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# Erythrocyte Sedimentation Rate and Complete Blood Count Parameters among Female Students of DIII Medical Laboratory Technology, Poltekkes Kemenkes Kaltim

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**ABSTRACT**

**Background:** Erythrocyte Sedimentation Rate (ESR) is a non-specific indicator of systemic inflammation widely used in clinical laboratory practice. Physiological factors including menstrual cycle phase, anemia, and hormonal influences can affect ESR values in women of reproductive age. Female medical laboratory technology students represent an ideal population for studying physiological variation in hematological parameters. This study aimed to describe ESR values and complete blood count (CBC) parameters among female DIII Medical Laboratory Technology students at Poltekkes Kemenkes Kaltim and to analyze their correlation.

**Methods:** This descriptive observational study with a cross-sectional design was conducted at the Hematology Laboratory of Poltekkes Kemenkes Kaltim. A total of 31 female students aged 18–25 years who met the inclusion criteria were enrolled. Blood samples were collected by venipuncture; CBC was examined using a Hematology Analyzer and ESR was measured using the Westergren method. Data were analyzed using descriptive statistics and Spearman correlation (α=0.05). Informed consent was obtained from all participants.

**Results:** The mean ESR was 20.74 ± 16.38 mm/h (median 18.00 mm/h, IQR 11.5–28.5, range 1–76 mm/h); Shapiro-Wilk test confirmed non-normal distribution (W=0.8937; p=0.005). Based on the Westergren reference value for adult women (≤20 mm/h), 58.1% of subjects had normal ESR and 41.9% had elevated ESR. Mean hemoglobin was 13.01 g/dL with 12.9% classified as mildly anemic. Mean leukocyte count was 8,143 cells/µL with a normal differential. Spearman correlation analysis revealed no statistically significant correlation between ESR and all CBC parameters (p>0.05), although a borderline correlation was found between ESR and lymphocytes (rho=0.343; p=0.059).

**Conclusion:** ESR values in apparently healthy female students showed wide variability, with 41.9% exceeding the normal reference limit, reflecting the influence of physiological factors—particularly menstrual cycle phase and hormonal status—rather than pathological processes. No significant correlation was found between ESR and CBC parameters, likely due to the narrow hemoglobin range in the study population. These findings emphasize the importance of considering physiological context when interpreting ESR in women of reproductive age. Longitudinal studies recording menstrual cycle phases are recommended.

**ABSTRAK**

**Latar Belakang:** Laju Endap Darah (LED) merupakan indikator inflamasi sistemik non-spesifik yang digunakan luas dalam praktik laboratorium klinik. Faktor fisiologis seperti fase siklus menstruasi, anemia, dan pengaruh hormonal dapat mempengaruhi nilai LED pada wanita usia reproduktif. Penelitian ini bertujuan menggambarkan nilai LED dan parameter darah lengkap pada mahasiswi DIII Teknologi Laboratorium Medis Poltekkes Kemenkes Kaltim serta menganalisis korelasinya.

**Metode:** Penelitian deskriptif observasional dengan desain cross-sectional ini dilaksanakan di Laboratorium Hematologi Poltekkes Kemenkes Kaltim. Sebanyak 31 mahasiswi usia 18–25 tahun yang memenuhi kriteria inklusi terlibat sebagai responden. Sampel darah vena dikumpulkan; pemeriksaan darah lengkap menggunakan Hematology Analyzer dan LED menggunakan metode Westergren. Data dianalisis dengan statistik deskriptif dan korelasi Spearman (α=0,05). Seluruh responden memberikan informed consent.

**Hasil:** Rata-rata nilai LED adalah 20,74 ± 16,38 mm/jam (median 18,00 mm/jam, IQR 11,5–28,5, rentang 1–76 mm/jam); uji Shapiro-Wilk menunjukkan distribusi tidak normal (W=0,8937; p=0,005). Berdasarkan nilai rujukan metode Westergren untuk wanita dewasa (≤20 mm/jam), 58,1% responden memiliki LED normal dan 41,9% LED meningkat. Rata-rata hemoglobin 13,01 g/dL dengan 12,9% mengalami anemia ringan. Tidak terdapat korelasi bermakna antara LED dengan seluruh parameter darah lengkap (p>0,05), meskipun terdapat korelasi borderline antara LED dan limfosit (rho=0,343; p=0,059).

