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Unexpected Risk Factors of Premature Rupture of Membranes in Independent Midwife Practice: A Contradiction to Existing Theory

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ABSTRACT

The incidence of premature rupture of membranes (PROM) is still one of the critical problems in obstetrics that increases maternal and neonatal morbidity and mortality. This study aims to investigate the relationship between anemia, parity, and chronic energy deficiency (CED) and the incidence of premature rupture of membranes (PROM) in the Independent Midwife Practice (PMB) setting at the Sukarame Health Center area, Bandar Lampung City. The study design used was cross-sectional. The subjects were 137 mothers giving birth in the PMB area of Sukarame Health Center, Bandar Lampung City in 2024. Data collection was carried out using primary data from interviews with mothers giving birth in PMB in the Sukarame Health Center area, Bandar Lampung City. Data analysis used univariate and bivariate data analysis with the Chi-Square test. The results showed that there was no significant relationship between parity and premature rupture of membranes (p-value: 0.637). However, there were significant relationships between anemia (p-value: 0.017) and CED (p-value: 0.029) and PROM in PMB. Interestingly, the results showed that PROM was more common in mothers without anemia and without CED. Although anemia and CED are conventionally considered risk factors for PROM, this study found a higher incidence of PROM among mothers without anemia and without CED. Therefore, antenatal care should not only focus on preventing anemia and CED but also on identifying other hidden risk factors such as infections, stress, and physical strain, even in seemingly healthy pregnancies.

INTRODUCTION

Premature rupture of membranes (PROM) is a problem important in problem obstetrics, which can also cause infection in mother and baby as well as increase morbidity and mortality in mothers and babies. PROM is the rupture of membrane amniotic fluid before it is time to give birth, where in primiparas, it is less than 3 cm, and in multiparas, it is less than 5 cm. PROM can occur in pregnancy aterm as well as in preterm pregnancy (Astuti, 2023).

Anemia is when the body's hemoglobin (Hb) concentration decreases below normal limits. Low hemoglobin levels increase the risk of pregnant women suffering from infection. Nutritional deficiency can influence the body's response to infection and strengthen membrane and structural collagen, which can cause amniotic fluid to break early (Hidayat et al., 2020). Apart from anemia, another factor that can cause PROM is parity. Women who have given birth several times more frequently experience premature rupture of membranes. This is because amniotic fluid, a type of membranous connective tissue, is fragile. After all, vascularization in the uterus is experiencing disturbances that result in the membrane amniotic fluid experience being broken spontaneously (Puspitasari et al., 2023).

A pregnant woman who experiences Chronic Energy Deficiency (CED) will affect her health condition. Another potential impact is the disturbance of the fetus's growth in the womb. During pregnancy, CED can become triggered by the emergence of several cases, one of which is an amniotic fluid broken early (Roberts, 2018). Chronic energy deficiency in the pregnant mother

can contribute to the risk of complications of pregnancy, including premature rupture of membranes. A lack of adequate energy and nutrition can result in the mother becoming fatigued, as well as the occurrence of dilation on the cervix, which causes the membranes to thin and easily rupture, allowing amniotic fluid to break (Rosyidah & Rafhani, 2022). Iron deficiency increases oxidative damage to erythrocytes and fetoplacental units. It can also increase the risk of maternal infection, leading to premature membrane rupture (Dewi et al., 2020).

Cunningham's theory (2010) states that parity one and parity more than three are at higher risk of premature rupture of membranes. In parity one, the pelvic floor tools are still stiff compared to multiparity. The uterus that has given birth to many children tends to work inefficiently in labor due to decreased reproductive function (Fahimah, 2020). Based on Natsir's research (2019) entitled The Relationship between parity and anemia with the incidence of premature rupture of membranes (PROM) in mothers giving birth at Panembahan Senopati Bantul Hospital with a case-control method by random sampling using bivariate analysis, namely chi-square, the p-value was obtained at 0.011 and 0.001 (p-value <0.05) OR 2,765 and 0.286, and there is a significant relationship between parity and anemia with premature rupture of membranes (PROM) at Panembahan Senopati Bantul Hospital. Furthermore, research by Novitasari et al. (2017) stated that CED during pregnancy causes the mother to become tired quickly and inadequately, and there is more dilation in the cervix, resulting in thin and easily ruptured amniotic membranes, so there is a relationship between CED and PROM. One of the indirect causes of maternal mortality in Indonesia is the occurrence of premature rupture of membranes. The incidence of PROM globally reaches 12.3% of the total number of deliveries, all spread across developing countries in Southeast Asia, including Indonesia, Malaysia, Thailand, Myanmar, and Laos. In Indonesia, the number of premature ruptures of membranes in 2020 was 17,665 people (Fatimah et al., 2023).

