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Immune Response Indicators in Term and Preterm Premature Rupture of Membranes: A Leukocyte Profile Evaluation

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ABSTRACT

Background: Premature rupture of membranes (PRM) occurs when membranes rupture spontaneously before delivery. PRM is categorized into preterm PRMor preterm premature rupture of membranes (PPROM), occurring before and at 37 weeks of gestation, and term PRM or premature rupture of membranes (PROM), occurring after 37 weeks.

Objective: This study aimed to determine differences in leukocyte profiles between term and preterm PRM cases at RSD dr. Soebandi Jember.

Methods: This research used an observational analytic design. This research involved two groups of pregnant women with term and preterm PRM. A total of 55 participants were included, with 28 in the preterm PRM group and 27 in the term PRM group. Data were collected from medical records between January 2023 and July 2024 using a purposive sampling technique. Normality tests were conducted using the Shapiro-Wilk Test. For normally distributed data ($p > 0.05$), the Independent T-Test was applied, while the Mann-Whitney Test was used for non-normally distributed data ($p < 0.05$).

Results: The results showed no significant differences in lymphocyte (p-value=0.725) and neutrophil (p-value=0.893) levels. Similarly, no significant differences were found in leukocyte, monocyte, eosinophil, and basophil levels (p-values=0.987; 0.666; 0.949; and 0. 979, respectively).

Conclusion: The study showed no significant differences in the leukocyte profiles between term and preterm PRM. However, increased neutrophil counts in preterm cases may suggest an ongoing infection, highlighting the importance of monitoring leukocyte levels in PRM for potential infection risk management. Further studies are needed to assess how factors such as occupation and daily fatigue affect the incidence of PRM, especially in the preterm group.

Keywords: aterm, leukocyte, preterm, premature rupture of membranes

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BACKGROUND

Premature rupture of membranes (PRM) is a complication in the obstetric field that requires more attention because it can increase the incidence of mortality and morbidity for both the fetus and the pregnant woman (Amadi et al., 2021). The definition of PRM is an event where the membranes spontaneously rupture before the time of delivery (Barokah & Agustina, 2022). PRM can be divided into preterm PRM or preterm premature rupture of membranes (PPROM) which can occur before or at 37 weeks of gestation, and aterm PRM, or premature rupture of membranes (PROM) which can occur after 37 weeks of gestation (Amadi et al., 2021).

PRM is found in 3-15% of all pregnancies and 30-40% of preterm labor worldwide (Badan Litbang Kesehatan, 2018). The results of the 2018 Riskesdas report showed that the incidence of PRM was the highest disorder among labor complications in Indonesia, reaching 5.6%. East Java Province ranked second with the highest incidence of PRM in Indonesia in 2018 at 8.3% (Masruroh et al., 2021). The cause of PRM is still unknown, but one factor that can drive the incidence of PRM is infection (Barokah & Agustina, 2022). PRM caused by infection can be characterized by leukocytosis, which is one of the markers of infection. Leukocytes activate cytokines, which trigger the production of matrix metalloproteinase and prostaglandin hormones and stimulate contractions (Esercan & Demir, 2023; Galaz et al., 2020).

The levels of leukocyte types can be determined using a leukocyte differential count. Types of leukocytes include lymphocytes, monocytes, neutrophils, eosinophils, and basophils. Certain infectious processes can trigger changes in the values of one or more of the cell types. During systemic inflammation, leukocyte subtypes differentiate through the immune response so that there can be an increase in the number of neutrophils and a decrease in the number of lymphocytes. The number of leukocytes, especially neutrophils and monocytes, increased in women with preterm PRM and intra-uterine infection (Galaz et al., 2020). A study showed a significant difference in lymphocyte count where the lymphocyte count was lower in PRM with infection compared to PRM without infection (Gimeno-Molina et al., 2022). There is a difference in leukocyte levels higher found in preterm PRM compared to aterm PRM (Indrasuari et al., 2023).