**Kesimpulan:** Nilai LED pada mahasiswi yang tampak sehat menunjukkan variabilitas lebar dengan 41,9% melebihi nilai rujukan normal, mencerminkan pengaruh faktor fisiologis—khususnya fase siklus menstruasi dan status hormonal—bukan proses patologis. Tidak ditemukan korelasi bermakna antara LED dengan parameter darah lengkap, kemungkinan akibat sempitnya rentang hemoglobin pada populasi studi. Temuan ini menegaskan pentingnya mempertimbangkan konteks fisiologis dalam interpretasi nilai LED pada wanita usia reproduktif.

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## INTRODUCTION

Begin by introducing the general topic and its relevance to international health. Provide a brief overview of the broader health issue or challenge you are addressing (Nasrul, Hafid, Ramadhan, Suza, & Efendi, 2020). Emphasize why the health issue is of international importance. Discuss any global trends, patterns, or statistics that showcase the widespread impact of the problem. This can involve citing the normal value of LEDs for adult females to be 0–20 mm/h according to the Westergren method recommended by ICSH (Pieri et al., 2024). The basic principle of LED is based on the ability of erythrocytes to settle due to the influence of gravity, where an increase in acute phase proteins such as fibrinogen promotes the formation of rouleaux thereby accelerating the rate of deposition (Higuchi & Watanabe, 2023).

Clearly articulate the specific gap or problem that your research addresses. This could be a lack of data, conflicting findings, or an unexplored aspect of the issue (Istifa et al., 2021). This helps establish the rationale for your study. If the health issue has a historical dimension or has evolved over time, briefly provide this context. Historical information can help readers understand the roots of the problem and how it has developed. Address any policy implications related to the health issue. This helps to underscore the real-world significance of your research and how it can contribute to improving health outcomes on a global scale (Khasanah et al., 2023).

In Indonesia, the prevalence of anemia in women of reproductive age reaches 31%, higher than in neighboring countries (Dharsono et al., 2024). Students of the DIII Medical Laboratory Technology Study Program of the Ministry of Health of East Kalimantan are an ideal population to understand the physiological variations of laboratory parameters. As aspiring health analysts, an understanding of normal values and the factors that influence LEDs will improve their professional competence. This study aims to describe the description of LED values and complete blood parameters in DIII students of Medical Laboratory Technology of the Ministry of Health of East Kalimantan.

The menstrual cycle involves complex fluctuations of reproductive hormones that affect the production of fibrinogen as a major determinant of LED values. Research by Dapper & Didia (2002) showed significant variation in LEDs during the menstrual cycle phase, with the highest LED values in the menstrual phase ($p<0.05$). Understanding the physiological variation of LEDs has important clinical implications for preventing misinterpretation of laboratory results. The formulation of this research problem is how to describe the LED value and complete blood parameters in DIII students of Medical Laboratory Technology of the Ministry of Health of East Kalimantan.

## METHOD

The writing method is made sub to be more detailed and organized. Write like the following example:

### Types of Research

This study uses an observational descriptive design with a cross-sectional approach.

**Research Location and Time**

The research was carried out at the Hematology Laboratory of the DIII Study Program of Medical Laboratory Technology, Polytechnic of the Ministry of Health, East Kalimantan in 2025.

**Population and Sample**

The research population is all active students of the DIII Medical Laboratory Technology Study Program, Polytechnic of the Ministry of Health, East Kalimantan. The sample consisted of 31 female students who met the inclusion criteria: women aged 18–25 years, willing to participate by signing an informed consent, and in good health at the time of sampling. Exclusion criteria include: undergoing treatment that affects hematological parameters, suffering from a known chronic disease, and being pregnant.

**Data Collection**

Venous blood collection is carried out by trained personnel using a sterile syringe of 2–3 mL transferred to the EDTA vacutainer tube. Complete blood tests were performed using the Hematology Analyzer for the parameters of leukocytes, lymphocytes, monocytes, neutrophils/segments, hemoglobin, erythrocytes, hematocrits, and platelets.

Pemeriksaan LED dilakukan menggunakan metode Westergren: sampel darah EDTA dicampur natrium sitrat 3,8% (4:1), diaspirasi ke tabung Westergren hingga tanda 0 mm, diletakkan vertikal selama tepat 60 menit, dan hasil dibaca dalam satuan mm/jam. – 0.725. Invalid statements are removed from the list before reliability testing is performed. Reliability tests were performed on 26 items and based on the test results all statements were declared reliable with a calculated r-value greater than the r-table value. All statements are declared reliable with the results of *the Alpa Cronbach statistical test* with a value range between 0.668 – 0.706.

