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THE RELATIONSHIP BETWEEN THE DURATION OF TREATMENT WITH THE RATIO OF PLATELETS TO LYMPHOCYTES AND THE RATIO OF NEUTROPHILS TO LYMPHOCYTES IN PULMONARY TUBERCULOSIS

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ABSTRACT

Background: *Mycobacterium tuberculosis infection triggers a systemic inflammatory response, reflected by hematological changes such as increased Platelet-to-Lymphocyte Ratio (PLR) and Neutrophil-to-Lymphocyte Ratio (NLR). This study aims to determine the relationship between the duration of treatment and PLR and NLR values in pulmonary TB patients*
Methods: *The type of research used was descriptive research with a cross-sectional study. Data was collected to determine the Relationship between Duration of Treatment with PLR and NLR in TB Patients in Jambi City in 2025.*
Results: *This study found that the mean values of PLR and NLR tend to increase during the early phase of tuberculosistreatment and decrease in the advanced phase. These results are consistent with our initial hypothesis regarding the relationship between treatment phases and changes in inflammatory parameters. Laboratory analysis data, including descriptive data and PLR and NLR values based on treatment duration, were analyzed using statistical tests. Although the analysis revealed no significant association between treatment duration and PLR or NLR values in pulmonary tuberculosispatients*
Conclusion: *The duration of treatment does not directly influence changes in PLR and NLR levels. Several studies have also demonstrated that inflammatory parameters such as PLR and NLR can be affected by individual factors, particularly the body's immune response, which are not necessarily dependent on the length of treatment. Therefore, individual factors and other clinical conditions may substantially influence PLR and NLR parameters.*

Keywords: *Pulmonary Tuberculosis, Duration of Treatment, Systemic Inflammatory Response, Platelet-to-Lymphocyte*

INTRODUCTION

Pulmonary Tuberculosis (TB) is a contagious infectious disease caused by the acid-fast bacterium *Mycobacterium tuberculosis*. TB spreads through respiratory droplets when an infected person coughs or sneezes. The bacteria can also affect organs outside the lungs, such as the intestines, bones, and joints. The droplets released during coughing or talking can be inhaled by healthy individuals, leading to TB infection (Kemenkes RI, 2022).

In 2023, it was estimated that there were 10.8 million global TB cases, including 6 million men, 3.6 million women, and 1.3 million children. TB resulted in 1.25 million deaths, including 161,000 people with HIV (WHO, 2024). In Indonesia, 2023 TB cases reached 77%, with 820,789 reported cases and 134,000 deaths annually, including 134,528 cases in children. In Jambi Province, 5,308 TB cases were reported in 2022, with 209 TB patients per 100,000 residents in Jambi City, and a mortality rate of 6 per 100,000 residents (Dinkes Provinsi Jambi, 2023).

TB significantly impacts the immune system and hematological profile of patients. Inflammation caused by TB infection results in hematological abnormalities such as increased

platelet count (thrombocytosis), increased neutrophils (neutrophilia), and decreased lymphocytes (lymphocytopenia), indicating inflammation. Laboratory tests such as Platelet-to-Lymphocyte Ratio (PLR) and Neutrophil-to-Lymphocyte Ratio (NLR) are used to detect inflammation (Mansyur, Ramdani, & Santoso, 2018).

In the early stages of TB infection, an increased PLR is induced by the bacteria, leading to thrombocytosis and lymphocytopenia, reflecting inflammation. Studies have shown a significant increase in PLR in TB patients compared to healthy individuals, with an average of 201.7 in TB patients versus 78.7 in controls (Abakay, Sen, & Tanrikulu, 2015). Research also highlights neutrophils as a primary immune response against TB infection (Sormin et al., 2018). Furthermore, lymphocyte depletion is linked to the migration of lymphocytes to infected tissues (Cahyadi & Steffanus, 2022).

In TB patients, both PLR and NLR typically increase. High PLR values are due to platelet increase and lymphocyte reduction, while NLR is a key immune system response during TB infection (Makarim, 2019). TB is treatable with a two-phase treatment regimen: an intensive phase lasting about two months, followed by a continuation phase for less than six months to prevent relapse (Kemenkes RI, 2022).