Preterm PRM conditions can be caused by external factors such as infection (Masruroh et al., 2021). Infection of the amniotic sac can increase the risk of preterm PRM. To deal with infection, the body increases leukocyte production. During the inflammatory process, there is an increase in cytokine production which results in the production of prostaglandins by neutrophils (Hromadnikova et al., 2021). The response to infection also causes monocytes to produce cytokine. Cytokines that continue to be produced will cause levels of MMPs (matrix metalloproteinases) and TIMPs (tissue inhibitors of metalloproteinases) to become unbalanced. Some of these activities can lead to collagen degradation and reduce the strength of the chorioamnion membrane and cervical thinning which can result in rupture of the amniotic membrane (Gimeno-Molina et al., 2022).

The mechanism of aterm PRM can be influenced by biochemical imbalances in the amniotic membrane. In the case of PRM aterm, physiological imbalances can occur in the form of changes in cell number, structure, and collagen catabolism (Hromadnikova et al., 2021; Jung et al., 2022). When TIMP concentration is high and MMP activity is low, there is an imbalance between the two, so collagen production is reduced and can trigger the rupture of the amniotic membrane. In addition, there is a process of tissue remodeling during pregnancy, which involves changes in the cellular matrix and collagen type and composition that aim to adjust

changes in volume and pressure as pregnancy develops(Wahyunindita, 2019). These changes can lead to the weakening of the amniotic membrane structure and can trigger PRM.
The impact of complications on mothers with PRM can include intrauterine infections such as endometritis or chorioamnionitis. A study showed that mothers with preterm PRM have an increased cardiovascular risk in the future (Jung et al., 2022). Meanwhile, the impact on neonatal showed that aterm babies have a greater chance of experiencing Acute Respiratory Distress Syndrome (ARDS). Maternal leukocyte examination can serve as a common marker of infection and inflammation in the body, but comparing leukocyte profiles in both aterm and preterm PRM can provide a more specific marker. There is a differences in leukocyte count in aterm and preterm PRM that can be an important indicator of maternal immune response and early detection of the potential risk of infection and disease (Galaz et al., 2020; Pramono et al., 2020). Preterm PRM can have increased maternal cardiovascular risks including coronary heart disease, stroke, and myocardial infarction (Kim et al., 2014). Meanwhile, aterm PRM may have an increased risk of Early-Onset Sepsis (EOS) and neonatal Acute Respiratory Distress Syndrome (ARDS) in postpartum infants. However, there is limited evidence in Indonesia comparing leukocyte subtypes between term and preterm PRM as markers of maternal immune response. Thus, research on the differences in leukocyte profiles in aterm and preterm PRM may provide insights into the possibility of early detection to reduce the risk of future PRM outcomes and assist in appropriate management or intervention to improve maternal and neonatal outcomes.

OBJECTIVE

This study aimed to determine differences in leukocyte profiles between term and preterm PRM cases at RSD dr. Soebandi Jember.

METHODS

This research used an observational analytic design with a cross-sectional study. The data measured were secondary data from medical records. There are two categories of research samples, pregnant women who experience aterm PRM (>37 weeks) and pregnant women who experience preterm PRM (≤37 weeks) and documented in medical records from January 2023 to July 2024 at RSD dr. Soebandi Jember. This study used a purposive sampling technique so that 55 total respondents were obtained.

The inclusion criteria in this study included: pregnant women diagnosed with aterm PRM and preterm PRM; pregnant women with PRM who conducted examinations at RSD dr. Soebandi Jember. Meanwhile, the exclusion criteria in this study included: pregnant women with PRM who had incomplete medical records; pregnant women with PRM who had other pregnancy complications including heart defects, chronic lung disease, preeclampsia, hypertension, tumors, cancer, twins, diabetes mellitus, etc.; pregnant women with PRM who had received intervention/administration of antibiotics or corticosteroids in previous health facilities; pregnant women with PRM who had a history of sexual intercourse within the previous day. The normality test was carried out using the Shapiro-Wilk Test. If the data were normally distributed ($P>0.05$), then the Independent T-Test hypothesis test was used, but if the data were not normally distributed ($P<0.05$), then the Mann-Whitney hypothesis test was used. Data were analyzed using SPSS version 22. This research has been ethically tested and declared ethically sound by the Health Research Ethics Committee (KEPK) team of the Faculty of Nursing, University of Jember with number No.345/UN25.1.14/KEPK/2024.

