Volume 6, No. 4, 2025

ISSN 2723-7583 (Online)

ANALYSIS OF HEMATOLOGICAL PROFILE OF CATFISH (*Clarias* sp.) AS A HEALTH INDICATOR USE OF HEMOLYZER FOR AQUATIC ANIMALS

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Submitted: 18 September 2024 / Revised: 12 September 2025 / Accepted: 16 October 2025

http://doi.org/10.21107/juvenil.v6i4.27494

ABSTRACT

The hematological profile of catfish (Clarias sp.) is a critical indicator of health and well-being in aquaculture practices. This study aimed to analyze the hematological parameters of catfish under aquaculture conditions using two different hematology analyzers: Hemolyzer 3 Pro and Veterinary Hematology Analyzer Mindray Series BC2800Vet. Blood samples were collected from the caudal vein, anticoagulated with EDTA, and analyzed for red blood cell count (RBC), white blood cell count (WBC), hemoglobin (Hb), hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), and platelet count (PLT). Results indicated significant variations between the analyzers. The Hemolyzer 3 Pro indicated elevated levels, with Hb ranging from 15.7 to 16.7 g/dl, RBC from 2.66 to 2.79 × 10^6/mm³, and WBC from 92,200 to 98,040 × 10^6/mm³, suggesting possible polycythemia and an active immune response. In contrast, the Mindray Analyzer reported values within the normal range, with Hb at 7.2 g/dl, RBC at 1.43 × 10^6/mm³, and WBC at 46,100 × 10^6/mm³, implying stable health conditions. The study also observed monocytosis, indicative of potential chronic inflammation or infection. These discrepancies highlight the importance of standardized methodologies in hematological assessments. Regular monitoring of hematological parameters is essential for early disease detection and effective management in aquaculture. Further research is recommended to explore the underlying causes of these variations and to optimize health management strategies for catfish in aquaculture systems.

Keywords: *Aquaculture, Catfish, Haemolyzer, Hematology*

INTRODUCTION

Catfish (*Clarias* sp.) is a vital freshwater species in aquaculture, particularly in Indonesia. Its popularity stems from its rapid growth, resilience to harsh environmental conditions, and high market demand. However, the success of catfish farming is highly dependent on the health status of the fish, which can be monitored through various physiological parameters, one of which is hematology. The hematological profile, including red blood cell count, white blood cell count, hematocrit levels, and hemoglobin concentration, serves as a crucial indicator reflecting the overall health of the fish. Variations in these hematological parameters are often associated with stress, infections, or environmental disturbances. A deeper understanding of the hematological profile of catfish can provide essential information for early detection of diseases or stress, enabling timelier and more effective preventive or therapeutic interventions. To date, hematological examinations in fish are still largely performed manually. Unfortunately, manual methods have several limitations, such as technical difficulties, subjectivity of results, and the requirement of considerable time and labor. To minimize these limitations, automated blood analyzers are increasingly being utilized, including those adapted for use in fish. However, since most analyzers are originally designed for mammals, it is important to compare the performance of different devices to determine their reliability and suitability for

fish hematology. This study aims to analyze the hematological profile of catfish (Clarias sp.) under aquaculture conditions and to compare the results obtained from two different hematology analyzers, thereby providing valuable insights into effective health monitoring. Consequently, the findings are expected to contribute to improved fish health management and productivity within the aquaculture industry.

MATERIAL AND METHODS

Sample

This study was conducted using a descriptive approach. Blood samples of 1 mL each were collected from *Clarias* sp. catfish broodstock. The experimental total sampel consisted of six brooders of *Clarias* sp with three replication, each measuring approximately 44-45 cm. The fish were maintained in a round pond with a total volume of 3 m^3 under controlled conditions.

Blood Collection

Blood was drawn using a sterile needle and collected into a tube containing EDTA (ethylenediaminetetraacetic acid) as an anticoagulant to prevent coagulation. The blood was obtained from the caudal vein of the fish. Immediately after collection, the samples were processed to avoid alterations in blood parameters. The blood samples were then analyzed using a hemolyzer for a comprehensive hematological profile.