Studies have shown that platelet count drops during treatment (Prameswari, Wahyudi, & Achmad, 2015), and lymphocytes are crucial in combating *Mycobacterium tuberculosis*. Research also indicates that pre- treatment NLR can predict treatment failure (Sormin et al., 2018). Over time, changes in PLR and NLR may be seen as markers of treatment progress (Makarim, 2019; Nabilah, 2020).

In 2023, several health centers in Jambi City reported varying TB cases, with the highest number (15 cases) at Puskesmas Simpang IV Sipin and the lowest (4 cases) at Puskesmas Paal Merah I. This background has motivated the author to investigate the relationship between treatment duration and PLR and NLR in pulmonary TB patients in Jambi City.

METHODS

This analytical observational study examined pulmonary tuberculosis (TB) patients based on duration of treatment at Puskesmas Simpang IV, Puskesmas Putri Ayu, Puskesmas Pakuan Baru, Puskesmas Paal Merah I and Puskesmas Paal V from January to May 2025. The sample included 30 outpatients with positive AFB results. The study analyzed Platelet and Leukocyte counts and types, focusing on the Platelet-to-Lymphocyte Ratio (PLR) and Neutrophil-to-Lymphocyte Ratio (NLR). These results are consistent with our initial ypothesis regarding the relationship between treatment phases and changes in inflammatory parameters. Although, the analysis revealed no significant association between treatment duration with PLR and NLR values in pulmonary tuberculosis patients in Jambi City.

RESULTS AND DISCUSSION

This study aimed to evaluate the changes in Platelet and Leukocyte counts and types, focusing on the Platelet-to-Lymphocyte Ratio (PLR) and Neutrophil-to-Lymphocyte Ratio (NLR) in tuberculosis patients based on duration of treatment at Puskesmas Simpang IV, Puskesmas Putri Ayu, Puskesmas Pakuan Baru, Puskesmas Paal Merah I, and Puskesmas Paal. Tuberculosis, caused by *Mycobacterium tuberculosis*, elicits a significant inflammatory response, and effective treatment is crucial for reducing the bacterial load.

Tuberculosis, caused by *Mycobacterium tuberculosis*, elicits a significant inflammatory response, and effective treatment is crucial for reducing the

bacterial load. By analyzing hematological parameters, including total platelet and leukocyte counts and their differential components, the research sought to assess the immune status of patients throughout their treatment journey. The methodology involved collecting and comparing laboratory data before and after the intensive phase, utilizing appropriate statistical tests to determine any significant differences. The results are expected to shed light on the immunological effects of intensive anti-tuberculosis therapy, providing valuable insights into patient management. This research contributes to understanding how hematological changes can reflect treatment efficacy and overall patient outcomes in tuberculosis management.

Respondent Characteristics

Gendersection

Table 1. Table of Frequency Distribution of Characteristics by Gender

Gender	Frequency	Percentage (%)
Male	20	66.7%
Female	10	33.3%
Total	30	100.0%

Based on the data presented in the Table of Frequency Distribution of Characteristics by Gender, it can be interpreted that out of a total of 30 study subjects, there is a significant difference in the distribution of genders among tuberculosis patients undergoing treatment at Puskesmas Simpang IV, Puskesmas Putri Ayu, Puskesmas Pakuan Baru, Puskesmas Paal Merah I, and Puskesmas Paal. The majority of patients are male, totaling 20 individuals or 66,7% of the total sample. Meanwhile, female patients number 10, representing 33,3% of all study subjects.

Age

Based on the Table of Frequency Distribution of Respondent Characteristics by Age, it can be observed that tuberculosis patients undergoing treatment at Puskesmas Simpang IV, Puskesmas Putri Ayu, Puskesmas Pakuan Baru, Puskesmas Paal Merah I, and Puskesmas Paal have a varied age distribution. The most prevalent age group is 18-59 years, comprising 20 patients or 66,7% of the total sample. Meanwhile, ≥60 years age group comparising 10 patients or 33,3% of all study subjects.

