

HEMATOLOGICAL STUDY OF TILAPIA (*OREOCHROMIS NILOTICUS*) AT LAKE TOGA, BETENGMON VILLAGE DONDO DISTRICT TOLITOLI

Studi Hematologi Ikan Nila (*Oreochromis niloticus*) Di Danau Toga Desa Betengon Kecamatan Dondo Kabupaten Tolitoli

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ABSTRACT

Lake Toga is located in Betengon Village, has an area of eight hectares, there has been fish death caused by changes in the aquatic environment which organisms in the lake can no longer tolerate, especially fish. The research was analyzed in descriptive form. The research results are presented in tabular form. One way to diagnose diseases in fish quickly and effectively can be done by means of a hematological examination of fish. Study of fish blood characteristics, such as hematological parameters in tilapia (*Oreochromis niloticus*), needs to be done by observing the appearance of red blood cells (erythrocytes) and white blood cells (leukocytes). Sampling of fish blood was carried out at Lake Toga, Betengon Village. Tests for analysis of total erythrocytes and total leukocytes were carried out at UPT Puskesmas Managaisaki Tolitoli. As for the results of observations on the blood picture of tilapia (*Oreochromis niloticus*) it is known that the average total erythrocytes and leukocytes in Lake Toga, Betengon Village, showed a normal range with the number of 2,170,000 cells/mm³ for red blood cells and 35,850 cells/mm³ for white blood cells. . Based on these results it can be concluded that tilapia in Toga Lake, Betengon Village, shows a healthy blood picture.

Keywords: *Oreochromis niloticus*, erythrocytes, leukocytes, lake toga, hematological

ABSTRAK

Danau Toga terletak di Desa Betengon memiliki luas delapan hektar, telah terjadi kematian ikan yang diakibatkan oleh perubahan lingkungan perairan yang sudah tidak bisa ditolerir oleh organisme di danau tersebut terutama oleh ikan. Penelitian dianalisis dalam bentuk deskriptif. Hasil penelitian disajikan dalam bentuk tabel. Salah satu cara untuk mendiagnosis penyakit pada ikan dengan cepat serta efektif dapat dilakukan dengan cara pemeriksaan hematologi pada ikan. Studi tentang gambaran darah ikan, seperti parameter hematologis pada ikan nila (*Oreochromis niloticus*), perlu dilakukan dengan pengamatan gambaran sel darah merah

(eritrosit), dan sel darah putih (leukosit). Pengambilan sampel darah ikan dilakukan di Danau Toga Desa Betengon. Pengujian analisis total eritrosit dan total leukosit dilakukan di UPT Puskesmas Managaisaki Tolitoli. Hasil pengamatan pada gambaran darah ikan nila (*Oreochromis niloticus*) diketahui rata-rata total eritrosit dan leukosit di Danau Toga Desa Betengon menunjukkan kisaran yang normal dengan jumlah $2.170.000 \text{ sel/mm}^3$ untuk sel darah merah dan 35.850 sel/mm^3 untuk sel darah putih. Berdasarkan hasil tersebut dapat disimpulkan bahwa ikan nila yang ada di danau Toga Desa Betengon menunjukkan gambaran darah yang sehat.

Kata Kunci: *Oreochromis niloticus*, eritrosit, leukosit, danau toga, hematologi

INTRODUCTION

The tissue called blood is made of cells dissolved in plasma. Compared to other blood types, red blood cells are the most common. Normally, almost half the blood volume consists of red blood cells. Normal red blood cell density in teleosts ranges from $1.05\text{-}3.0 \times 10^6 \text{ cells/mm}^3$ (Irianto, 2005). Because red blood cells can indicate fish resistance to dangerous microorganisms, red blood cells can also be used to indicate the condition of fish (Putri *et al.*, 2013).

White blood cells are the most active component of the body's defense system, circulating in various forms throughout the blood. The main task of white blood cells is to consume dangerous and infectious substances and kill them by producing antibodies through phagocytosis (Rustikawati, 2012). According to Fauzan *et al.*, (2017), fish that have a lower leukocyte count will be more susceptible to attack by pathogenic bacteria. The leukocyte density in tilapia is around 20,000 to 150,000 cells/mm³ (Arfiati *et al.*, 2019; Arfiati *et al.*, 2021; Arfiati *et al.*, 2022). The bacteria that cause strep throat (called *Streptococcus* species) often contaminate some freshwater and marine fish farmed in several developed countries and can cause fish death (Alam *et al.*, 2019; Hastuti & Subandiyono 2015; Jennerjahn & Klöpper, 2013; Prayogo *et al.*, 2016). *Streptococcus* disease is a disease that causes death in tilapia (Hardi *et al.*, 2012; Evans *et al.*, 2000). Ectoparasites are often caused by various factors. Air quality problems, increased fish consumption, and weather changes are factors that contribute to the growth of parasites (Pudjiastuti, 2015).

METHODS

Fish blood samples were taken from Toga Lake, Betengon Village, Dondo District, Tolitoli Regency. Examination of red blood cells and white blood cells was carried out at the Managaisaki Tolitoli Community Health Center UPT. The tools and materials used are basins, spoons, syringes, Efindorf tubes, pipettes, hemocytometers, microscopes, clove oil, 10% EDTA, hayem solution, and turk solution.

Research Procedur

The hematology study of tilapia involves taking blood by looking at red blood cells and leukocytes. The fish used in this research were tilapia fish obtained from Lake Toga. Tilapia samples were obtained from 3 different locations in the lake. Ninety fish were used, each measuring 8–12 cm. The fish were then anesthetized using clove oil at a dose of 0.05 mL/L of water, then blood was taken from the unconscious fish using an injection of 1 ml of fish scales. Insert the injection needle into the midline of the body behind the anal fin. The needle is inserted into the muscle until it reaches the spine. Then slowly pull the syringe until the blood enters the syringe. Next, the blood is filled into a vacuum tube (tube) that has been labeled and anticoagulant (Lestari *et al.*, 2019).

