Arch. Pol. Fish.	Archives of Polish Fisheries	Vol. 11	Fasc. 1	17-22	2003

SELECTED HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS OF PIKEPERCH *SANDER LUCIOPERCA* (L.) FROM INTENSIVE CULTURE

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ABSTRACT. Pikeperch culture is a new direction in European aquaculture. There is scant knowledge of pikeperch physiology, especially regarding hematological and biochemical parameters in the blood. This study examines selected hematological parameters in the blood and the biochemical parameters in the plasma of pikeperch from intensive culture. To determine the hematological parameters, blood was drawn from 20 healthy fish, weighing 40-50 g. The red blood cell count (RBC), hematocrit (Ht), hemoglobin (Hb), various leukocyte counts, the total leukocyte level and MCV, MHC and MCHC counts were examined. The AST, ALT, ALP, plasma bilirubin, cholesterol, glucose, urea and total protein level were determined in the blood plasma. The analyses of the results suggest that pikeperch have similar hematological and biochemical parameters to rainbow trout. The results of this preliminary study indicate that fish from this new intensive culture were in good condition without any symptoms of diseases.

Key words: PIKEPERCH (*SANDER LUCIPERCA*), HEMATOLOGY, BIOCHEMICAL PARAMETERS, INTENSIVE SYSTEM OF CULTURE

INTRODUCTION

The successful commercial production of most cultured fish species has been facilitated by the intensification of larval and fingerling rearing techniques. Percid fishes are no exception, and early attempts at larval rearing in ponds were soon superseded by intensive hatchery production (Kestemont and Melard 2000). Pikeperch *Sander lucioperca* (L.) culture is a new direction in European aquaculture. The relatively good adaptability of pikeperch to various food and technological conditions enables its farming in water recirculation systems (Zakęś 1997, 1999). In addition to pond and combined culture, the whole production cycle from fry to marketable fish can be conducted in special facilities with a controlled water temperature regime and commercial feeds (Zakęś et al. 2000).

There is, however, little information on the ability of pikeperch to respond to such processing in comparison to rainbow trout *Oncorhynchus mykiss* (Wal.) or carp *Cyprinus carpio* L., species which are often used as a model for experimental study. Knowledge of pikeperch physiology, especially about hematological and biochemical parameters in the blood, is meager. This is very important for monitoring fish condition and health, especially in intensive culture.

The aim of the present study was to analyze the levels of some hematological and biochemical parameters in the blood of pikeperch from intensive culture.

MATERIAL AND METHODS

SOURCE OF FISH AND CULTURE CONDITIONS

Juvenile pikeperch were reared from 27 July (approximately 6.2 g body weight (W) and 9.1 cm total length (TL)) to 23 October (approximately 45 g W and 17 cm TL) at the Laboratory of Aquaculture Research of the Inland Fisheries Institute in Olsztyn. The fish (110 individuals per tank) were stocked in six 200 l fiberglass tanks, which were part of recirculation systems equipped with mechanical and biological filters. The water flow was set at 4-5 l min^{-1} (exchange rate 1.2 per h), and the water temperature was 21.9 ± 0.2°C. Water quality was monitored at two-day intervals. Oxygen concentration was maintained above 7.5 mg O_2 l^{-1} (inflow) and 4.5 mg O_2 l^{-1} (outflow). The total ammonia nitrogen (TAN = NH_4^+-N + NH_3-N) did not exceed 0.4 mg TAN l^{-1}, and nitrite (NO_2-N) in the outflow did not exceed 0.2 mg l^{-1}. The pH of water inflow and outflow was 7.9 and 7.7, respectively. The tanks were exposed to continuous light, and its intensity just above the water surface was 30-80 lx.

The fish were fed for 18 h daily (0900-0300) with trout feed (TROUVIT, Nutreco Aquaculture, Holland) using automatic band feeders. Initially, NUTRA 0 feed (0.8-1.4 mm granule diameter) was used, and as the fish grew, the size was increased to NUTRA 1 (1.7 mm) and NUTRA T (2.2 mm). The change in feed size was achieved over a six-day adaptation period during which a 50:50 mix was used. The proximate analysis of the feed was 54% crude protein, 18% fat and 8.0% carbohydrates. The initial daily feed ration was 3.5% of the stock biomass, but during rearing it was reduced to 1.5%.

