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Analysis Of Factors Associated With The Incidence Of Premature Rupture Of Membranes In Women During Labor

Antik Marjayanti[1✉], Yuni Sulistiawati[2], Nur Alfi Fauziah[3], Iis Tri Utami[4]
[1]Undergraduate Midwifery Student, Midwifery Bachelor's Program, Faculty of Health, Aisyah University of Pringsewu Lampung
[2,3,4]Lecturer of Undergraduate Midwifery, Midwifery Bachelor's Program, Faculty of Health, Aisyah University of Pringsewu Lampung
Email: antikmarjayanti0@gmail.com[1✉]

Abstrak

Ketuban pecah dini atau *Premature rupture of membranes* (PROM) adalah kebocoran cairan ketuban secara spontan sebelum tanda-tanda persalinan muncul. Meskipun penyebab pasti PROM masih belum diketahui, beberapa faktor diduga mempengaruhi terjadinya PROM, termasuk posisi janin, paritas, dan usia ibu. Data RSIA Mutiara Hati Kabupaten Pringsewu pada tahun 2024 menunjukkan 91 kasus PROM (50,0%) terjadi dari 724 persalinan. Penelitian ini bertujuan untuk menganalisis faktor-faktor yang berhubungan dengan ketuban pecah dini. Penelitian analitik ini menggunakan desain *case-control* dengan subjek 91 orang perempuan. Pengambilan sampel dilakukan secara sengaja untuk kelompok kasus, dan untuk kelompok kontrol, teknik yang berbeda diterapkan. Variabel dalam penelitian ini meliputi posisi janin, paritas, dan usia. Analisis data dilakukan dengan metode univariat dan bivariat dengan uji statistik *Chi-square*. Hasil penelitian menunjukkan PROM terjadi pada 91 responden (50,0%). Paritas menjadi faktor risiko sebanyak 19 responden (10,4%), sedangkan usia menjadi faktor risiko sebanyak 35 responden (19,2%). Selain itu, 58 responden (31,9%) memiliki hubungan posisi janin dengan risiko. Terdapat hubungan yang bermakna antara paritas dan umur dengan kejadian PROM. Disarankan agar ibu hamil rutin melakukan pemeriksaan kehamilan untuk mengantisipasi komplikasi kehamilan, termasuk PROM.

Kata Kunci: *Ketuban Pecah Dini, Posisi Janin, Paritas, Usia Ibu*

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Abstract

Premature rupture of membranes (PROM) is the spontaneous leakage of amniotic fluid before any signs of labor. While the exact cause of PROM is still unknown, several factors are thought to influence its occurrence, including fetal position, parity, and maternal age. Data from RSIA Mutiara Hati, Pringsewu Regency, in 2024 showed that 91 cases of PROM (50.0%) occurred out of 724 deliveries. This study aims to analyze the factors associated with premature rupture of membranes. This analytical research used a case-control design with 91 women as subjects. Sampling was purposive for the case group, and for the control group, a different technique was applied. The variables in this study included fetal position, parity, and age. Data analysis was conducted using univariate and bivariate methods with the Chi-square statistical test.The results showed that PROM occurred in 91 respondents (50.0%). Parity was a risk factor in 19 respondents (10.4%), while age was a risk factor in 35 respondents (19.2%). Additionally, 58 respondents (31.9%) had a fetal position associated with risk. There was a significant relationship between parity and age with the incidence of PROM. It is recommended that pregnant women regularly attend prenatal check-ups to anticipate pregnancy complications, including PROM.
Keywords: *Premature Rupture of Membranes, Fetal Position, Parity, Maternal Age*

INTRODUCTION

Premature Rupture of Membranes (PROM) is the condition where the amniotic sac ruptures before labor, and labor does not begin within one hour after the rupture. PROM can occur in both full-term and preterm pregnancies. This condition increases the risk for both mother and baby, making it one of the emergency complications during pregnancy and childbirth (Kennedy et al., 2021). According to the World Health Organization (WHO) in 2021, 12.3% of global deliveries are complicated by PROM (WHO, 2021). In developing countries, cases of PROM-related deliveries are reported as 179,000 in Africa, 69,000 in South Asia, and 16,000 in Southeast Asia (ASEAN, 2021). In Indonesia, the Basic Health Research (Riskesdas) 2021 recorded a 5.6% incidence rate of PROM among all pregnant women and those giving birth (Riskesdas, 2021).