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RESULTS

Table 1. Frequency Distribution of Characteristics of Pregnant Women with PRM in RSD dr. Soebandi Jember from January 2023 to July 2024

Characteristics of Research Respondents	Frequency of Preterm PRM	Percentage of Preterm PRM (%)	Frequency of Aterm PRM	Percentage of Aterm PRM (%)	Total Frequency	Total Percentage (%)
Age						
<20 years	1	3.6%	0	0%	1	1.8%
20-35 years	20	71.4%	24	88.9%	44	80%
>35 years	7	25%	3	11.1%	10	18.2%
Total	28	100%	27	100%	55	100%
Education						
Not is School	0	0%	1	3.7%	1	1.8%
Elementary School	9	32.1%	7	25.9%	16	29.1%
Junior High School	7	25%	7	25.9%	14	25.5%
Senior High School	12	42.9%	12	44.4%	24	43.6%
Total	28	100%	27	100%	55	100%
Occupation						
Unemployed	2	7.1%	2	7.4%	4	7.3%
Housewife	22	78.6%	23	85.2%	45	81.8%
Farmer	1	3.6%	0	0%	1	1.8%
Self-employed	3	10.7%	2	7.4%	5	9.1%
Total	28	100%	27	100%	55	100%
History of PRM						
Yes	1	3.6%	0	0%	1	1.8%
None	27	96.4%	27	100%	54	98.2%
Total	28	100%	27	100%	55	100%
Gravida						
Primigravida	10	35.7%	12	44.4%	22	40%
Multigravida	17	60.7%	15	55.6%	32	58.2%
Grand multi-gravida	1	3.6%	0	0%	1	1.8%
Total	28	100%	27	100%	55	100%
Partus						
Nulliparaous	12	42.9%	13	48.1%	25	45.5%
Primiparaous	11	39.3%	8	29.6%	19	34.5%
Multiparaous	5	17.9%	6	22.2%	11	20%
Grandemultiparaous	0	0%	0	0%	0	0%
Total	28	100%	27	100%	55	100%
Abortion						
A0	23	82.1%	25	92.6%	48	87.3%
A1	5	17.9%	2	7.4%	7	12.7%
Total	28	100%	27	100%	55	100%
Gestational Age						
≤37 weeks					28	50.9%
>37 weeks					27	49.1%
Total					55	100%
Amniotic Fluid Index (AFI)						
Oligohydramnios	5	17.9%	0	0%	6	10.9%
Normal	20	71.4%	26	96.3%	46	83.6%
Polyhydramnios	3	10.7%	1	3.7%	3	5.5%
Total	28	100%	27	100%	55	100%

Based on the results of research on the characteristics of research respondents of pregnant women with PRM in RSD dr. Soebandi Jember (table 1) shows that the majority of the age of pregnant women with PRM who became research respondents were 20-35 years

(80%). Based on the characteristics of educational background, the majority of research respondents had a senior high school educational background with a percentage of 43.6%. Based on employment characteristics, the majority of research respondents worked as housewives (81.8%). Based on the characteristics of PRM history, the majority of respondents did not have a history of PRM (98.2%). Based on gravida characteristics, the majority of study respondents were multigravida mothers (58.2%). Based on partus characteristics, it shows that the majority are nulliparous mothers (45.5%). Based on the characteristics of abortion, 87.3% had no history of abortion. Based on the characteristics of gestational age, the majority of study respondents had a gestational age of ≤37 weeks (50.9%). Based on the characteristics of the Amniotic Fluid Index (AFI), the majority 83.6% normal.

Table 2. Frequency Distribution of Leukocyte Profile Levels in Patients with Preterm PRM at RSD dr. Soebandi Jember from January 2023 to July 2024.