The prevalence of premature rupture of membranes in Indonesia (2018) was 5.6% and can occur in preterm or aterm pregnancies. As many as 84.43% of PROM occurred at a gestational age of ≥37 weeks (term), while at preterm age, it was only 15.57%. The province with the highest incidence of PROM was DI Yogyakarta, at 10.1%, and the lowest incidence of PROM was in the South Sumatra province, at 2.6% (Ilawati, 2021). In Lampung Province, based on Basic Health Research, the prevalence of premature rupture of membranes was 4.2% spread across all regencies and cities. This incident is still one of the important problems in obstetrics that increases maternal and neonatal morbidity and mortality (Sefin, 2022). Researchers are interested in exploring the relationship between anemia, parity, chronic energy deficiency, and the incidence of premature rupture of membranes.

METHOD

The design research used is cross-sectional. This study examines the relationship between anemia, parity, and CED and the incidence of premature rupture of membranes (PROM) in the PMB work area of Health Center Sukarame, Bandar Lampung. The subjects of this study were 137 mothers giving birth in the PMB area of Sukarame Health Center, Bandar Lampung City. Data collection in this study was carried out using primary data from interviews with mothers giving birth in PMB in the Sukarame Health Center area, Bandar Lampung City.

Data collection starts with management's permission to conduct research. Next, the researcher requests agreement from the client using informed consent and then automatically collects data directly from the client. The researcher recorded data using a fill-in sheet checklist, filling in the required information based on the interview results. The data was analyzed using univariate and bivariate data analysis with the Chi-Square test. This study has received ethical clearance from the Ethics Committee of Health Research, Poltekkes Kemenkes Tanjung Karang, with the number 481/KEPK-TJK/VII/2024.

RESULTS

Based on Table 1, it can be seen that of 137 respondents, as many as 115 (83.9%) respondents with incident no PROM, as many as 84 (61.3%) respondents with primigravida parity, as many as 84 (61.3%) respondents with not anemia, and as many as 132 (96.4%) respondents No CED.

Table 1. Distribution frequency incident premature rupture membranes, parity, anemia, and the occurrence of CED in mothers giving birth

Variables	Category	n	%
PROM Incident	PROM	22	16.1
	No PROM	115	83.9
Parity	Primigravida	84	61.3
	Multigravida	53	38.7
Anemia	Anemia	53	38.7
	No anemia	84	61.3
CED	CED	5	3.6
	No CED	132	96.4

Table 2 shows 84 respondents with primigravida parity, 12 (14.3%) PROM incidents, and 72 (85.7%) incidents with no PROM. Of the 53 respondents with parity at risk, 10 (18.9%) had PROM, and 43 (81.1%) had no PROM. The statistical test results obtained a p-value of 0.637, p>α=0.05. It can be concluded that there is no meaningful relationship between parity and PROM incidents in PMB work areas at the Health Center in Sukarame, Bandar Lampung, in 2024.

It is observed that among 53 respondents with no anemia, 14 (26.4%) had PROM, and 39 (73.6%) had no PROM incidents. Of the 84 respondents with anemia, 8 (9.5%) did not have PROM, and 76 (90.5%) had PROM incidents. Statistical test results obtained a p-value of 0.017, p<α=0.05. It can be concluded that there is a meaningful relationship between parity and PROM incidents in PMB work areas at the Health Center in Sukarame, Bandar Lampung, in 2024. An OR value of 3.4 means non-anemic respondents have a 3.4 times risk for PROM occurring compared to an anemic mother.