Parameter Measurement

The hemolyzer measured the following parameters: Red Blood Cell count (RBC), White Blood Cell count (WBC), Hemoglobin (Hb), Hematocrit (Hct), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin Concentration (MCHC), and Platelet count. The clinical pathology examination aimed to obtain a complete blood profile of the animal, including RBC, WBC, Lymphocytes, Hct, Hb, Granulocytes, and Monocytes. These results were compared to the normal hematological profile for the species. This examination was performed using the Veterinary Hematology Analyzer Mindray BC2800Vet, following the guidelines of Stedman's, 2002.

Data Analysis

The data obtained from the hemolyzer were analyzed to assess the health status of the fish, such as the presence of anemia, infections, or other blood disorders. The data obtained from the hemolyzer were examined in a descriptive manner to assess the health status of the fish, including the presence or absence of anemia, infections, or other blood abnormalities. Observations and measurements (e.g., cell counts, morphology, hemoglobin levels) were summarized in tables and/or figures. Where multiple sample groups existed, simple comparisons were made by directly contrasting values across groups (for example: higher vs. lower values) without performing formal statistical hypothesis tests. The description focused on trends, patterns, and notable differences, rather than tests of significance.

RESULTS AND DISCCUSIONS

The hematological analysis of catfish (*Clarias* sp.) revealed significant findings that could indicate underlying health conditions and physiological responses within the fish population studied. Polycythemia is characterized by an increase in hemoglobin levels and erythrocyte count, which is associated with hematopoiesis. This condition can also be caused by bleeding, potentially due to disorders in the urinary tract or the gastrointestinal tract (GIT) (**Fig 1A**). Monocytosis is often a result of chronic inflammation and can be associated with the phagocytic process involving bacteria, viruses, or parasites. It may also indicate disturbances in the GIT, liver function, or renal function. Additionally, monocytosis can be linked to malnutrition, corticosteroid imbalances, or the influence of certain medications (**Fig 1B**).

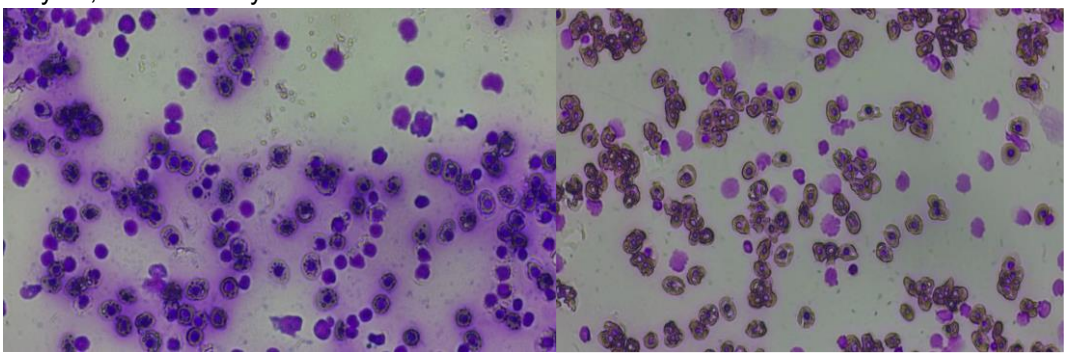

Figure 1. Blood Smear of Clarias sp. (A. Polycythemia B. Monocytosis)

Table 1. Profil Hematology of Catfish (*Clarias* sp.)