Table 2. Table of Frequency Distribution of Respondent Characteristics by Age

Age	Frequency	Percentage (%)
18-59 years	20	66,7%
≥60 years	10	33,3%
Total	30	100,0%

This age distribution indicates that tuberculosis tends to affectthe elderly population more significantly, with a total of 66,7% of patients over the age of 18-59. This age distribution shows that tuberculosis tends to affect the elderly population more, with 66,7% of patients aged 18-59 years. This indicates a higher risk factor in this age group, which may be due to increased social and work activity, raising the risk of exposure to TB bacteria through contact with infected individuals. In addition, high stress, economic challenges, and unhealthy lifestyles can weaken the immune system, making them more susceptible to infection. Meanwhile, the lower proportion in the older age groups (33,3% for ≥60 years) reflects differences in exposure or resistance to tuberculosis infection.

Table 3. Table of Comparison of PLR Values Based on Duration of Anti- Tuberculosis Treatment

Variable	Mean ± SD	Median (Min – max)
≤ 2 months	142 ± 44,52	137 (41 - 216)
> 2 months	137 ± 53,98	139 (47 - 218)

This study demonstrates a significant difference in Platelet-to-Lymphocyte Ratio (PLR) values before and after anti-tuberculosis treatment. The median PLR before treatment was 137, indicating an abnormal level, while after treatment, it decreased to a median of 139, which ups when compared to before. This reduction in PLR reflects a no improvement in the inflammatory response.

In this study, of the 30 samples, the average PLR in Pulmonary TB patients

undergoing treatment for ≤2 months has an average PLR of 142 with a range of 41–216. Meanwhile, in Pulmonary TB patients with a treatment duration of >2 months, the average PLR is 137 with a range of 47–218.These findings indicate that anti-tuberculosis therapy effectively reduces inflammatory responses, suggesting a positive therapeutic outcome for patients.

Table 4. Table of Comparison of NLR Values Based on Duration of Anti- Tuberculosis Treatment

Variable	Mean±SD	Median (min- max)
≤ 2 months	2,86 ± 2,10	2,39 (2,18 - 9,34)
> 2 months	1,70 ± 0,64	1,53 (0,4 - 3,17)

This study demonstrates a significant difference in Neutrophil-to-Lymphocyte Ratio (NLR) values before and after anti- tuberculosis treatment. The median NLR before treatment was 2,86, indicating an abnormal level, while after treatment, it decreased to a median of 1,70, which falls within the normal range. This reduction in NLR reflects an improvement in the inflammatory response.

The NLR, calculated by dividing the number of neutrophils by lymphocytes, serves as a critical parameter for assessing inflammation. Normal NLR values in healthy adults range from 0.78 to 3.53, with values above 3.0 considered pathological. Notably, NLR values in the gray zone (2.3–3.0) can signal potential pathological processes, including infections or inflammation.

In this study, of the 30 samples, 15 (50%) exhibited an increased neutrophil-to-lymphocyte ratio in ≤2 months. After >2 months treatment, 15 samples (50%) showed an decline ratio. These findings indicate that anti-tuberculosis therapy effectively reduces inflammatory responses, suggesting a positive therapeutic outcome for patients.

CONCLUSION

In conclusion, the data presented in the Frequency Distribution Table of Characteristics by Gender reveals a notable disparity in the distribution of tuberculosis patients undergoing intensive treatment in Jambi City, with a clear predominance of male patients. The age distribution shows varied range among patients, with the elderly representing the productive age. This suggests that the productive age may face a higher risk of tuberculosis, potentially due to factors like In addition, high stress, economic problems, and unhealthy lifestyles can weaken the immune system, making them more susceptible to infection. Additionally, there is a statistically no significant reduction in the PLR and NLR as treatment duration progresses, linked to increases in platelet and lymphocyte counts, along with a decrease in neutrophil levels. This decrease in PLR and NLR can be affected by individual factors, particularly the body's immune response, which are not necessarily dependent on the length of treatment.

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CONFLICT OF INTEREST

This research, there are no conflicts of interest regarding funding, including names in published articles, and the data collection process.

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