Variable	Frequency of Preterm PRM	Percentage of Preterm PRM (%)	Frequency of Preterm PRM Patients with Leukocytosis	Percentage of Preterm PRM Patients with Leukocytosis (%)	Frequency of Preterm PRM Patients with Neutrofilia	Percentage of Preterm PRM Patients with Neutrofilia (%)
Leukocytes						
<5.7x10⁹/L	0	0%	0	0%	0	0%
5.7–16.9x10⁹/L	24	85.7%	0	0%	14	77.8%
>16.9x10⁹/L	4	14.3%	4	100%	4	22.2%
Total	28	100%	4	100%	18	100%
Lymphocytes						
<15%	11	39.3%	4	100%	11	61.1%
15-45%	17	60.7%	0	0%	7	38.9%
>45%	0	0%	0	0%	0	0%
Total	28	100%	4	100%	18	61.1%
Monocytes						
0-11%	28	100%	4	100%	18	100%
>11%	0	0%	0	0%	0	0%
Total	28	100%	4	100%	18	100%
Neutrophils						
36-73%	10	35.7%	0	0%	0	0%
>73%	18	64.3%	4	100%	18	100%
Total	28	100%	4	100%	18	100%
Eosinophils						
0-6%	28	100%	4	100%	18	100%
>6%	0	0%	0	0%	0	0%
Total	28	100%	4	100%	18	100%
Basophils						
0-2%	28	100%	4	100%	18	100%
>2%	0	0%	0	0%	0	0%
Total	28	100%	4	100%	18	100%

Based on the results of research on the characteristics of leukocyte profile levels in patients with preterm PRM at RSD dr. Soebandi Jember (table 2) shows that the majority of patients with preterm PRM have normal leukocyte levels (85.7%). Based on the data in the results of the study regarding the characteristics of leukocyte profile levels in patients with preterm PRM at RSD dr. Soebandi Jember (table 2) shows that all respondents with preterm PRM who experienced leukocytosis also experienced lymphocytopenia and neutrophilia. Based on the characteristics of lymphocyte levels, the majority of research respondents with preterm PRM had normal lymphocyte levels (60.7%). Based on the characteristics of monocytes, eosinophils, and basophils, all research respondents with preterm PRM had normal levels of monocytes, eosinophils, and basophils. Based on the characteristics of neutrophils, it

shows that most patients with preterm PRM, namely 64.3%, have neutrophilia. Based on the data on the characteristics of leukocyte profile levels in patients with preterm PRM at RSD dr. Soebandi Jember (table 2) shows that the majority of respondents with preterm PRM who experienced neutrophilia also experienced lymphocytopenia (61.1%).

Table 3. Frequency Distribution of Leukocyte Profile Levels in Patients with Aterm PRM at RSD dr. Soebandi Jember from January 2023 to July 2024

Variable	Frequency of Aterm PRM	Percentage of Aterm PRM (%)	Frequency of Aterm PRM Patients with Leukocytosis	Percentage of Aterm PRM Patients with Leukocytosis (%)	Frequency of Aterm PRM Patients with Neutrofilia	Percentage of Aterm PRM Patients with Neutrofilia (%)
Leukocytes						
<5.7 x 10⁹/L	0	0%	0	0%	0	0%
5.7 – 16.9 x 10⁹/L	23	85.2%	0	0%	7	63.6%
>16.9 x 10⁹/L	4	14.8%	4	100%	4	36.4%
Total	27	100%	4	100%	11	100%
Lymphocytes						
<15%	11	40.7%	4	100%	10	90.9%
15-45%	16	59.3%	0	0%	1	9.1%
>45%	0	0%	0	0%	0	0%
Total	27	100%	4	100%	11	100%
Monocytes						
0-11%	27	100%	4	100%	11	100%
>11%	0	0%	0	0%	0	0%
Total	27	100%	4	100%	11	100%
Neutrophils						
36-73%	16	59.3%	0	0%	0	0%
>73%	11	40.7%	4	100%	11	100%
Total	27	100%	4	100%	11	100%
Eosinophils						
0-6%	27	100%	4	100%	11	100%
>6%	0	0%	0	0%	0	0%
Total	27	100%	4	100%	11	100%
Basophils						
0-2%	27	100%	4	100%	11	100%
>2%	0	0%	0	0%	0	0%
Total	27	100%	4	100%	11	100%

