

Overview of Complete Blood Test Results in D3 Medical Laboratory Technology Students of the Ministry of Health of East Kalimantan

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ABSTRACT

Background: Anemia is a global health problem that affects women of reproductive age. In Indonesia, the prevalence of anemia in women aged 15-49 years reaches 23.7%. Health students are at high risk of anemia due to lifestyle factors and academic stress. This study aims to analyze the complete picture of the results of the complete blood test in D3 Medical Laboratory Technology students.

Methods: Descriptive research with a cross-sectional design was conducted on 31 students of D3 Medical Laboratory Technology of the Ministry of Health of East Kalimantan in 2025. Complete blood test using a hematology analyzer with the parameters of hemoglobin, erythrocytes, hematocrit, leukocytes, type, and platelets. The data were analyzed descriptively with the mean, standard deviation, and frequency distribution.

Results: The average hemoglobin level was 13.01 ± 0.83 g/dL with a range of 11.1-14.6 g/dL. The prevalence of anemia (<12 g/dL) was 12.9% (n=4), all of which were categorized as mild anemia. Average erythrocytes 4.54 ± 0.34 million/ μ L, hematocrit $39.58 \pm 2.90\%$, leukocytes 8144 ± 2066 cells/ μ L, and platelets 317613 ± 56493 / μ L. All parameters were within the normal range.

Conclusion: The majority of female students (87.1%) have normal hemoglobin levels. The prevalence of mild anemia at 12.9% indicates the need for nutrition screening and education programs. Further research needs to integrate iron status biomarkers to confirm the etiology of anemia.

ABSTRACT

Background: Anemia merupakan masalah kesehatan global yang mempengaruhi wanita usia reproduksi. Di Indonesia, prevalensi anemia pada wanita usia 15-49 tahun mencapai 23,7%. Mahasiswa kesehatan berisiko tinggi mengalami anemia akibat faktor gaya hidup dan stress akademik. Penelitian ini bertujuan menganalisis gambaran hasil pemeriksaan darah lengkap pada mahasiswa D3 Teknologi Laboratorium Medik.

Methods: Penelitian deskriptif dengan desain cross-sectional dilakukan pada 31 mahasiswa D3 Teknologi Laboratorium Medik Poltekkes Kemenkes Kalimantan Timur Tahun 2025. Pemeriksaan darah lengkap menggunakan hematology analyzer dengan parameter hemoglobin, eritrosit, hematokrit, leukosit, hitung jenis, dan trombosit. Data dianalisis secara deskriptif dengan mean, standar deviasi, dan distribusi frekuensi.

Results: Rerata kadar hemoglobin adalah 13.01 ± 0.83 g/dL dengan rentang 11.1-14.6 g/dL. Prevalensi anemia (<12 g/dL) sebesar 12,9% (n=4), seluruhnya kategori anemia ringan. Rerata eritrosit 4.54 ± 0.34 juta/ μ L, hematokrit $39.58 \pm 2.90\%$, leukosit 8144 ± 2066 sel/ μ L, dan trombosit 317613 ± 56493 / μ L. Seluruh parameter berada dalam rentang normal.

Conclusion: Mayoritas mahasiswa (87,1%) memiliki kadar hemoglobin normal. Prevalensi anemia ringan sebesar 12,9% mengindikasikan perlunya program skrining dan edukasi gizi. Penelitian selanjutnya perlu mengintegrasikan biomarker status besi untuk konfirmasi etiologi anemia.

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INTRODUCTION

A Complete Blood Count (CBC) is a fundamental laboratory test that provides a comprehensive picture of a person's hematological status. These tests measure a variety of blood components including red blood cells, white blood cells, hemoglobin, hematocrits, and platelets, making them valuable for screening, diagnosis, and monitoring of various health conditions (Means et al., 2020).