The causes of maternal deaths in Lampung Province in 2020 include hemorrhage with 44 cases (38.26%), hypertension with 24 cases (20.86%), infection with 2 cases (1.73%), circulatory system disorders with 9 cases (7.82%), metabolic disorders with 1 case (0.86%), and other causes with 35 cases (30.43%) (Provincial Health Profile, 2020). The exact cause of PROM is still unknown, but potential predisposing factors include infections, abnormal amniotic membranes, cervical incompetence, fetal malposition, maternal age under 20 or over 35, blood type, multigravidity/parity, smoking, socioeconomic factors, antepartum hemorrhage, previous history of abortions and preterm deliveries, prior PROM, nutritional deficiencies, uterine tension, narrow pelvis, maternal exhaustion, and trauma such as from

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internal examinations and amniocentesis (Tahir & Suriani, 2012).

One of the most common impacts of PROM before 37 weeks of pregnancy is respiratory distress syndrome (RDS), which occurs in 10-40% of newborns. The risks of infection, prematurity, asphyxia, hypoxia, umbilical cord prolapse, congenital disabilities, and pulmonary hypoplasia in full-term pregnancies also increase. Almost all cases of PROM in preterm pregnancies result in labor occurring within one week of the rupture. Approximately 85% of perinatal morbidity and mortality in these cases is caused by prematurity due to PROM (Nur, 2018).

Data from Pringsewu District Hospital shows that out of 899 respondents, 714 (79.5%) did not experience PROM, while 185 (20.5%) did (Yona, 2020). At Mutiara Hati Hospital, Pringsewu Regency, there were 79 cases of PROM (10.74%) out of 732 deliveries in 2021. In 2022, the incidence increased to 85 cases (12.00%) out of 708 deliveries, and in 2023, the number rose to 104 cases (14.36%) out of 724 deliveries (Medical Records, 2024). Based on the background above, the author is interested in conducting a study on the factors associated with PROM at Mutiara Hati Hospital, Pringsewu Regency

RESEARCH METHOD

This study uses a quantitative research design with an observational analytic approach and a case-control study method aimed at identifying factors associated with premature rupture of membranes (PROM) at Mutiara Hati Hospital, Pringsewu Regency, in July-August 2024. The population includes all mothers who gave birth at the hospital in 2023, with a sample of 182 participants, consisting of 91 PROM cases and 91 controls, selected using purposive sampling. The independent variables in this study are maternal age, parity, and fetal position, while the dependent variable is PROM. Data collection involved reviewing medical records and using observation checklists, with analysis conducted using SPSS. Univariate and bivariate analyses were performed, and a chi-square test was used to assess the relationship between variables, with a significance level of 0.05. The odds ratio (OR) was calculated to determine the strength of the association between the dependent and independent variables.

RESULTS AND DISCUSSION

Table 1 presents the frequency distribution of the incidence of premature rupture of membranes (PROM) at Mutiara Hati Hospital in Pringsewu Regency for the year 2024. Among the total sample of 182 mothers, 50% (91) experienced no PROM, while the other 50% (91) did experience PROM. The analysis of fetal position revealed that 54.4% (99) of the

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mothers were classified as not at risk, while 45.6% (83) were at risk. In terms of parity, 73.6% (134) of the mothers were categorized as not at risk, compared to 26.4% (48) who were at risk. Additionally, regarding maternal age, 68.1% (124) were considered not at risk, while 31.9% (58) fell into the at-risk category. These findings highlight a balanced incidence of PROM among the participants, with a majority being classified as not at risk across all examined characteristics.

Table 1 Frequency distribution of the incidence of premature rupture of membranes at Mutiara Hati Hospital, Pringsewu Regency, in 2024.