Based on the table, it can be seen that among the 5 respondents with CED, there were 3 (60.0%) PROMs and 2 (40.0%) incidents with no PROM. Of 132 respondents with no CED, 19 (14.4%) have PROM, and 113 (85.6%) have no PROM. Statistical test results obtained a p-value of 0.029, p<α=0.05. It can be concluded that there is a meaningful relationship between CED and PROM incidents in PMB work areas at the Health Center in Sukarame, Bandar Lampung, in 2024. With an OR value of 8.9, respondents who do not have CED have 8.9 times the risk of PROM occurring compared to those with CED mothers.

Table 2. Relationships parity, anemia, and CED with incident premature rupture OF membranes

Variables	PROM Incident				n	%	p-value	OR 95% CI
	PROM		No PROM					
	n	%	n	%				
Parity								
Primigravida	12	14.3	72	85.7	84	100.0	0.637	0.717
Multigravida	10	18.9	43	81.1	53	100.0		0.286
Anemia								
No anemia	14	26.4	39	73.6	53	100.0	0.017	3,410
Anemia	8	9.5	76	90.5	84	100.0		1,318
CED								
CED	3	60.0	2	40.0	5	100.0	0.029	8,921
No CED	19	14.4	113	85.6	132	100.0		1,397

DISCUSSION

Parity relationship with PROM incident

The statistical test results showed no significant relationship between parity and the incidence of PROM in the PMB in the Sukarame Health Center working area of Bandar Lampung City in 2024. In line with Puspitasari research (2023), the chi-square statistical test showed no relationship between parity and the incidence of premature rupture of membranes. Rahayu's research (2019) found no relationship between parity and the incidence of premature rupture of membranes with a p-value>0.05.

Comparison between primigravida and multigravida parity in research results shows that the percentage of PROM incidents in primigravida (pregnant mothers for the first time) and multigravida (mothers with more than one birth) is not significantly different. The statistical test results showed that although There is a difference in the number of PROM incidents between the second group parity, the difference is not significant enough in a way that statistics state that parity relates directly to PROM incidents.

The occurrence of PROM is influenced by various factors beyond parity, including the mother's age, health status, nutritional status, history of disease, genetic factors, and socio-economic factors. Therefore, although parity can become a risk factor, other factors not controlled in the study may influence the occurrence of PROM. For example, mothers with multigravida are not always at risk of experiencing PROM if they have good health, access to services, adequate health, and a supportive environment.

Although there was a difference in the incidence of PROM between primigravida and multigravida groups, the sample used in this study was relatively small, which could reduce the statistical power needed to detect a more significant relationship. The parity factor may not have a significant impact on the incidence of PROM compared to other more dominant factors. For example, maternal health, provision of antenatal care, or high-risk pregnancy are more influential than parity.

A limitation of the research design is the use of a cross-sectional design, which only measures the incidence of PROM at a particular time. As a result, the results may be influenced by time factors and long-term influences that have not been adequately accounted for. Other uncontrolled factors outside of parity can be more substantial causal variables in the incidence of PROM. The researcher's assumption based on this study's results is that although parity can be considered one of the factors that potentially influence the incidence of PROM, its influence is not statistically significant enough in the population studied at the Sukarame Health Center. This means that parity may not be the main factor that needs to be focused on in efforts to prevent PROM in the area. Further research is needed with a larger sample or a more in-depth research design that considers other relevant factors to understand the leading causes of PROM better. Although parity does not show a significant relationship, other factors such as maternal health, nutritional status, medical history, good pregnancy monitoring, and stress levels may be more influential factors in the incidence of PROM.

The relationship between anemia and premature rupture of membranes

The statistical test results showed a significant relationship between anemia and the incidence of PROM in the PMB in the Sukarame Health Center work area of Bandar Lampung City in 2024. Respondents who are not anemic have a 7.4 times risk of experiencing PROM compared to mothers who are anemic. The theory from Manuaba (2019) states that anemia during pregnancy causes pregnant women to be less able to deal with blood loss and makes them susceptible to infection. Anemia also causes fetal hypoxia and premature labor, which are dangerous for the mother and fetus. The presence of anemia will prevent the fetus from absorbing various nutrients from its mother, and the body's metabolic ability will be reduced so that the growth and development of the fetus in the womb will be disrupted.

