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Risk Factors for Low Birth Weight (LBW) Infants in East Nusa Tenggara (NTT) Province

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ABSTRACT

Background: The cause of infant mortality in East Nusa Tenggara (NTT) is 33% due to Low Birth Weight (LBW) infants, which is closely related to maternal nutrition and monitoring of pregnant women during pregnancy. This study aims to analyze the risk factors for LBW in East Nusa Tenggara Province in 2018 based on the 2018 Basic Health Research data results. **Method**: The research method used was quantitative with a Cross-sectional design. The population in the study totaled 1544 respondents. The sample in this study totaled 472 respondents. Univariate analysis aims to describe the data characteristics of each variable studied. Using the Chi-Square test, bivariate analysis was conducted to see the relationship between the independent and dependent variables.; **Results**: Variables associated significantly associated with the LBW infants in NTT Province in 2018 were the variables of education (ρ=0.034), parity (ρ=0.034), and gestational age (ρ=0.000). The dominant variable was Pregnancy Age (PR=2.613). The variable of gestational age was the most dominant risk factor associated with LBW infants with PR = 2.613 (95% CI = 1.525-4.478). The variable of gestational age has a three times greater risk of experiencing LBW infants in NTT Province in 2018. **Conclusion**: It is expected that health services and educational equality in rural areas in NTT Province should be further improved, especially maternal and child health. Maternal and child health, to improve the community's health status and reduce the morbidity and mortality rates of LBW infants

Introduction

Maternal and infant health is a critical focus of the Sustainable Development Goals (SDGs) for Indonesia. The SDGs target for reducing Infant Mortality Rate (IMR) in Indonesia is less than 25 per 1000 live births by 2030. However, despite the government's efforts, the maternal mortality rate (MMR) and IMR have not decreased significantly. One of the reasons for this is the uneven distribution

of healthcare resources and services, with rural and remote areas often having limited access to quality healthcare. This disparity in healthcare access contributes to the uneven distribution of the numbers between regions in Indonesia[1].

The high IMR is mainly caused by respiratory failure, which is based on the mother's medical history, and another cause is premature birth, which causes Low Birth Weight (LBW) below 2500 grams. Birth weight is the first weight a fetus or newborn obtains after birth. Low birth weight refers to birth weight below 2500 grams. It is one of the significant determinants of perinatal survival, infant morbidity, and mortality, as well as the risk of future developmental disabilities and diseases. Neonatal mortality among infants weighing 1500-2500 grams is 20 times higher than among normal-weight infants. The WHO in 2014 estimates that approximately 25 million babies with low birth weights are born each year, nearly 95% of whom are in developing countries[2].

The situation of infant mortality in Indonesia based on United Nations (UN) data, the infant mortality rate in Indonesia in 2019 was 21.12%. This figure decreased from the record in 2018 when the infant mortality rate in Indonesia still reached 21.86%, and in 2017, it reached 22.62%. Although it continues to experience a significant increase, the infant mortality rate in Indonesia is still relatively high compared to other Southeast Asian countries[3]. Indonesia is one of the developing countries with the highest MMR and IMR. The IMR in Indonesia reached 24 deaths per 1000 live births in 2017, with the target for 2024 IMR reaching 16.8% and the 2030 SDGs target reaching 12.3%, making Indonesia one of the countries with the highest IMR in Southeast Asia[4].

Reducing low birth weight and improving child survival could be achieved using extra diet, practical dietary advice, and the application of tried-and-true methods to prevent preterm delivery and smoking cessation during pregnancy[5]. According to the Irawati's (2023) findings, policymakers should concentrate on assisting urban-dwelling, elderly, single, low-educated women who are also jobless, primiparous, and economically disadvantaged in order to reduce the number of low birth weight (LBW) cases in Indonesia[6].

Based on Indonesian Demographic and Health Survey 2017 (IDHS) data, the incidence of LBW in Indonesia in 2017 was still relatively high at 7.1%. LBW will bring the risk of death, impaired growth, and development of children if not handled properly. One of the regions in Indonesia that still faces various resource challenges to improve the quality of children's health and education is East Nusa Tenggara Province. One of them can be seen from the percentage of LBW in East Nusa Tenggara Province, which had the highest LBW in Indonesia in 2017 at 13.43%, compare with Central Sulawesi Province the incidence of LBW at 8.9%, while the province with the lowest percentage of LBW was Jambi Province (2.6%). This shows East Nusa Tenggara Province experienced LBW almost twice the national average[4].

