (in June and December)

	Month		Difference in %
	June	December	
Lipids mg%	2191 ( $\pm 30$ )	1277 ( $\pm 38$ )	42 (-)
Total cholesterol mg%	381 ( $\pm 6.5$ )	492 ( $\pm 5.6$ )	29 (+)
Free cholesterol mg%	116 ( $\pm 5.6$ )	279 ( $\pm 11.4$ )	140 (+)
Cholesterol esters mg%	265	213	20 (-)
Total protein g%	7.66 ( $\pm 0.84$ )	6.28 ( $\pm 0.84$ )	18 (-)
Malate-dehydrogenase	25.8 ( $\pm 3.81$ )	135.3 ( $\pm 13.2$ )	424 (+)

The content of lipids in 100 ml of blood serum for June amounted in average to 2191 mg, while of spawning females - 1277 mg what presents 58% of previous value. Felińska (1970) reported that fatty acids in blood serum of June in esterificated form appeared in 85.25% and during spawning - in 95.5%. The content of total cholesterol in blood serum for June amounted in average to 381 mg and it increased during spawning by average 29%. An increase of non esterificated cholesterol level of average 140% was noted simultaneously. Thus, during the first period the esterificated cholesterol amounted to 69% and free cholesterol - 31%. Noted during spawning was distinct decrease of cholesterol level in form of ester (to 51%) and an increase of non esterificated cholesterol level (49%). The decrease of total protein was in average 18% and the activity of malate - dehydrogenase MDH increased 5 times during spawning period.

## DISCUSSION

Similar changes in content of above mentioned components within blood serum obtained also Robertson et al. (1961) and Stuart Patton et al. (1970) at salmon. Kukuć (1960) proved in his investigations that changes in content of fat, protein and water in particular parts of trout body occur during the year.

Such changes depend probably from many factors to which most essential should be accounted: quantity and quality of food, hydrobiological factors, maturity of gonads etc.

The opinions on trout feeding during its migration for spawning are controversial. Żarnęcki and Piątek (1954) while investigating the trouts and salmon ascending Vistula river, ascertained that both species feed in sea up to the last time and enter the waters of river for spawning with more or less filled alimentary duct. The trouts from Rega river caught near of Trzebiatów during June and July, had the alimentary ducts filled with content which comprised partly digested sea fishes and mainly the herrings. In December, their alimentary ducts were filled with mucus and non-digested part of fish skeleton (verbal information of dr Chełkowski).

The organism of fish in question during its migration for spawning had utilized the energy stored in triglycerides of fat tissue. The liberation of fat tissue triglycerides is influenced by various compounds, to which belong: adrenaline, glycogen, corticotropine, tyrotropine, gonadotropine and others (Korniszewski, Krotkowski, 1967).

Penetration rate of albumin to fat tissue and its level in blood serum may be one of the main factors to control the liberation of total fat acids and disintegration of triglycerides in secondary action.

The decrease of total protein (by 18%) was also noted in blood serum of trout females. With growth of gonads and limited feeding, the energetic balance of fish organism is upset. Catabolic reactions of lipids and proteins occur within higher extent.

Most important part in metabolism of endogenous cholesterol plays the liver and the mucosa of small intestine, as it is secreted from here into blood as lipido-protein compounds. The cholesterol is also used for synthesis of steroid hormones in ovaries and testicles. Also the cholesterol is a precursor of hormones of suprarenal cortex and of other steroids, the role of which is not yet exactly known. The changes of cholesterol which are so important from physiological aspect, present in this respect negligent quantitative percent. It may be assumed that an increase of total cholesterol particularly non-esterified on blood serum of trout during spawning, expresses the homeostasis in fish organism, as due to migration from sea into river and with growth of gonads, increases also the number of metabolites in blood.

An increase of malate - dehydrogenase (MDH) was also noted during spawning. This enzyme catalyzes before last cycle of citrate acid changes and finally oxidizes the saccharum fats and amino acids. An increase of enzyme activity conforms the processes discussed previously. The presented data indicate the essential changes which take place in organism of bulltrout females during their spawning migration from sea into river and when the gonads are maturing very fast.

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SEZONOWE ZMIANY W SUROWICY KRWI SAMIC TROCI  
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## Streszczenie

W surowicy krwi samic troci „bałtyckiej”, których gonady znajdowały się w III stopniu dojrzałości płciowej wg skali Mayera, oraz w okresie sztucznego tarła oznaczono zawartość lipidów, cholesterolu, białka całkowitego oraz aktywność dehydrogenazy jabłczanowej.

1. Zawartość lipidów w 100 ml surowicy krwi samic troci w pierwszym okresie wynosiła średnio 2191 mg, zaś w okresie tarła 1277 mg.

2. Zawartość cholesterolu całkowitego wynosiła analogicznie 381 mg i 492 mg, zaś cholesterolu niezestryfikowanego 116 mg i 279 mg.

3. Zawartość białka całkowitego w surowicy krwi samic wynosiła 7,66 g i 6,28 g.

4. Aktywność dehydrogenazy jabłczanowej w surowicy krwi wzrosła z 28,8 mU do 135,3 mU w czasie tarła.

СЕЗОННЫЕ ИЗМЕНЕНИЯ В СЫВОРОТКЕ САМОК КУМЖИ *SALMO TRUTTA L.*

## Р е з ю м е

В сыворотке крови самок "балтийской" кумжи, гонады которых находились в III стадии половой зрелости по шкале Мейера, а также в период искусственного икрOMETания определялось содержание липидов, холестерина, общего белка а также активность дегидрогеназы яблочной кислоты.

Содержание липидов в 100 мл сыворотки крови самок кумжи в первый период, составляло в среднем 2191 мг, в период нереста 1271 мг.

2. Содержание общего холестерина составляло 381 мг и 492 мг, соответственно; не эстрифицированного холестерина - 116 мг и 279 мг.

3. Содержание общего белка в сыворотке крови самок составляло 7,66 г и 6,28 г.

4. Активность дегидрогеназы яблочной кислоты в сыворотке крови во время нереста возрастала с 25,8 мждун, единиц до 135,3 м.е.

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