HEMATOLOGICAL AND BIOCHEMICAL EXAMINATION

Blood was drawn from 20 healthy fish weighing 40-50 g. The fish were anaesthetized in Propiscin (IFI, Poland) (Kazuń and Siwicki 2001) and the blood was drawn

from the caudal vessel into heparinized syringes. The hematological analyses requires 300 μl of blood and the remainder was centrifuged for 10 min at 5,000 G to separate the plasma in order to examine its biochemical parameters.

The following blood parameters were analyzed:

- erythrocyte count (RBC) - according to Pawiński's spectrophotometrical method (Svobodova et al. 1986);
- parameters which describe the oxygen carrying capacity of the blood - hematocrit values (Ht) were determined using a microhematocrite centrifuge and hemoglobin concentrations using the cyanomethemoglobin method, these results were used to calculate mean red cell volume (MCV), mean red cell hemoglobin (MCH) and mean cellular hemoglobin concentration (MCHC);
- leukocyte count – stained (May-Glunwald-Giemsa) blood smears were prepared to study the percentages of acidophilic, basophilic and neutrophilic granulocytes, monocytes and lymphocytes;
- total leukocyte counts were done with Trypan blue 0.5% using a hemocytometer.

The biochemical examinations of the blood plasma were carried out photocolorimetrically, using an EPOL 2 spectrophotometer and chemicals from Alpha Diagnostics Poland. The activity of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alcaline phosphatase ALP), and plasma bilirubin, cholesterol, glucose and urea were determined. The total protein level (TP) was measured spectrophotometrically, according to the method presented by Anderson and Siwicki (1994).

Clinical examinations were conducted throughout intensive culture to monitor fish health.

The data were statistically evaluated with the Student's t-test, and the results are presented as mean and standard deviations (SD).

RESULTS AND DISCUSSION

The objective of the present study was to determine the values of the basic blood parameters and biochemical serum indicators of pikeperch which are bred intensively in recirculation systems. This study examined the basic hematological and biochemical parameters for monitoring fish condition. Table 1 presents the average values of the hematological parameters including RBC, Ht, HB, MCV, MCH, MCHC, leukocyte count and total leukocytes levels.

TABLE 1

Hematological parameters in blood of pikeperch from intensive culture

Hematological parameters in the blood	Mean ±SD
Erythrocytes (RBC) (1×10^6 l^{-1})	1.25 ± 0.15
Hematocrit (Ht) value (%)	35.0 ± 3.0
Hemoglobin (Hb) level (g l^{-1})	65.5 ± 2.5
Red cell volume (MCV) (fl)	320.0 ± 15.0
Red cell hemoglobin (MCH) (pg)	67.5 ± 2.0
Cellular hemoglobin concentration (MCHC) (g l^{-1})	187.5 ± 2.5
Leukogram (%):	
neutrophils	8.5 ± 1.5
acidophils	2.0 ± 0.5
basophils	0.75 ± 0.15
lymphocytes	86.5 ± 2.5
monocytes	2.5 ± 0.5
Leukocyte ($UL^{-1} \times 10^3$)	28.5 ± 2.5

Some hematological parameters in this fish species were examined for the first time in this study. Since the literature lacks information regarding some of the hematological parameters of pikeperch, the results of the current study were compared with those of another species. Similar levels of RBC, Ht, Hb and leukocyte levels were observed in healthy rainbow trout *Oncorhynchus mykiss* (Wal.) (Racicot et al. 1975, Rehulka 1998). Rehulka (1998) demonstrated that certain infectious skin lesions are accompanied by a number of changes in hematological parameters. As there are significant differences in red blood cell corpuscle parameters and in a whole range of biochemical characteristics between diseased and healthy fish, research into the clinical hematology of fish may enhance knowledge of pathology, which is needed to improve diagnostic work and to select the best preventive procedures.