East Nusa Tenggara Province is home to a significant number of young people, with 2.2 million individuals or 42% of the total population being children. Most of these children, eight out of ten, reside in rural areas. To expedite the achievement of the SDGs in the province, it is crucial to make substantial strategic investments in children. These investments hold the potential to significantly improve the health and education of children in the region[7].

The low quality of health of the people of NTT is characterized by the low quality of maternal and infant health, worrying nutritional problems of the people of NTT, low community participation in preventive and promotive efforts, and low quality of environmental health. The quality of maternal and infant health in NTT is still poor. As for the cause of infant mortality, 33% is caused by LBW, which is, of course, closely related to the nutritional problems of pregnant women and the monitoring of pregnant women during pregnancy. The main problem in NTT is the low life expectancy of NTT[7]. The goal of this study is to analyze secondary data from the results of the 2018.

Materials and Method

The research method was a quantitative method with a cross-sectional design. The population in the study in total1544 respondents. The sample in this study in total 472 respondents Data collection was conducted by local enumerators with technical supervision by the District/City PJT and administrative supervision by the District/City PJO. In data collection, 1 team was responsible for 11 to 12 BS. 1 BS consisted of 10 households, so 1 team was responsible for 110 to 120 households.

Data collection for basic health research 2018 data was conducted through interviews, measurements, and examinations. The interview used two instruments, namely, Household Instrument and Individual Instrument. This study uses secondary data from the 2018 basic health research survey data, so the selection of variables used in this study must be from the Questionnaire. The data was collected through interviews, measurements, and examinations. The interview used two instruments, namely, household, and individual instrument. The variables analyzed in the study were taken from the IDHS 2017, along with their codes. The dependent variable was the incidence of LBW (K06). At the same time, the independent variables consist of the following: age (section IV, column 9), education (section IV, column 11), occupation (section IV, column 12), parity (J02), gestational age (J10), multiple pregnancies (J07), antenatal care (J16), anemia (J16), hypertension (J21), place of residence (I5), premature rupture of membranes (I24).

Results and Discussion

Results

Table 1. Characteristics of Respondents

Variable	n	%
LBW		
LBW	195	41,3%
Not LBW	277	58,7%
Age of mother		
Risky (age <20/>35 year)	153	32,4
Not risk (age 20-35 year)	319	67,6
Education		
Low (<= junior high school)	280	59,3%
High (graduated high school and more)	192	40,7%
Occupation		
Work	298	63,1%
Do not work	174	36,9%
Parity		
Multiparous	340	72%
Primiparous	132	28%
Gestational Age		
<37 weeks	176	37,3%
≥ 37 weeks	296	62,7%
Multiple Pregnancy		
Multiple	5	1,1%
Single	467	98,9%
Ante Natal Care (ANC)		
Incomplete	81	17,2%
Complete	391	82,8%
Anemia		
Yes	176	37,3%
No	296	62,7%
Hypertension		
Yes	26	5,5%
No	446	94,5%
Premature rupture of membranes (PROM)		
Yes	26	5,5%
No	446	94,5%
Residence		
Rural	363	76,9%
Urban	109	23,1%

Table 1 shows that the proportion of mothers who experienced LBW was 195 people (41.3%) and the normal 277 respondents (58.7%). The proportion of mothers who had a non-risk age (age 20-35) years was 67.6% and those at risk (age <20/>35) years was 32.4%. In the education variable, 59.3% had low education (completed junior high school and below) and 40.7% had high education (completed high school and above). The proportion of working mothers was 63.1% and 36.9% did not work. In the parity variable, multiparity (giving birth to 2 or more children) was 72% while primiparity (giving birth to 1 child) was only 28%. The majority at gestational age ≥ 37 weeks 62.7% and gestational age <37 weeks only 37.3%. The majority of mothers had a singleton pregnancy of 98.9% and a twin pregnancy of 1.1%. Antenatal care behaviour was complete (≥4 examinations) by 82.8% and incomplete (≥4 examinations) only 17.2%. Mothers who were not anaemic were 62.7% compared to 37.3% of anaemic mothers. The majority of mothers did not experience hypertension during pregnancy by 94.5% and only 5.5% experienced hypertension. The majority of mothers did not have PROM at 94.5% and those who had PROM at 5.5%. The majority of mothers who experienced LBW lived in rural 76.9% compared to mothers who lived in urban areas 23.1%.