Characteristics	F	(%)
Incidence of PROM		
No PROM	91	50,0
PROM	91	50,0
Fetal Position		
Not at Risk	99	54,4
At Risk	83	45,6
Parity		
Not at Risk	134	73,6
At Risk	48	26,4
Age		
Not at Risk	124	68,1
At Risk	58	31,9
Total	182	100.0

Source: Primary Data

Table 2. The Relationship Between Fetal Position and Premature Rupture of Membranes at Mutiara Hati Hospital, Pringsewu Regency, in 2024

Fetal Position	Incidence of PROM				N	p-value	OR 95% CI
	No PROM		PROM				
	n	%	n	%			
Not at Risk	66	36,3	33	18,1	99	0,000	4,640
At Risk	25	13,7	58	31,9	83		
Total	91	50,0	91	50,0	182		

Source: Primary Data

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Table 2 indicates a significant relationship between fetal position and the incidence of premature rupture of membranes (PROM) at Mutiara Hati Hospital, Pringsewu Regency, in 2024. The table shows that among the "Not at Risk" fetal position group, there are 66 mothers who did not experience PROM (36.3%) and 33 mothers who did (18.1%). In contrast, in the "At Risk" group, 25 mothers did not experience PROM (13.7%) while 58 mothers did (31.9%). Statistical analysis reveals a p-value of 0.000, indicating a highly significant relationship, with an odds ratio (OR) of 4.640 and a 95% confidence interval (CI). This suggests that a risky fetal position increases the likelihood of PROM occurrence by more than four times compared to a non-risky position.

Table 3 The relationship between parity and premature rupture of membranes at Mutiara Hati Hospital, Pringsewu Regency, in 2024

Parity	Incidence of PROM				N	p-value	OR 95% CI
	No PROM		PROM				
	n	%	n	%			
Not at Risk	62	34,1	72	39,6	134	0,093	0,564
At Risk	29	15,9	19	10,4	48		
Total	91	50,0	91	50,0	182		

Source: Primary Data

Table 4. The relationship between age and premature rupture of membranes at Mutiara Hati Hospital, Pringsewu Regency, in 2024.

Age	Incidence of PROM				N	ρ – value	OR 95% CI
	No PROM		PROM				
	n	%	n	%			
Not at Risk	68	37,4	56	30,8	124	0,056	1,848
At Risk	23	12,6	35	19,2	58		
Total	91	50,0	91	50,0	182		

Source: Primary Data

Table 3 indicates the relationship between parity and the incidence of premature rupture of membranes (PROM) at Mutiara Hati Hospital in Pringsewu Regency for the year 2024. Among the participants, 134 were categorized as "Not at Risk," with 62 (34.1%) experiencing no PROM and 72 (39.6%) having PROM. In contrast, within the "At Risk"

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category, 29 (15.9%) had no PROM, while 19 (10.4%) experienced PROM. The p-value of 0.093 suggests that the relationship between parity and PROM is not statistically significant at the 0.05 level. This indicates that parity may not be a strong risk factor for PROM in this population. Additionally, the odds ratio (OR) of 0.564, along with the 95% confidence interval (CI), further supports this finding by suggesting that parity does not significantly influence the likelihood of experiencing PROM.

Based on Table 4, among the 58 respondents categorized as at risk due to age, 35 individuals (19.2%) experienced premature rupture of membranes (PROM). In comparison, 56 out of 124 respondents (30.8%) in the not-at-risk category also encountered PROM. The statistical test yielded a p-value of 0.056, indicating that $p < \alpha = 0.05$, which means that the null hypothesis (Ho) is accepted. This suggests that there is a significant relationship between age and the occurrence of PROM in postpartum women at Mutiara Hati Hospital. The odds ratio (OR) of 1.848 indicates that respondents in the at-risk age category are 1.848 times more likely to experience PROM compared to those in the not-at-risk age category.

Fetal Position and the Incidence of Premature Rupture of Membranes (PROM)

Based on the research findings, among the 91 respondents, 33 (18.1%) were found to have a non-risk fetal position, while 58 (31.9%) had a risk fetal position. The statistical analysis revealed a p-value of 0.000, indicating $p < \alpha = 0.05$, which suggests a significant relationship between fetal position and the incidence of PROM at RSIA Mutiara Hati in Pringsewu Regency in 2024. With an odds ratio (OR) of 4.640, this indicates that respondents with a non-risk fetal position are four times less likely to experience PROM compared to those with a risk fetal position.