Calculation of Total Red Blood Cells (erythrocytes)

Blood is sucked with a pipette to a limit of 0.5. Then the blood has been mixed using Hayem's solution to the limit of 101 stated on the pipette. The solution was shaken by making a figure 8 movement to make it homogeneous. Erythrocyte counting is carried out under a microscope. The liquid that has been entered into the counting chamber is placed under the objective and the focus of the microscope is directed at the bisector lines and red blood cells will be visible. All erythrocytes have been counted in 5 fields consisting of 16 small fields.

Erythrocytes are counted from the top left corner, all the way to the right, then down and from right to left and so on. Formula for calculating the number of erythrocytes:

$$N = n \times 10^4$$

Information

- n : Amount of red blood cells contained in 80 boxes
- N : Amount of red blood cells in 1 mm³ of blood

Calculation of Total White Blood Cells (leukocytes)

Blood is sucked with a pipette to a limit of 0.5. Then the blood that has been mixed with Turk's solution up to the limit of 11 stated on the pipette is shaken by making a number 8 movement to mix. Liquid calculations are carried out under a microscope in a counting room. The counting chamber on the striped plane is placed under the objective glass and the focus of the microscope is directed at the bisector lines until the leukocytes are visible. All leukocytes found in the four large areas were counted at the corners of the entire divided surface (Mahasri *et al.*, 2011).

Leukocytes are counted from the top left corner, all the way to the right, then down and from right to left and so on. Leukocyte count calculation formula:

$$N = n \times 50$$

Information :

- n : Amount of white blood cells contained in 64 boxes
- N : Amount of white blood cells in 1 mm³ of blood

RESULTS

The number of blood cells obtained in this study was observed in images of blood containing red blood cells (erythrocytes) and white blood cells (leukocytes) in Toga Lake, Betengon Village. The results of monitoring the hemogram of tilapia (*Oreochromis niloticus*) are shown in Table 1 below:

Table 1. Results of observations of red blood cells and white blood cells

No	Parameter	Results	Normal Value
1	Red blood cells	2.170.000 cell/mm ³	20.000 – 3.000.000 (Hartika <i>et al.</i> , 2014)
2	White blood cells	35.850 cell/mm ³	20.000 - 150.000 (Fauzan <i>et al.</i> , 2017)

In table 1 it is known that the average total erythrocytes and leukocytes in Toga Lake, Betengon Village show a normal range with a number of 2,170,000 cells/mm³ for red blood cells and 35,850 cells/mm³ for white blood cells.

DISCUSSION

Red blood cells are the most abundant type of blood cell (Royan *et al.*, 2014). Under

normal conditions, the number of erythrocytes reaches almost half of the blood volume (Vonti, 2008). Erythrocytes can also describe the condition of the fish's body because they can show the fish's body's defense against pathogenic bacteria (Putri *et al.*, 2013). A high number of erythrocytes (above normal) indicates that the fish is under stress and a low number of erythrocytes (below normal) indicates that the fish is suffering from anemia and kidney damage (Eviani *et al.*, 2019; Yanto *et al.*, 2015).

White blood cells are the most active units of the body's defense system and circulate in the blood in various types. The main function of leukocytes is to produce antibodies to destroy infectious and toxic substances through the process of phagocytosis (Rustikawati 2012). The results of observations of Tilapia leukocytes in Lake Toga are still within normal limits, namely 35850/mm³. For research purposes (Fauzan *et al.*, 2017) the normal range of leukocytes in tilapia is 20,000 - 150,000. The average total erythrocytes in this study are still within the normal range. A normal average number of erythrocytes indicates that the fish is in a healthy condition, where the function of the blood in transporting oxygen (O₂) outside the body is not disturbed (Susandi *et al.*, 2017). The normal number of erythrocytes in tilapia generally ranges from 20,000-3,000,000 cells/mm³ (Hartika *et al.*, 2014). The increase in the total number of erythrocytes is thought to be caused by fish experiencing stress when blood is drawn. According to Zuhrawati (2014), to reduce stress in fish, the number of erythrocytes in the fish's blood circulation will adjust to their biological condition. The level of stress will have a negative impact on fish so that it can affect fish performance and health in the form of blood cell disorders (Maulinia, 2022).

Leukocytes are components of bloods that play a role in the fish body's defense system (Astari *et al.*, 2015). Leukocytes have a role in responding to immunity when foreign substances enter the body. The primary function of leukocytes is to inhibit infectious and toxic materials through the process of phagocytosis by producing antibodies (Putranto *et al.*, 2019). Factors that influence the number of leukocytes are the condition and health of the fish's body. Sick fish will produce many leukocytes to phagocytose bacteria and synthesize antibodies (Moyle & Cech, 2004).

Normal range, normal white blood cell count is generally around 20,000-150,000 cells/mm³ (Sasongko, 2001). The intrinsic ability to bind microorganisms directly and in its work, phagocytic cells interact with complement and the specific immune system. According to Arry (2007), an increase in the number of leukocytes occurs as a result of the fish's body responding to environmental conditions, stress factors and disease infections. Meanwhile, a decrease in the number of leukocytes occurs due to disturbances in the function of the kidneys and spleen in producing leukocytes caused by infectious diseases.

CONCLUSSION

The healthy blood of tilapia in Lake Toga Batengan village has red blood cells (erythrocytes) 2170000 cells/mm³ and white blood cells (leukocytes) 35850 cells/mm³. Based on this research further research on hemoglobin and hematocrit blood features is recommended.

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