Table 2. Relationship between Risk Factor Variables and LBW (n= 472)

Variables	LBW		Total (100%)	p-value	PR (95% CI)
	Yes n (%)	No n (%)			
Age					
High Risk (<20/>35yr)	55 (35,9)	98 (64,1)	153	0,124	0,718
No Risk (20-35 yr)	140 (43,9)	179 (56,1)	319		(0,482-1,068)
Education					
Low	120 (42,9)	160 (57,1)	280	0,467	1,170
High	75 (39,1)	117 (60,9)	192		(0,805-1,701)
Occupation					
Work	116 (38,9)	182 (61,1)	298	0,200	0,766
Do not work	79 (45,4)	95 (54,6)	174		(0,525-1,119)
Parity					
Multiparous	121 (35,6)	219 (64,4)	340	0,000	0,433
Primiparous	74 (56,1)	58 (43,9)	132		(0,288-0,652)
Gestational Age					
< 37 weeks	91 (51,7)	85 (48,3)	176	0,001	1,976
≥ 37 weeks	104 (35,1)	192 964,9)	296		(1,352 – 2,890)
Multiple Pregnancy					
Multiple	4 (80)	1 (20)	5	0,165	1,976
Single	191 (40,9)	276 (59,1)	467		(1,352- 2,980)
Ante Natal Care (ANC)					
Incomplete	91 (51,7)	85 (41)	176	0,001	1,976
Complete	4 (80)	1 (20)	5		(1,352-2,890)
Anemia					
Yes	71 (40,3)	105 (56,5)	176	0,815	0,938
No	124 (41,9)	172 (58,1)	296		(0,642 – 1,371)
Ante Natal Care (ANC)					
Incomplete	25 (30,9)	56 (69,1)	81	0,048	0,580
Completed	170 (43,5)	221 (56,5)	391		(0,348 – 0,968)
Hypertension					
Yes	8 (30,8)	18 (69,2)	26	0,815	0,938
No	187 (41,9)	259 (58,1)	446		(0,642-1,371)
Premature rupture of membranes (PROM)					
Yes	9 (34,6)	17 (65,4)	26	0,611	0,740
No	186 (41,7)	260 (58,3)	446		(0,323-1,696)
Residence					
Urban	149 (41)	214 (59)	363	0,917	0,954
Rural	46 (41,2)	53 (57,8)	109		(0,618 – 1,472)

Table 4.2 for the bivariate analysis results reveals the crucial variables with a ρ value ≤ 0.05, namely parity, gestational age, and ANC. These findings underscore the statistically significant relationship between these factors and the risk of LBW. Conversely, the variables of age, education,

occupation, multiple pregnancies, anemia, hypertension, PROM, and residence, resulting in a ρ value >0.05, do not show a statistically significant relationship with the risk factors for LBW in NTT. The chi-square test results further confirm the importance of age, indicating that mothers with a risk age have a protective factor of not experiencing LBW by 0.7 times compared to mothers with an at-risk age.

Mothers with low education (graduated from junior high school and below) have a risk of experiencing LBW 1.2 times compared to mothers with high education (graduated from high school and above). The proportion of respondents who experienced LBW was more significant among working mothers, 116 respondents (38.9%), compared to non-working mothers, 79 respondents (45.4%). Chi-square test results showed there was no significant relationship between maternal employment and the LBW in NTT, with a value of ρ = 0.200 and PR = 0.766 (95% CI = 0.525-1.119), meaning that mothers who did not work had a protection factor of not experiencing LBW by 0.8 times compared to mothers who worked.

Those who were multiparous mothers (giving birth to 2 or more children) 121 respondents (35.6%) compared to primiparous mothers (giving birth to 1 child) and 74 respondents (56.1%). Chi-square test results showed there was a significant relationship between maternal parity and the incidence of LBW in East Nusa Tenggara Province in 2018, with a value of ρ = 0.000 and PR = 0.433 (95% CI = 0.288-0.652), meaning that primiparous mothers (giving birth to 1 child) had a protection factor of not experiencing LBW by 0.4 times compared to multiparous mothers (giving birth to children two or more times).