Hematology Test Parameter	Hemolyzer 3 Pro (Analyticon)	Veterinary Hematology Analyzer Mindray Series BC2800Vet	Reference (Fawole et al., 2020)	Normal Range
Hb (Hemoglobin) (g/dl)	15.7 – 16.7	7.2	8.97	6-10
RBC (Red Blood Cell) (Jt/mm^3)	2.66-2.79	1.43	4.89	1.1-1.8
WBC (x10^6/mm3)	92.200-98.040	46.100	87.300	10-80
MCV (Fl)	106 – 107	251.74	62.33	200-300
MCH (Pg)	68.9 – 60.1	50.34	18.40	50-60
MCHC (g/dl)	55.6 -56	20	29.50	0.20-0.26
PLT (x10^3/mm^3)	23.000-36.000	143.000	120.000	20-200
Neutrofil (%)	6.6 -6.7	3.8	3.5	2-10
Limfosit (%)	65.6- 68.6	81.3	63.00	76-97.5
Monosit (%)	3	1.3	1.67	3-5

Mean values with no superscript letter in the same row are not significantly different ($p > .05$). SEM – Pooled Standard error of the mean. Hb (Hemoglobin) (g/dl): RBC (Red Blood Cell) (Jt/mm^3): WBC: White Blood Cell, HB: Hemoglobin, RBC: Red Blood Cell, MCV: Mean Corpuscular Volume, MCH: Mean Concentration Hemoglobin, MCHC: Mean Corpuscular Hemoglobin Concentration.

RBC and Hemoglobin Profile

Polycythemia can occur as a physiological response to environmental stressors, such as low dissolved oxygen levels in the water, prompting an increase in hematopoiesis to enhance oxygen transport capacity. Another potential cause of polycythemia could be bleeding, possibly related to disorders in the urinary tract or gastrointestinal tract (GIT). However, additional diagnostic evaluations would be necessary to confirm these conditions as contributing factors. The analysis also indicated monocytosis, with the percentage of monocytes measured using the Hemolyzer 3 Pro being 3%, which is within the normal range (3-5%). However, the slightly elevated level could suggest an ongoing chronic inflammatory response.

Monocytosis is typically associated with the phagocytic process involved in combating bacterial, viral, or parasitic infections. It can also signify disturbances in the GIT, liver function, or renal function. Moreover, monocytosis can be linked to malnutrition, imbalances in corticosteroids, or the influence of certain medications. The presence of monocytosis in this study suggests the potential for chronic inflammation or infection within the fish population, or perhaps an underlying issue related to nutrition or medication effects. The hematological profile of catfish (*Clarias* sp.) serves as a critical indicator of their physiological status and overall health in aquaculture practices. Variations in hematological parameters can be associated with different health conditions, including stress, infection, and environmental disturbances.

This study analyzed various hematological parameters using two different hematology analyzers: Hemolyzer 3 Pro and the Veterinary Hematology Analyzer Mindray Series BC2800Vet, providing insights into the health status of catfish in an aquaculture setting. Hemoglobin concentration and RBC count are primary indicators of the oxygen-carrying capacity of the blood. The study revealed that the Hb levels in catfish varied between the two analyzers. The Hemolyzer 3 Pro recorded higher Hb values ranging from 15.7 to 16.7 g/dl, exceeding the normal range of 6-10 g/dl. This could indicate a physiological adaptation to environmental stressors, such as low dissolved oxygen levels in the water (Satheeshkumar et al., 2012). In contrast, the Veterinary Hematology Analyzer recorded an Hb value of 7.2 g/dl, which falls within the normal range, suggesting no immediate concern regarding oxygen transport capacity in these fish. Similarly, RBC counts measured by the Hemolyzer 3 Pro ranged from 2.66 to 2.79 x10^6/mm³, slightly higher than the normal reference range of 1.1-1.8 x10^6/mm³. Elevated RBC counts can be a compensatory mechanism in response to hypoxia or increased metabolic demand (Fazio et al., 2013). However, the RBC count from the Veterinary Hematology Analyzer was 1.43 x10^6/mm³, within the normal range, indicating stable

erythropoiesis under the given aquaculture conditions.