Based on the results of research on the characteristics of leukocyte profile levels in patients with aterm PRM at RSD dr. Soebandi Jember (table 3) shows that the majority of patients with aterm PRM have normal leukocyte levels (85.2%). Based on the data in the results of research on the characteristics of leukocyte profile levels in patients with aterm PRM at RSD dr. Soebandi Jember (table 3) shows that all respondents with aterm PRM who experienced leukocytosis also experienced lymphocytopenia and neutrophilia. Based on the characteristics of lymphocytes, the majority of patients with aterm PRM had normal lymphocyte levels (59.3%). Based on the characteristics of monocytes, eosinophils, and basophils, all patients with aterm PRM who were respondents in this study had normal levels of monocytes, eosinophils, and basophils. Based on the characteristics of neutrophils, it shows that 59.3% of patients with PRM aterm have normal neutrophil levels. Based on the data in the results of research on the characteristics of leukocyte profile levels in patients with aterm PRM at RSD dr. Soebandi Jember (table 3) shows that the majority of respondents with aterm PRM who experienced neutrophilia also experienced lymphocytopenia (90.9%).

Table 4. Normality Test of Shapiro Wilk Test of Differences in Leukocyte Profile Levels in Patients with Aterm and Preterm PRM in RSD dr. Soebandi Jember

Variable	n	*p-value*
Leukocytes	55	0.000
Lymphocytes	55	0.427
Monocytes	55	0.028
Neutrophils	55	0.066
Eosinophils	55	0.000
Basophils	55	0.000

The results of the normality test using the Shapiro Wilk Test (table 4), show that the significance value for leukocyte profile levels in patients with aterm and preterm PRM in the lymphocyte data group (p-value=0.427) and neutrophils (p-value=0.066) are normally distributed or p-value>0.05 so that the Independent T-Test was performed. Based on the results of the normality test using the Shapiro Wilk Test, the significance value for leukocyte profile levels in patients with aterm and preterm PRM in the leukocyte data group (p-value=0.000), monocytes (p-value=0.028), eosinophils (p-value=0.000) and basophils (p-value=0.000) were not normally distributed or p-value<0.05 so the Mann Whitney test was performed.

Table 5. Independent T-Test of Differences in Leukocyte Profile Levels in Patients with Aterm and Preterm PRM at RSD dr. Soebandi Jember

Group		n	Mean (±SD)	Mean Differences (CI 95%)	*p-value*
Lymphocytes	PRM Preterm	28	16.843 (±5.0386)	0.5466 (-2.5578-3.6509)	0.725
	PRM Aterm	27	16.296 (±6.3840)		
Neutrophils	PRM Preterm	28	76.257 (±6.0589)	0.2571 (-3.5460-4.0603)	0.893
	PRM Aterm	27	76.000 (±7.9130)		

The results of the Independent T-Test (table 5) show that the average lymphocyte count of patients with preterm PRM is higher than that of patients with aterm PRM with a mean difference of 0.5466. Based on the results of the Independent T-test, shows that neutrophil levels have a higher average in patients with preterm PRM compared to aterm PRM with a mean difference of 0.2571. The results of the Independent T-Test obtained the sig value of lymphocytes (p-value=0.725) and neutrophils (p-value=0.893) greater than 0.05, it can be concluded that statistically there is no significant difference in the profile levels of lymphocytes and neutrophils in patients with aterm and preterm PRM.

Table 6. Mann Whitney Test of Differences in Leukocyte Profile Levels in Patients with Aterm and Preterm PRM at RSD dr. Soebandi Jember

Group		n	Mean Rank	*p-value*
Leukosit	PRM Preterm	28	27.96	0.987
	PRM Aterm	27	28.04	
Monosit	PRM Preterm	28	27.11	0.666
	PRM Aterm	27	28.93	
Eosinofil	PRM Preterm	28	27.88	0.949
	PRM Aterm	27	28.13	
Basofil	PRM Preterm	28	27.98	0.979
	PRM Aterm	27	28.02	

Based on the results of the Mann-Whitney statistical test (table 6), it shows that the average ranking of leukocyte, monocyte, eosinophil, and basophil levels in patients with aterm

PRM is higher than in patients with preterm PRM. The results of the Mann-Whitney statistical test showed that the sig value of leukocytes (p-value=0.987), monocytes (p-value=0.666), eosinophils (p-value=0.949), and basophils (p-value=0.979) was greater than 0.05, so it can be concluded that there is no statistically significant difference in the profile levels of leukocytes, monocytes, eosinophils and basophils in patients with aterm and preterm premature rupture of membranes.