According to Manuaba (2013), premature rupture of membranes (PROM) is defined as the rupture of the amniotic sac before the onset of labor or before any signs of labor appear. If no labor occurs within an hour of rupture, it is considered PROM. The time interval from membrane rupture until uterine contractions begin is referred to as the "latent period" of PROM.

Malposition or malpresentation refers to an abnormal position of the fetal vertex (with the small fontanelle as a marker) concerning the mother's pelvis. Malpresentation includes any presentation of the fetus other than vertex presentation (Saifuddin, 2010). Approximately 2-3% of babies are in this position at birth. Nugroho (2012) notes that one of the factors contributing to PROM is positional abnormalities. This occurs when the fetal position in the uterus does not align with the birth canal, such as in breech or transverse presentations, which prevent the lowest part of the fetus from covering the pelvic inlet,

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thereby reducing pressure on the lower membranes. In a transverse position, the amniotic sac can rupture immediately after the onset of contractions because the entire force of the contraction is transmitted directly to the fluid ahead.

Widia's study (2017) examined the relationship between fetal positional abnormalities and the incidence of PROM in parturient women. The results showed that out of 50 respondents who experienced PROM, 23.8% had fetal positional abnormalities. The chi-square test yielded a p-value of 0.003, indicating a strong correlation between fetal abnormalities and PROM among mothers at Paradise Hospital in Tanah Bambu Regency. This underscores the important role of midwives in promoting health to reduce the incidence of PROM .

The study found that among the 91 respondents who did not experience PROM , 66 (36.3%) had a non-risk fetal position, while 25 (13.7%) had a risk position. Among the 91 respondents with PROM , 33 (18.1%) had a non-risk fetal position, and 58 (31.9%) had a risk position. Fetal position is a significant contributing factor to PROM ; of the 91 respondents who experienced PROM , 58 (31.9%) had a risk position. Risky fetal positions include multiple births, breech presentation, transverse lie, and others.

Breech presentation occurs when the fetus is in a longitudinal position with the head at the fundus and the lowest part being the buttocks. A transverse lie occurs when the mother's longitudinal axis forms a right angle with the fetus's longitudinal axis, often resulting in the shoulders being positioned above the pelvic inlet, a condition referred to as shoulder presentation. Parturient women with positional abnormalities are highly susceptible to PROM . The number of mothers with positional abnormalities experiencing PROM is significant, estimated at 104 (Oxorn, 2010). Sujiyatini (2010) explains that positional abnormalities often complicate labor because the fetal position in the uterus may not align correctly with the birth canal, causing irregularities in the lowest fetal part covering the pelvic inlet, thus reducing pressure on the lower membranes. Consequently, the lowest part of the amniotic sac is directly exposed to dominant intrauterine pressure, which may result in PROM .

A pregnant woman with fetal positional abnormalities may cause an uneven surface with the lowest presentation at the pelvic inlet, leading to excessive stretching of the uterus. This excessive stretching can result in premature rupture of the membranes before labor begins. Intensive monitoring during pregnancy is essential to detect potential pregnancy risks. If intensive examinations are performed by doctors using ultrasound, they can help diagnose fetal positional abnormalities promptly, allowing for timely interventions to manage any emergencies during labor effectively.

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In the researcher's opinion, as healthcare professionals, efforts to prevent PROM and its potential impacts should begin during pregnancy by conducting regular antenatal examinations at healthcare facilities. This enables the early detection of risk factors for PROM and any potential complications. Antenatal examinations must adhere to established standards, and regular pregnancy checks should identify positional abnormalities through abdominal assessments or ultrasound. Additionally, planning and limiting the number of pregnancies using contraceptive methods, consuming a balanced diet according to the needs of pregnant mothers, maintaining cleanliness, especially of the birth canal, and actively participating in prenatal classes or exercises are vital.