Iron deficiency anemia is a hematologic condition that affects more than 1.74 billion individuals globally, with the highest prevalence in women of reproductive age reaching 29.8% according to data from the Global Burden of Disease Study 2019 (Chaparro & Suchdev, 2019). In Indonesia, the prevalence of anemia in women aged 15-49 years reached 23.7% based on the 2018 Basic Health Research, with a higher rate in the female student group reaching 32.4% (Ministry of Health of the Republic of Indonesia, 2019). This condition is of serious concern because of its impact on cognitive capacity and academic productivity (Wirth et al., 2020).

Students of the Diploma 3 Medical Laboratory Technology program represent a unique population that has a theoretical understanding of hematological parameters but is at high risk of anemia due to lifestyle factors, academic stress, and nutritional imbalances (Rahman et al., 2021). Research by Putri et al. (2022) on female students in Jakarta showed a prevalence of anemia of 28.6%, with the highest distribution in health study programs (34.2%). This indicates that there is a gap between knowledge and practice of anemia prevention in health students (Hassan et al., 2020).

The World Health Organization has established hemoglobin <12 g/dL as the criteria for anemia in non-pregnant women aged 15 years and older, with the classification of mild (10-11.9 g/dL), moderate (8-9.9 g/dL), and severe (<8 g/dL) anemia (WHO, 2023). Understanding the hematologic profile in the female student population is essential for the development of effective campus health programs.

Based on this background, this study aims to analyze the picture of complete blood test results in D3 Medical Laboratory Technology students of the Ministry of Health of East Kalimantan in 2025, focusing on the prevalence of anemia and other characteristics of hematological parameters.

METHOD

Types of Research

This study uses a descriptive design with a cross-sectional approach to describe the profile of complete blood test results in D3 Medical Laboratory Technology students of the Ministry of Health of East Kalimantan.

Research Location and Time

Penelitian dilaksanakan di Laboratorium Hematologi Program Studi D3 Teknologi Laboratorium Medik Poltekkes Kemenkes Kalimantan Timur pada tahun 2025.

Population and Sample

The research population is all active female students of the D3 Medical Laboratory Technology Program of the Ministry of Health of the Ministry of Health, East Kalimantan. The sample consisted of 31 female students who met the inclusion criteria: active female students aged 18-24 years, willing to participate by signing an informed consent, and had no history of chronic diseases. Exclusion criteria included being pregnant or breastfeeding, using iron supplements in the last 4 weeks, and having an acute infection during sampling.

Data Collection

Venous blood sampling was carried out using a 3 mL K2EDTA vacutainer in the morning (08.00-10.00 WIB). Complete blood tests were performed using a hematology analyzer with parameters: hemoglobin (g/dL), erythrocytes (million/ μ L), hematocrit (%), leukocytes (cells/ μ L), leukocyte types including lymphocytes, monocytes, and segments (%), and platelets (/ μ L). Quality control is carried out daily using tri-level control materials prior to sample analysis.

Data Processing and Analysis

The data was analyzed descriptively using statistical software. Continuous variables are presented in the form of mean \pm standard deviation, minimum and maximum values. Categorical variables are presented in the form of frequency and percentage. The classification of anemia refers to the WHO criterion of <12 g/dL for non-pregnant women, with subclassifications of mild (10-11.9 g/dL), moderate (8-9.9 g/dL), and severe (<8 g/dL) anemia.

RESEARCH RESULTS

This study involved 31 D3 students of Medical Laboratory Technology at the Ministry of Health of East Kalimantan. All respondents were female with an age ranging from 18-24 years. The results of the complete blood test are presented in the following table.