DISCUSSION

The majority of patients with preterm (85.7%) and aterm (85.2%) PRM had normal leukocyte levels with a range of 5.7-16.9 x 10^9/L. An increase in leukocytes in pregnancy, especially when entering the third trimester of pregnancy, is common and physiological, but in this study, researchers limited normal leukocyte levels to 16.9 x 10^9/L, so it can be seen that there are 14.3% of patients with preterm PRM and 14.8% of patients with aterm PRM who experience leukocytosis. An increase in the number of leukocytes since the first trimester can be a risk factor in preterm labor (Suryani & Widhiyastuti, 2022). Based on result of this study, shows that all respondents with preterm and aterm PRM who experienced leukocytosis also experienced lymphocytopenia and neutrophilia. In cases of preterm PRM, there was an increase in total leukocytes including an increase in neutrophils (Galaz et al., 2020). In addition, a research also showed that there were significant differences in lymphocyte counts where lymphocyte counts were lower in PRM with infection compared to PRM without infection (Kim et al., 2014). So based on these results can indicate the presence of infection which is characterized by leukocytosis.

The majority of patients with preterm (60.7%) and at term (59.3%) PRM also had normal lymphocyte levels. The results of the analysis in Table 5 show that the average number of lymphocytes of patients with preterm PRM is higher than that of patients with aterm PRM, with a mean difference of 0.5466. An increase in the number of leukocytes, including lymphocytes, has been observed in cases of PRM, although no significant difference was found between aterm PRM and preterm PRM in terms of maternal leukocyte levels (Sulawati & Kurniawati, 2020). All patients with preterm and aterm PRM who were respondents in this study had normal monocyte levels. Amniotic fluid monocytes or macrophages increased in women with preterm PRM (Soucek et al., 2022). In the immune response, several types of leukocytes, namely neutrophils and monocytes, have a role in cell activation by releasing inflammatory mediators such as cytokines related to the inflammatory process in the process of rupture of the amniotic membrane (Telayneh et al., 2023). All patients with preterm and aterm PRM who were respondents in this study also had normal eosinophil levels of 0-6% and normal basophil levels of 0-2%. Eosinophils have a role in allergic reactions because they are often found in tissues with allergic reactions or chronic inflammation. Meanwhile, in general, the number of basophil cells is around 0.5%, so it is very difficult to find in smear preparations (Wahyunindita, 2019).

The majority of patients with aterm PRM had normal neutrophil levels (59.3%). However, the results showed that preterm PRM (64.3%) had neutrophilia. In Table 5, the results of this study show that neutrophil levels show a higher average in patients with preterm PRM compared to aterm PRM with a mean difference of 0.2571. A study shows there is an increase in total leukocytes including an increase in neutrophils (Galaz et al., 2020). Neutrophil activity can be an important factor in the incidence of early rupture of membranes (Oh et al., 2021). In cases of preterm PRM, neutrophils can migrate to infected or inflamed tissue so that they play a role in the infection control process (Soucek et al., 2022). Based on this study showed that the majority of respondents with preterm (61.1%) and aterm (90.9%) PRM who experienced neutrophilia also experienced lymphocytopenia. Based on these results may

indicate an infection. During systemic inflammation, leukocyte subtypes differentiate through immune responses so that there can be an increase in the number of neutrophils and a decrease in the number of lymphocytes. A decrease in lymphocyte count <500/mm³ indicates that the patient is in danger and at risk of infection. Therefore, measures must be taken to protect the patient from infection.

The results of the analysis of this study indicate that there are no significant differences in leukocyte levels (p-value=0.987), lymphocytes (p-value=0.725), monocytes (p-value=0.666), neutrophils (p-value=0.893), eosinophils (p-value=0.949), and basophils (p-value=0.979) in patients with aterm and preterm PRM. The results of this study are in line with the results of previous research at Dr. H. Abdul Moeloek Hospital which states that there are no differences in total leukocyte count levels in patients with aterm and preterm PRM (Wahyunindita, 2019). In addition, research also showed that there was no difference in total leukocyte count levels in patients with aterm and preterm PRM (Pramono et al., 2020). However, the results of this study also showed that the majority of respondents with preterm PRM experienced neutrophilia (64.3%) with neutrophil levels showing a higher average in patients with preterm PRM compared to aterm PRM with a mean difference of 0.2571. There is an increase in total leukocytes including an increase in neutrophils (Galaz et al., 2020). Neutrophils are a major component of the innate immune system that plays an important role in inflammatory and infectious responses (Gimeno-Molina et al., 2022). When there is systemic inflammation, leukocyte subtypes differentiate through the immune response so that there can be an increase in the number of neutrophils.