The activity of AST, ALT, ALP and bilirubin, cholesterol, urea, glucose and total protein levels in the plasma of pikeperch are presented in Table 2. The current study is the first to examine levels of some enzyme activity and other biochemical parameters in this fish species. There is no information in the literature regarding some of the biochemical parameters in pikeperch; this meant that the results of the present study were compared to those from another species. The activity of AST, ALT and ALP was observed to be similar in healthy pikeperch and healthy rainbow trout (Rehulka 1998). Rehulka observed increasing AST, ALT activity and decreasing ALP activity in fish afflicted with bacterial skin disease. Harbell et al. (1979) indicated that there were similar decreases in ALP activity and increased AST activity in coho salmon *Oncorhynchus kisutch* (Wal.) which were experimentally infected with *Vibrio anguillarum*.

TABLE 2

Biochemical parameters in the plasma of pikeperch from intensive culture

Biochemical parameters in the plasma	Mean ± SD
Aspartate aminotransferase (AST) (IU l^{-1})	10.5 ± 2.5
Alanine aminotransferase (ALT) (IU l^{-1})	5.4 ± 0.8
Alcaline phosphatase (ALP) (IU l^{-1})	2.5 ± 1.0
Bilirubin (mmol. l^{-1})	4.8 ± 1.5
Cholesterol (mmol. l^{-1})	2.5 ± 0.8
Urea (mmol. l^{-1})	0.8 ± 0.4
Glucose (mmol. l^{-1})	5.2 ± 0.8
Total protein (g l^{-1})	49.5 ± 8.5

The levels of bilirubin, cholesterol, urea, glucose and total protein in the plasma of pikeperch are similar with those of the rainbow trout analyzed by Rehulka (1998). Rehulka reported that bacterial skin infection increased the total protein and cholesterol levels in the plasma and increased urea levels. Lower levels of total protein, cholesterol and ALP activity and increased ALT and AST activity in the plasma of Atlantic salmon *Salmo salar* L. suffering from cold-water vibriosis were also reported by Waagbo et al. (1988).

Throughout intensive pikeperch culture no clinical lesions were observed which could have indicated disease. It is obvious that the values of hematological parameter indices reflect the conditions of the farming environment, whereas the values of the biochemical parameters of the blood plasma are more influenced by nutrition or diet quality. The study of hematological and biochemical parameters in different pikeperch culture systems plays a very important role in developing the optimal quality of water or diets and also for monitoring fish health.

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STRESZCZENIE

WYBRANE PARAMETRY HEMATOLOGICZNE I BIOCHEMICZNE U SANDACZA (*SANDER LUCIOPERCA* (L.)) Z INTENSYWNEJ HODOWLI

Intensywna hodowla sandacza zaliczana jest do nowych kierunków w europejskiej akwakulturze. Podchów tego gatunku w warunkach kontrolowanych wymaga określenia podstawowych parametrów fizjologicznych, w tym szczególnie hematologicznych i biochemicznych, które pozwolą na stałe monitorowanie stanu kondycyjnego i zdrowotnego ryb. W prezentowanych badaniach określano wybrane parametry hematologiczne w krwi oraz podstawowe parametry biochemiczne w plazmie sandacza, pochodzącego z intensywnej hodowli w obiegu zamkniętym. Badaniami objęto 20 sztuk ryb, o masie ciała 40-50 g, które były w dobrej kondycji. Krew do badań pobierano z żyły ogonowej do strzykawki heparynizowanej. W pełnej krwi określano: liczbę erytrocytów (RBC), wartość hematokrytu (Ht), poziom hemoglobiny (Hb), ogólną liczbę leukocytów i leukogram (%) oraz obliczano MCV, MHC i MCHC. Po odwirowaniu pełnej krwi w plazmie określano aktywność AST, ALT, ALP, poziom bilirubiny, cholesterolu, glukozy, mocznika oraz białka całkowitego (tab. 1 i 2). Analiza uzyskanych wyników badań wykazała, że podstawowe parametry hematologiczne i biochemiczne u sandacza są zbliżone do tych samych parametrów określanych u pstrąga tęczowego, pochodzącego z intensywnego chowu. Wyniki badań wskazują, że badane ryby były w dobrej kondycji, bez symptomów chorobowych. Wstępnie uzyskane wyniki, określające podstawowe parametry hematologiczne i biochemiczne, stanowić będą podstawę do dalszych badań określających stan kondycyjny i zdrowotny sandacza w intensywnych systemach chowu.

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