Overall, aspects such as parity and positional abnormalities have proven to correlate with PROM incidence, where increased parity and positional abnormalities contribute to a higher occurrence of PROM. However, it is essential to acknowledge that other factors can also lead to PROM. This situation warrants special attention from midwives, who serve as the frontline healthcare providers for mothers and infants, considering the risks involved for both the mother and fetus in cases of PROM. Healthcare providers must follow proper management procedures for PROM cases, ensuring they act within their authority and detect PROM as early as possible to safeguard the health of the mother and the well-being of the fetus.

Parity and Premature Rupture of Membranes (PROM)

The statistical test results show a p-value of 0.093, indicating that $p < \alpha = 0.05$. This suggests that there is a significant relationship between parity and the occurrence of Premature Rupture of Membranes (PROM) at RSIA Mutiara Hati, Pringsewu District, in 2024. The odds ratio (OR) is 0.564, meaning respondents with non-risk parity have a one-time lower risk of experiencing PROM compared to mothers with risk parity. According to Manuaba (2013), premature rupture of membranes (PROM) occurs when the membranes break before labor begins or before the onset of labor signs and if no labor signs have started after an hour. The time from membrane rupture to the onset of uterine contractions is referred to as the "latency period of premature rupture of membranes."

Parity is defined as the number of fetuses weighing more than 500 grams that have been born, whether alive or stillborn. If the birth weight is unknown, the gestational age of more than 24 weeks is used. Parity can be categorized into primipara, multipara, and grand multipara (Winkjosastro, 2007; Oxford, 2010; Manuaba, 2013; Saifuddin, 2014). Firdhausya's (2015) study titled "The Relationship Between Parity Status and the Incidence of Premature Rupture of Membranes in Mothers Giving Birth at RSUD Penebangan Senopati, Bantul"

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revealed that among mothers not experiencing PROM, 147 were primipara (57.8%) and 62 were multipara (42.2%). In contrast, 19 mothers who experienced PROM included 13 primiparas (68.4%) and 6 multiparas (31.6%). The chi-square test results showed a value of x^2 = 0.377 (alpha > 0.05), indicating no relationship between parity status and the occurrence of PROM at RSUD Penembahan Senopati Bantul in 2015.

Parity is related to the incidence of PROM (p = 0.007), which is consistent with the theory that multipara and grand multipara conditions increase the risk of PROM . Multiparity can lead to intrinsic weakness of the uterus due to cervical trauma from previous vaginal deliveries, which in turn increases uterine motility, causes abdominal hanging, and reduces cervical elasticity. This can result in early cervical dilation, ultimately leading to PROM. In multigravida and grand multipara, cervical tissues contain more nerve fibers than connective tissue, and damage to cervical tissue allows the base muscles of the uterus to stretch (Cunningham, 2012).

The researcher believes that this may be due to women who have given birth multiple times not achieving optimal reproductive function. Frequent childbirth can weaken the uterine muscles, making them lax and potentially leading to PROM, which is generally caused by uterine contractions and repetitive stretching. From the study involving 91 respondents who did not experience PROM, 62 (34.1%) had non-risk parity, while 29 (15.9%) had risk parity. Among the 91 respondents with PROM, 72 (39.6%) had non-risk parity, and 19 (10.4%) had risk parity.

The results indicate that in cases of PROM, there are more instances of risk parity compared to non-risk parity. In this study, a parity of less than three is considered relatively safer for pregnancy and childbirth. The data suggest that mothers who give birth more than three times are at higher risk of complications, such as PROM, which can negatively impact both the mother and baby during delivery. If PROM is not managed correctly, it can lead to infections due to the ruptured membranes.

Primipara should ideally not be vulnerable to PROM as they have not undergone the childbirth process or experienced uterine stretching; the vascularization and connective tissue in the membranes are still intact. However, many primiparas at RSUD Tegurejo Semarang experience PROM, likely due to the mothers' psychological conditions, such as stress and anxiety during pregnancy. When a mother is anxious, the amygdala in the brain sends signals to the hypothalamus, which produces CRH (corticotropin-releasing hormone), stimulating the production of ACTH (Adrenocorticotropic hormone) in the anterior pituitary. ACTH then signals the adrenal glands to release cortisol, increasing stress levels.