Furthermore, the mothers who experienced LBW were more significant at gestational age <37 weeks (51.7%) compared with gestational age ≥37 weeks (35.1%). Chi-square test results showed there was a significant relationship between gestational age and the incidence of LBW in East Nusa Tenggara Province in 2018, with a value of ρ = 0.001 and PR = 1.976 (95% CI = 1.352-2.890), meaning that gestational age <37 weeks had a risk of experiencing LBW by 1.9 times compared to mothers with gestational age ≥37 weeks. The respondents who experienced LBW were more significant in multiple pregnancies (80%) compared to single pregnancies (40.9%). Chi-square test results showed no significant relationship between multiple pregnancies and the incidence of LBW in NTT, with a value of ρ = 0.165 and PR = 5.780 (95% CI = 0.641-52.116), meaning that mothers with multiple pregnancies have a risk of experiencing LBW by 5.8 times compared to mothers with singleton pregnancies.

Subsequently, the number of those who got complete ANC (≥ four examinations) (43.5%) compared to incomplete ANC (<4 examinations) (30.9%). Chi-square test results showed that there was a significant relationship between ANC and the incidence of LBW, with a value of ρ = 0.048 and PR = 0.580 (95% CI = 0.348-0.968), meaning that mothers with complete ANC (≥ four times the examination) had a protection factor of not experiencing LBW by 0.6 times compared to mothers with incomplete ANC (<4 times the examination).

Moreover, the proportion of women who experienced LBW was more significant for mothers who were not anemic (41.9%) compared to anemic mothers (40.3%). Chi-square test results showed no significant relationship between anemia in mothers and the incidence of LBW, with a value of ρ = 0.815 and PR = 0.938 (95% CI = 0.642-1.371), meaning that mothers who were not anemic had a protective factor of not experiencing LBW by 0.9 times compared to anemic mothers.

Besides, the proportion of those who experienced LBW was more significant for mothers who were not hypertensive (41.9%) compared to mothers who were hypertensive (30.8%). Chi-square test results showed no significant relationship between maternal hypertension and the incidence of LBW, with a value of ρ = 0.358 and PR = 0.616 (95% CI = 0.262-1.446), meaning that mothers who were not hypertensive had a protection factor of not experiencing LBW of 0.6 times compared to hypertensive mothers.

Furthermore, table 2 shows that those who experienced LBW were more significant for mothers who did not have PROM (41.7%) compared to mothers who had PROM (34.6%). Chi-square test results showed no significant relationship between LBW and the incidence of LBW in East Nusa Tenggara Province in 2018, with a value of ρ = 0.611 and PR = 0.740 (95% CI = 0.323-1.696), meaning that mothers who did not have PROM had a protective factor of not experiencing LBW by 0.7 times compared to mothers who had PROM.

Table 2 also explains that the proportion of respondents who experienced LBW was more significant for mothers who lived in rural areas, 149 (41%), compared to mothers who lived in urban areas, 46 (42.2%). Chi-square test results showed no significant relationship between maternal residence and the incidence of LBW, with a value of ρ = 0.917 and PR = 0.954 (95% CI = 0.618-1.472), meaning that mothers who live in urban areas have a protective factor of not experiencing LBW by 0.9 times compared to mothers who live in rural areas.

Table 3. Final Model Logistic Regression

Variables	p-Value	PR	95% CI	
			Upper	Lower
Education	0,034	1,552	1,034	2,330
Parity	0,000	0,393	0,254	0,606
Age of Pregnancy	0,001	1,985	1,344	2,931

The results of the final multivariate analysis model showed that education, parity, and gestational age were significantly associated with LBW.

Discussion

The limitation of this study is that not all factors associated with LBW incidence can be studied because these variables are not available in the 2018 RISKESDAS data. Not all data available in RISKESDAS 2018 can be used in this study because respondent data is missing in several variables. Researchers have excluded the missing data, so this study only uses complete data. Information bias and measurement bias may occur. Information bias occurs due to errors in the data collection process, and measurement bias occurs during measurement, mainly when disease and exposure misclassification occur.

LBW by 0.7 times compared to mothers with an age that is (age <20/>35) years old. This analysis's results differ from research conducted by Susmita (2019) at Muhammadiyah Palembang Hospital. The results of this study show that respondents at age (<20 and >35 years) were 69.6% experienced LBW, while with age (20-35 years), as many as 42.6% experienced the incidence of LBW. Based on the Chi-Square test results, the p-value = 0.003 means that there is a significant relationship between age and the incidence of LBW at the Muhammadiyah Palembang Hospital[8].