Table 1. Descriptive Statistics of Complete Blood Count Parameters (n=31)

Parameter	Mean \pm SD	Min - Max	Normal Range
Hemoglobin (g/dL)	13.01 \pm 0.83	11.1-14.6	12.0-15.5
Erythrocyte (million/ μ L)	4.54 \pm 0.34	4.0-5.7	4.2-5.4
Hematocrit (%)	39.58 \pm 2.90	33-45	36-44
Leukocyte (cells/ μ L)	8144 \pm 2066	5130-12330	4,000-11,000
Platelet(μ L)	317613 \pm 56493	177000-417000	150,000-400,000

Based on Table 1, the average hemoglobin level of the respondents was 13.01 \pm 0.83 g/dL which was in the normal range. All other hematological parameters also show average values within normal limits. The distribution of anemia status based on WHO criteria is presented in Table 2.

Table 2. Distribution of Anemia Status Based on WHO Criteria (n=31)

Category	n	%
Normal (≥ 12 g/dL)	27	87.1
Mild Anemia (10-11.9 g/dL)	4	12.9
Moderate Anemia (8-9.9 g/dL)	0	0.0
Severe Anemia (<8 g/dL)	0	0.0

Based on Table 2, the prevalence of anemia in respondents was 12.9% (n=4), all of which were included in the category of mild anemia with a hemoglobin level of 10-11.9 g/dL. No cases of moderate or severe anemia were found. Respondents with anemia status were Salsabila AP (11.5 g/dL), Tsabitah (11.7 g/dL), Ayu Riska (11.4 g/dL), and Aisyah (11.1 g/dL).

DISCUSSION

The results showed that the average hemoglobin level of the respondents was 13.01 \pm 0.83 g/dL which was in the normal range for adult women (12.0-15.5 g/dL). This value is higher than the study by Putri et al. (2022) on Jakarta female students who found an average hemoglobin of 11.8 g/dL. These differences can be caused by variations in sample characteristics, nutritional status, and respondents' diets.

The prevalence of anemia in this study was 12.9% lower than the national prevalence in Indonesian women of reproductive age (23.7%) and the prevalence among health students in the previous study (34.2%) (Ministry of Health of the Republic of Indonesia, 2019; Putri et al., 2022). These findings indicate that D3 TLM students of the Jakarta III Polytechnic have a relatively good hematological status. All cases of anemia are relatively mild, indicating that the condition can be corrected through nutritional interventions without requiring intensive medical treatment.

Erythrocyte and hematocrit parameters that were within the normal range indicated an adequate erythropoiesis status in most respondents. A normal leukocyte count indicates no signs of active

infection or immunological disorders. Similarly, platelets that are in the normal range reflect good hemostasis function (Means et al., 2020).

Although the prevalence of anemia is relatively low, the existence of 4 respondents with mild anemia still requires attention. Rahman et al. (2021) stated that female health students often experience a gap between theoretical knowledge and anemia prevention practices. Nutrition education programs and periodic screening can help identify and treat anemia cases early.

This study has several limitations, including: cross-sectional design that cannot assess causal relationships, no measurement of iron status biomarkers (ferritin, transferrin saturation) to confirm the etiology of anemia, does not take into account the phase of the menstrual cycle, and the relatively small number of samples. Further research is recommended using a longitudinal design with the integration of iron biomarkers and larger samples.

CONCLUSIONS AND SUGGESTIONS

This study shows that the majority of D3 Medical Laboratory Technology students of the Jakarta III Polytechnic (87.1%) have normal hemoglobin levels with an average of 13.01 ± 0.83 g/dL. The prevalence of anemia of 12.9% is all in the category of mild anemia. All other haematological parameters were within the normal range.

For educational institutions, it is recommended to implement regular anaemia screening programmes and nutrition education for female students. For female students with anemia, it is recommended to increase the consumption of iron-rich foods and consult with health workers. For future researchers, it is recommended to conduct studies with larger samples, use longitudinal designs, and integrate iron status biomarker examination.

Author's Contribution Statement:

Askur: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Drafts, Writing – Review & Editing. **Sresta Azahra:** Conceptualization, Methodology, Supervision, Writing – Review & Editing, Validation. **Fitri Nur Rica:** Methodology, Supervision, Writing – Review & Editing, Validation. **Nurul Anggrieni:** Translate Language

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