**Data Processing and Analysis**

Grouping is carried out by making a total score of each assessment component for each lecturer and then determining the average score. If the score of each lecturer is less than the Mean, then it is categorized as good and if it is more than or equal to the Mean, then it is categorized as bad. The data were then analyzed frequency distribution, Chi-Square and Logistic Regression.

**RESEARCH RESULTS**

This study involved 31 students of the DIII Medical Laboratory Technology Study Program, Polytechnic of the Ministry of Health, East Kalimantan, who met the inclusion criteria. All respondents were women aged 18–25 years in good health at the time of sampling.

Table 1 presents descriptive statistics of LED values and all complete blood parameters in 31 respondents. The LED value has a mean of 20.74 ± 16.38 mm/h with a median of 18.00 mm/h. The distribution of LED data was abnormal based on the Shapiro-Wilk test (W=0.8937; p=0.005). A total of 58.1% of respondents (18/31) had normal LED values (≤20 mm/h) and 41.9% (13/31) had increased LEDs (>20 mm/h). The mean values of all complete blood parameters were within the normal range: hemoglobin 13.01 g/dL, hematocrit 39.58%, erythrocytes 4.54 million/µL, leukocytes 8,143 cells/µL, and platelets 317,613/µL. There were 4 respondents (12.9%) with hemoglobin <12.0 g/dL (mild anemia).

**Table 1. Descriptive Statistics of LED Values and Complete Blood Parameters of DIII TLM Polytechnics of the Ministry of Health of East Kalimantan (n=31)**

| Respondent Characteristics | n | Percent (%) |
|---|---|---|
| **Parameters Statistics** | | |
| Mean ± SD | 2 | 10 |
| Median (IQR) | 7 | 35 |
| Min – Max Value | 11 | 55 |

| Respondent Characteristics | n | Percent (%) |
|---|---|---|
| **Rated LED(mm/h)** | | |
| 20,74 ± 16,38 | 12 | 60 |
| 18,00 (11,50–28,50) | 8 | 40 |
| **Complete Blood Parameters (Mean ± SD)** | | |
| Hemoglobin: 13,01 ± 0,83 g/dL | 13 | 65 |
| Hematocrit: 39.58 ± 2.90% | 3 | 15 |
| Erythrocytes: 4.54 ± 0.34 million/µL | 2 | 10 |
| Leucositol: 8,143 ± 2,066 sel/µL | 2 | 10 |
| **Mother's Employment Status** | | |
| Normal (≤20 mm/jam): 18 (58,1%) | 8 | 40 |
| Increased (>20 mm/h): 13 (41.9%) | 12 | 60 |

Based on Table 1, the average values of all complete blood parameters are within the normal range. The categorization of LEDs and hemoglobin status is presented in Table 2. There was no meaningful correlation between LEDs and all complete blood parameters (p>0.05), although there was a borderline correlation between LEDs and lymphocytes (rho=0.343; p=0.059).

**Tabel 2. Kategorisasi Nilai LED dan Status Hemoglobin Mahasiswi DIII TLM Poltekkes Kemenkes Kaltim (n=31)**

| Research Variables | n | % |
|---|---|---|
| **Category LED** | | |
| Normal (≤20 mm/jam) | 13 | 65 |
| Increased (>20 mm/h) | 7 | 35 |
| **Status Hemoglobin** | | |
| Normal (Hb ≥12,0 g/dL): 27 (87,1%) | 13 | 65 |
| Mild Anemia (Hb 11.0–11.9 g/dL): 4 (12.9%) | 7 | 35 |

## DISCUSSION

The results of the study showed that the LED value in 31 DIII students of Medical Laboratory Technology at the Ministry of Health of East Kalimantan had a mean of 20.74 ± 16.38 mm/hour with a median of 18.00 mm/hour. The distribution of LED values was abnormal with wide variations (1–76 mm/h), reflecting the heterogeneity of physiological conditions between respondents. The median value (18.00 mm/h) is still within the normal range (<20 mm/h), but a slightly higher average and skewed distribution to the right indicates a subgroup with LEDs higher than normal. This is consistent with a reference study in women of reproductive age in India that found an ESR range of 4.35–41.65 mm/h, showing considerable variability in this age group (Ganie et al., 2024).