In line with Natsir's research (2019), there is a significant relationship between anemia and premature rupture of membranes (PROM) at Panembahan Senopati Bantul Regional Hospital. Researchers indicate that anemia in pregnant women is associated with a higher likelihood of PROM in their births. Mothers who are anemic tend to have a lower risk of PROM than mothers who are not anemic. This may seem contrary to common assumptions because anemia is often considered a risk factor for pregnancy complications, including PROM.

Most national and international literature indicates that the incidence of Premature Rupture of Membranes (PROM) is higher among pregnant women with anemia compared to those without. Mahjabeen et al. (2021), in the European Journal of Medical and Health Sciences, reported that the prevalence of PROM among anemic pregnant women reached 64%, while it was only 35% among non-anemic women. Statistically, the risk of PROM was significantly higher in the anemic group. Similar findings were supported by a meta-analysis conducted by Wang et al. (2025), which showed that anemia during pregnancy nearly doubled the risk of PROM (RR = 1.94; 95% CI = 1.26–3.00). A study in Egypt further confirmed this association, concluding that anemic pregnant women had a threefold increased risk of PROM compared to non-anemic counterparts (Omar et al., 2024).

However, it is important to note that PROM is a multifactorial condition resulting from the interplay of various contributing factors. These include maternal age, socio-economic status, strenuous physical activity, nutritional status, reproductive tract infections, and obstetric history. Therefore, in specific populations, non-anemic pregnant women may still experience PROM, particularly when other risk factors are more dominant. This multifactorial nature explains why, in some studies, the incidence of PROM among non-anemic women may be comparable to or even exceed that of anemic women. Scientific publications explicitly reporting a higher incidence of PROM in non-anemic women are exceedingly rare. Consequently, if a study yields such a finding, it may represent a novel result that deviates from the majority of existing literature. Such findings warrant further investigation through comprehensive research that accounts for various risk factors and considers population-specific and contextual differences.

According to the researchers, further investigation may be possible, as these results may be influenced by other factors, such as nutritional status, antenatal care, or other medical conditions that affect both anemia and the incidence of PROM. Researchers may need to explore further the reasons why mothers who are not anemic are more susceptible to PROM. It could be that mothers with anemia are more likely to receive medical attention or more intensive treatment, such as iron supplementation, which can reduce the risk of pregnancy complications. Although these results indicate that mothers who are not anemic are at higher risk of experiencing PROM, anemia management remains important in maternal health programs because anemia is associated with various other complications, such as premature birth and postpartum complications.

Researchers suggest improving antenatal care by considering various risk factors, including nutritional status, diet, infection management, and stress. Given that anemia is not the only risk factor for PROM, a holistic approach to maternal care is recommended. These results can serve as the basis for revising or strengthening health policies, particularly regarding the management of anemia in pregnant women and efforts to provide more attention to mothers with good nutritional status but at risk of preterm premature rupture of membranes (PROM). Furthermore, more in-depth research that controls for other risk factors will be beneficial in obtaining a clearer picture of the relationship between anemia, nutritional status, and the incidence of PROM in pregnant women.

The relationship between chronic energy deficiency and premature rupture of membranes

The study results showed a significant relationship between CED and the incidence of PROM in the PMB working area of the Sukarame Health Center, Bandar Lampung City, in 2024. With an OR value of 8.9, it means that respondents who did not have CED had an 8.9 times risk of experiencing PROM compared to mothers with CED. In line with Ekasari's research (2024), there was a relationship between Chronic Energy Deficiency in pregnancy and the incidence of Premature Rupture of Membranes in mothers giving birth at the Nurhikmah Gubug Clinic. The relationship between chronic energy deficiency and premature rupture of membranes is likely

because chronic energy deficiency can affect the health of connective tissue and the uterine structure. Healthy and strong amniotic membranes require adequate nutritional intake to support tissue function, and chronic energy deficiency can weaken the structure of this tissue, increasing the risk of rupture of membranes before labor occurs. The weakening of the extracellular matrix in the amniochorionic membrane is caused by collagen degradation, fetal membrane distension, and biochemical processes that cause apoptosis remodeling (Ekasari, 2024).