Neutrophil activity can be an important factor in the incidence of early rupture of membranes (Oh et al., 2021). In cases of preterm PRM, neutrophils can migrate to infected or inflamed tissues and thus play a role in the infection control process (Soucek et al., 2022). Neutrophils and the effects of neutrophil-secreted cytokines in preterm PRM can lead to sustained infection (Esercan & Demir, 2023). In addition, elevated neutrophils may also be associated with an exaggerated immune response to infection which may be associated with further tissue damage (Kumari et al., 2020). Therefore, monitoring neutrophil levels and appropriate further action is essential to reduce the risk of complications (Esercan & Demir, 2023). To manage the risks associated with the presence of neutrophilia in preterm PRM, it is important to closely monitor for signs of infection and inflammation. If there is a possibility of infection, antibiotic treatment can be done to reduce the risk of infection to the fetus (Amadi et al., 2021; Pramono et al., 2020). In addition, the management of labor should be carefully considered (Kumari et al., 2020). Proper and prompt management can help reduce the risk of serious complications.

Another factor that can affect the results of this study is parity, where the majority of research respondents with aterm (60.7%) and preterm (55.6%) PRM are multigravida mothers with a total percentage of 58.2%. A researsh states that gravidity factors are associated with the incidence of PRM in both aterm and preterm PRM (Wardani et al., 2024). Increased parity affects the strength of the membrane in holding amniotic fluid, causing the amniotic membrane to be more prone to rupture before complete opening (Ratika Lelo Yasinta et al., 2025). The risk of multigravida parity is 6 times for PRM, so multigravida parity has a greater risk of PRM (Wardani et al., 2024). Therefore, mothers with a history of multigravida in this study have the possibility of risk factors that are more influential as a cause of PRM in both aterm and preterm PRM.

Another factor that can influence is the mother's occupation. Based on the results of this study, 45 out of 55 total research respondents who had both aterm (85.2%) and preterm (78.6%) PRM worked as housewives (IRT) (81.8%). According to a research, housewives have repetitive work such as cooking, washing, and sweeping so the lack of rest time can lead to

fatigue complaints arising in the form of lower abdominal pain or contractions that can cause incidents of preterm PRM (Sulawati & Kurniawati, 2020).This occurs when the body feels tired there will be an increase in the production of the hormone oxytocin which is a trigger for early contractions. Increasingly frequent contractions will cause the amniotic membrane to no longer be able to hold the pregnancy. Therefore, pregnant women respondents in this study who do excessive activity can be one of the triggers for the increased risk of PRM.

While this study provides valuable insights into the differences in leukocyte profiles between term and preterm PRM, there are several limitations to consider. First, the data was retrospective, relying on medical records, which may not capture all relevant factors, such as detailed patient histories or potential confounding variables. Additionally, the sample size was limited to 55 participants, which may affect the generalizability of the findings. Further, the study was conducted at a single hospital, which may not fully represent broader populations in Indonesia. Lastly, the absence of long-term follow-up data on maternal and neonatal outcomes limits our understanding of how changes in leukocyte profiles might correlate with clinical outcomes over time.

CONCLUSION

This study found no significant differences in leukocyte profiles between term and preterm PRM cases, although increased neutrophil levels were observed in preterm PRM, suggesting a potential link to ongoing infection. The findings highlight the need for continuous monitoring of leukocyte levels in PRM patients, especially in preterm cases, to facilitate early detection of infection and timely intervention. The study also revealed a potential association between occupation and fatigue with the increased risk of PRM, particularly in housewives, which warrants further investigation. Despite these insights, the study's limitations, such as the small sample size and retrospective design, suggest the need for larger, prospective studies to validate these findings and assess the clinical implications for improving maternal and neonatal outcomes in PRM cases.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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