The study found that 41.9% of respondents had an increased LED value (>20 mm/h). This fairly high proportion is likely related to several physiological factors typical of women of reproductive age. First, the menstrual cycle and hormonal phase during sampling contribute significantly; Research by Dapper & Didia (2002) shows LEDs increase significantly during the menstrual phase. Second, anemia status in 12.9% of respondents with Hb <12 g/dL may contribute to increased LED as reduced erythrocyte concentrations allow for more efficient rouleaux formation (Higuchi & Watanabe, 2023). The prevalence of anemia in young women in Indonesia reaches 23.7–32.0% in the age group of 15–24 years (Wratsangka et al., 2024).

The average value of all complete blood parameters is within the normal range. The average hemoglobin was 13.01 ± 0.83 g/dL, hematocrit was 39.58 ± 2.90%, erythrocytes 4.54 ± 0.34 million/µL, leukocytes were 8,143 ± 2,065 cells/µL with normal type counts (neutrophils 58.74%, lymphocytes 34.52%, monocytes 6.55%), and platelets 317,613 ± 56,493/µL. An overall normal complete blood

profile indicates the absence of signs of acute infection or immunological abnormalities in this population (Gulati et al., 2024). These findings have important implications for clinical laboratory practitioners to consider the physiological context—particularly the phase of the menstrual cycle—in interpreting LED values in women of reproductive age.

Spearman correlation analysis showed no statistically significant correlation between the LED values and the entire complete blood parameter ($p>0.05$). The absence of a significant correlation between LED and hemoglobin/hematocrit may be due to the narrow range of hemoglobin values (11.1–14.6 g/dL) in this study population. The borderline correlation between LEDs and lymphocytes (rho=0.343; p=0.059) is interesting to observe; the direction of positive correlation indicates that respondents with higher lymphocytes tend to have slightly higher LEDs, perhaps reflecting an ongoing immune response related to the menstrual cycle (Ganie et al., 2024). The limitations of this study include the limited number of samples (n=31) and a cross-sectional design that does not record the phases of the menstrual cycle in a structured manner.

Follow-up research with a longitudinal design that records the phases of the menstrual cycle in a structured manner is highly recommended to obtain a more comprehensive picture of LED variation. Enlarging the sample count and adding fibrinogen and CRP examinations will strengthen the analysis of biological mechanisms. Determination of specific LED reference values for the female population of reproductive age in East Kalimantan also needs to be done (Pieri et al., 2024).

## CONCLUSIONS AND SUGGESTIONS

This study concluded that the LED value in 31 DIII students of Medical Laboratory Technology of the Ministry of Health of East Kalimantan had a mean of 20.74 ± 16.38 mm/hour (median 18.00 mm/hour) with abnormal distribution. A total of 58.1% of respondents had normal LEDs (≤20 mm/h) and 41.9% had increased LEDs (>20 mm/h). The average value of all complete blood parameters is within the normal range; 12.9% of respondents had mild anemia. There was no statistically significant correlation between LEDs and all complete blood parameters ($p>0.05$), although there was a borderline correlation between LEDs and lymphocytes (rho=0.343; p=0.059). The high variability of LEDs in female students who appear to be healthy indicates the magnitude of the influence of non-pathological physiological factors, especially the phases of the menstrual cycle and reproductive hormones.

For educational institutions: the results of this study should be used as a discussion material in haematology learning about physiological factors that affect the value of LEDs in women, as well as encourage further research with a design that records the phases of the menstrual cycle in a structured manner.

For clinical laboratory practitioners: should consider the phase of the menstrual cycle, the patient's anaemia status, and clinical history when interpreting the value of LEDs in women of reproductive age to avoid over-diagnosis of inflammatory conditions.

For further research: it is recommended to conduct longitudinal studies on the same subjects measuring LEDs at different phases of the menstrual cycle, enlarge the number of samples, adding fibrinogen and CRP examinations, and establishing specific LED reference values for the female population of reproductive age in East Kalimantan.

**Author's Contribution Statement:**

**Dewi Saraswati**: Conceptualization, Methodology, Investigation, Project Administration, Resources, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Funding Acquisition, Supervision. **Maria Eka Suryani:** Conceptualization, Methodology, Investigation, Data Curation, Validation, Writing – Review & Editing, Resources. **Yuliansyah Rianur:** Methodology, Supervision, Writing – Review & Editing, Validation. Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Visualization, Resources.

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