WBC Variations

WBC counts are crucial for assessing the immune function of fish. The Hemolyzer 3 Pro recorded WBC values ranging from 92.200 to 98.040 x10^6/mm³, which are above the normal range of 10-80 x10^6/mm³. Elevated WBC counts could signify an active immune response, potentially due to subclinical infections or environmental stressors (Rehulka, 2002). Conversely, the Veterinary Hematology Analyzer indicated a WBC count of 46.100 x10^6/mm³, which lies within the normal range. These differences suggest potential variability in immune status or analyzer sensitivity, but the elevated WBC counts from the Hemolyzer 3 Pro warrant further investigation into the health or environmental conditions affecting the fish. The differential leukocyte count provides a more detailed understanding of the fish's immune status. Neutrophil percentages from the Hemolyzer 3 Pro were slightly elevated at 6.6-6.7%, while the Veterinary Hematology Analyzer recorded a lower percentage of 3.8%, both within the normal range of 2-10%. Elevated neutrophils can indicate an acute inflammatory response (Tavares-Dias et al., 2002). Lymphocyte percentages from the Hemolyzer 3 Pro ranged from 65.6 to 68.6%, below the normal range of 76-97.5%, suggesting a possible stress response or chronic condition. The Veterinary Hematology Analyzer recorded a lymphocyte percentage of 81.3%, within the normal range, indicating a robust immune response. Monocyte counts were within the normal range, suggesting no significant monocytic response, which is typically associated with chronic inflammation or infection (Hrubec et al., 2000).

MCV and MCHC

MCV, MCH, and MCHC provide insights into the erythrocyte morphology and hemoglobin content. The MCV values from the Hemolyzer 3 Pro ranged from 106 to 107 fl, below the normal range of 200-300 fl, suggesting microcytic erythrocytes, which could be indicative of potential iron deficiency or other hematological anomalies (Hrubec et al., 2000). The Veterinary Hematology Analyzer reported an MCV of 251.74 fl, falling within the normal range, indicating normal erythrocyte size and volume. MCH values from the Hemolyzer 3 Pro were slightly higher (68.9 to 60.1 pg) than the normal range of 50-60 pg, while the Veterinary Hematology Analyzer reported an MCH of 50.34 pg, aligning with the reference range. Elevated MCH can indicate hyperchromic erythrocytes, potentially resulting from environmental stress or dietary factors (Satheeshkumar et al., 2012). MCHC values from the Hemolyzer 3 Pro were 55.6 to 56 g/dl, significantly above the normal range of 0.20-0.26 g/dl, suggesting hyperchromic erythrocytes, which may require further investigation.

Platelet Profile

Platelets are vital for hemostasis, and their count can reflect the blood's clotting ability. PLT counts measured by the Hemolyzer 3 Pro ranged from 23,000 to 36,000 x10^3/mm³, while the Veterinary Hematology Analyzer showed a much higher count of 143,000 x10^3/mm³. Both results are within the normal range of 20-200 x10^3/mm³, indicating that the clotting mechanism is likely functioning properly in these fish. The discrepancy between the two analyzers might be due to methodological differences or sample handling, but overall, the fish appear to maintain adequate hemostatic function (Tavares-Dias & Moraes, 2007).

CONCLUSION AND SUGGESTION

The hematological profile of *Clarias* sp. provides valuable insights into the health status of fish in aquaculture environments. While most parameters fall within the normal ranges, some variations, particularly in Hb, WBC, and erythrocyte indices, suggest potential adaptive responses to environmental stressors or subclinical health issues. Regular monitoring of these parameters is essential for early detection of health problems, allowing for timely intervention to maintain optimal fish health and aquaculture productivity. The discrepancies between the two analyzers used in this study highlight the importance of standardized methods for hematological assessments in aquaculture research and practice. Elevated Hb and RBC levels suggest indications of polycythemia, possibly as an adaptive response to environmental stress or due to bleeding disorders. The presence of monocytosis could indicate chronic inflammation, potentially linked to infections or other physiological disturbances in the fish. Further investigations, including environmental assessments, nutritional evaluations, and more detailed diagnostic testing, are necessary to elucidate the underlying causes of these hematological changes and to determine appropriate management or therapeutic interventions.

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