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Elevated cortisol production suppresses the immune system, making mothers more susceptible to infections or inflammation. Infections and inflammation can increase IL-1 activity and prostaglandins, leading to collagenase production, which causes collagen depolymerization in the chorion/amnion membranes. This weakens the membranes, making them thin and prone to spontaneous rupture, resulting in PROM (Lowdermik, 2004). Mechanical stretching can trigger various factors in the membranes, such as prostaglandin E2 (PGE2) and interleukin-8 (IL-8). Additionally, stretching can stimulate MMP-1 activity on interleukin-8 membranes, which is chemotactic for neutrophils and promotes collagenase activity, disrupting the balance between extracellular matrix synthesis and degradation and ultimately leading to membrane rupture (Cunningham, 2012).

The researcher believes that parity significantly influences the occurrence of premature membrane rupture. The higher the parity risk, the lower the parity risk, leading to a reduced incidence of premature membrane rupture. Thus, health professionals play a crucial role in counseling pregnant women about the importance of antenatal care and encouraging regular check-ups to detect complications early. Additionally, counseling for mothers with high parity about postpartum family planning is essential to prevent future occurrences of PROM.

Age and the Incidence of Premature Rupture of Membranes (PROM)

The statistical test results imply a significant relationship between age and the occurrence of PROM at RSIA Mutiara Hati in Pringsewu Regency in 2024. The odds ratio (OR) of 1.848 means that respondents in the non-risk age group have a one-fold risk of not experiencing PROM compared to mothers in the at-risk age group. According to theory, PROM, often referred to as premature rupture of membranes before labor (KPSW), is defined as the rupture of amniotic membranes prior to delivery. This rupture can occur before the onset of labor, with dilation in primiparas being less than 3 cm and in multiparas less than 5 cm. PROM can happen in both term and preterm pregnancies, increasing the risk of infection for both mother and child. PROM poses significant obstetric concerns, potentially leading to maternal and neonatal infections, and can elevate morbidity and mortality rates for both (Rohmawati, 2018).

The researcher posits that PROM can occur in pregnancies among women younger than 20 or older than 35. Women under 20 often delay pregnancy due to underdeveloped reproductive organs, making them less capable of supporting the fetus adequately. This can result in weaker, thinner amniotic membranes that are more prone to premature rupture. Identifying and managing patients with predispositions to PROM at the earliest opportunity

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is crucial, alongside enhancing preventive measures by healthcare professionals. Effective communication, information dissemination, and education can encourage mothers to attend regular prenatal check-ups to detect complications early.

The study showed that among 91 respondents without PROM, 68 (37.4%) were in the non-risk age category, while 23 (12.6%) were in the at-risk age group. Among 94 respondents with PROM, 56 (30.8%) were in the non-risk category and 35 (19.2%) were at-risk. Research by Panjahitan et al. (2018) found a correlation between maternal age, parity, and PROM at Martha Friska Hospital, indicating that cervical incompetence is more common in mothers aged 20 to 35. Cervical incompetence refers to the loss of flexibility in the cervix, which can result from repeated pregnancies or prior curettage (Prawiroharjo, 2016).

Sutomo (2018) noted that mothers under 27 have a higher potential for experiencing PROM compared to those over 27. This may be attributed to younger mothers' higher sexual drive, which can lead to neglecting their pregnancy status, resulting in premature membrane rupture. The findings indicate that various factors related to age contribute to the incidence of PROM, including uterine maturity in younger mothers and functional decline in older mothers. Additionally, uterine strength correlates with reproductive maturity and the care taken during sexual relations during pregnancy. Safe sexual practices are essential to minimize risks, including PROM

CONCLUSION

Based on the research findings, premature rupture of membranes (PROM) occurred quite frequently among the respondents. There is a significant relationship between fetal position, parity, and maternal age with the risk of PROM. An abnormal fetal position is linked to PROM, although it has a lower impact compared to other factors. Risky parity, especially in mothers who have given birth more than once, has a significantly higher likelihood of PROM. Maternal age is also an important factor, with mothers under 20 or over 35 being more susceptible to PROM compared to those within the safe reproductive age range. This shows that pregnancy conditions can be greatly influenced by age, parity, and fetal position, requiring increased attention to prevent pregnancy complications such as PROM.

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