Chronic energy deficiency conditions are often accompanied by nutritional deficiencies caused by inadequate food intake for the body's needs, which, of course, will have an impact on the health of the mother and fetus in the womb, such as body immunity. Chronic energy deficiency in pregnancy can cause significant maternal and neonatal complications such as anemia, perinatal complications, incidence of congenital disabilities, and hyaline membrane disease (Indarti et al., 2023). Energy deficiency can weaken the immune system, making pregnant women susceptible to infection. If it infects the urinary tract system, it can spread to the uterine cavity and damage the amniotic membrane, potentially triggering premature rupture of the membranes. The researcher assumes that CED can be a risk factor that influences the occurrence of PROM. Mothers with CED have a lower risk of experiencing PROM than mothers who do not have CED. This result may be surprising because, in general, CED is often considered to increase the risk of complications in pregnancy, including PROM.

Mothers with CED may receive more intensive medical attention and better management of nutrition and supplementation. For example, mothers with CED are often given nutritional supplements, such as iron or vitamins, which can help improve their health during pregnancy. Mothers without CED may appear physically healthier and have no obvious nutritional problems. However, they may be more susceptible to other, more overlooked risk factors, such as infection or stress, which can affect their pregnancy and increase their risk of PROM. Mothers with CED may come from poorer economic or social conditions, leading to better access to antenatal care or more intensive medical supervision. Mothers with good nutritional status (not CED) may receive less attention or inadequate supplementation. Mothers with CED often receive more intensive health supervision to address malnutrition. More in-depth nutrition and health programs may help reduce the risk of PROM in mothers with CED. In contrast, mothers without CED may be more likely to neglect antenatal care or not receive adequate medical care, which can worsen their condition during pregnancy and increase their risk of PROM.

The researcher assumes that although mothers who are not CED tend to have better nutritional conditions, they may be more susceptible to other risk factors, such as fatigue, undiagnosed illness, or high gestational age. This can increase the risk of premature birth in these mothers. Mothers who are not CED can also experience a decline in physical condition due to other factors that are not directly related to nutrition, such as emotional disorders, excessive physical fatigue, or environmental factors.

Although the results are significant, the small sample size (5 respondents with CED and 132 respondents without CED) may affect the accuracy of the estimates. Small differences in the number of events between these groups could significantly influence the results, so further research with larger samples is needed to strengthen these findings. This study may not have fully controlled for other factors that influence the incidence of PROM, such as overall maternal health status, other diseases, genetic factors, or access to healthcare services. Although mothers with CED were at lower risk of PROM in this study, prevention of CED remains a priority, as CED can increase the risk of other health complications, such as anemia, infection, and fetal growth retardation. It is essential to enhance holistic maternal care, encompassing maternal nutrition, physical and emotional health, and access to suitable medical care. Close antenatal surveillance is essential to ensure that pregnant women receive adequate care to prevent pregnancy complications, including PROM. The researchers recommend that mothers who do not experience CED be given more attention in antenatal care to reduce the risk of PROM, as this group tends to have other risk factors that may be more difficult to detect or manage.

CONCLUSION

There was no significant relationship between parity and PROM. However, there was a significant relationship between anemia and CED with the incidence of PROM in the PMB working area of Sukarame Health Center, Bandar Lampung, in 2024. Midwives must pay attention to the risks of PROM, including not only parity, anemia, and CED, but also mothers who appear nutritionally healthy. This study revealed that PROM was more likely to occur in women without anemia and without CED, indicating that other hidden or under-recognized risk factors such as infections, stress, or physical strain may play a role. Routine counseling on nutrition, supplementation, stress management, and antenatal care remains essential. Health workers should increase monitoring of all pregnant women, not just those classified as high-risk based on traditional indicators. The Health Office needs to strengthen education programs and ensure comprehensive maternal health surveillance to prevent PROM-related complications. Pregnant women must routinely attend antenatal check-ups, comply with medical advice, and maintain both physical and mental well-being throughout pregnancy.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

MM: Writing original draft, funding acquisition, conceptualization, editing; **NIT:** writing original draft (supporting), visualization, funding acquisition; **IT:** Review, analysis; **YP:** writing original draft (supporting).

Availability of data and materials

All data are available from the authors.

Competing interests

The authors declare no competing interest.

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