According to (Momeni, 2017), maternal age at delivery <18 and >35 years old is associated with an increased risk of LBW. Some epidemiological studies have shown that LBW occurs in both young and old mothers. There are social disadvantages such as low socioeconomic status, low education, poor nutrition, and low body mass index that are responsible for this outcome in younger mothers; however, in younger mothers; however, in older mothers, biological factors such as chromosomal anomalies, preeclampsia, and low body mass index are responsible for this outcome. According to the researchers, LBW has a chance to occur in mothers who have an at-risk age. Age can affect the readiness of the mother in her pregnancy to maintain, check her pregnancy, and make preventive efforts for LBW[9].

The analysis aligned with Nazirun's research (2019) which found that low maternal education is more at risk of causing LBW in babies born 1.7 times compared to high maternal education. This is because low maternal education (elementary and junior high school) can increase the incidence of LBW due to a lack of knowledge about maintaining the pregnancy. The higher the mother's education, the lower the mortality and morbidity. The higher the mother's education, the lower the mortality and morbidity. This is not only due to the mother's health awareness but also to the influence of social economics[10].

Moreover, the results of this analysis are in line with the research of Bahrami et al. (2020) that individuals who work have a 2.4 times greater risk of experiencing the birth of LBW babies compared to homemakers. The results of this analysis are not in line with Susmita's research (2019). Based on the results of the study found that 54.2% of respondents who did not work experienced LBW, while those who worked were 6.7% who experienced LBW[118].

The results of this analysis are in line with research by Wachamo et al. (2019); Gravidity (2-4 pregnancies) also showed a significant association with low birth weight (AOR: 0.36; 95% CI 0.18, 0.73). Number of pregnancies was the obstetric factor associated with low birth weight in this study. Mothers who were in their second to fourth pregnancy were more likely to have low birth weight babies than primigravida. Parity was significantly associated with birth weight in northwest Ethiopia The Gambia, and London[12].

Furthermore, the analysis's results align with the research of Halil et al. (2019). In addition, gestational age less than 37 weeks was almost four times more likely to deliver a LBW infants

compared to newborns at term and above [AOR=4.1, 95% CI (2.0,8.39)]. This study suggests that gestational age below 37 weeks is one of the risk factors for LBW risk factor for low birth weight. This result is consistent with a study conducted in Jimma, Ethiopia, and Malaysia. It is a fact that neonates born below 37 weeks of gestation are physically small and immature, because of which they are at greater risk of having low birth weight[1314]. This analysis's results differ from the study by Afaya (2020), this study found that LBW was highly prevalent. A higher chance of an Apgar score of less than 7 in the first minute was an independent result of LBW deliveries, although women's marital status (single mothers), gestational age (<37 weeks), and newborn sex (female) are independent risk factors associated with LBW. The results of this study add to the expanding body of research on how LBW are affected by maternal and neonatal variables in environments with limited resources[15].

Subsequently, the results of this analysis are in line with the research of Susanti (2019) that multiple pregnancies have a risk of 84 times giving birth to LBW compared to single pregnancies (OR = 84 and p = 0.0001). This means that multiple pregnancies are a risk factor for LBW. Twin babies will require greater nutritional intake than non-twin babies. Several studies have reported an association between multiple births and LBW infants. According to researchers who experienced the incidence of LBW, most mothers with multiple pregnancies (88.9%) compared to single pregnancies (49.2%). In multiple pregnancies with excessive uterine distension, it can cause premature labor with LBW. The mother's need for growth in twin pregnancies is more significant, so nutritional deficiencies such as pregnancy anemia can interfere with fetal growth in the womb. Nutritional deficiencies such as pregnancy anemia can interfere with fetal growth in the womb[16].

This analysis's results align with the study by Seid et al. (2019). Neonates whose mothers did not attend ANC follow-up had a higher prevalence of LBW infants(7.76%) than neonates whose mothers had ANC follow-up (7.68%). A possible explanation is that mothers with ANC follow-ups had more obstetric problems detected, treated, or referred previously[17].

This analysis's results align with Indah's research (2020). based on the table, mothers who give birth to LBW are higher in mothers who were not anemic, as many as 169 people (97.1%) than in mothers who were anemic, as many as five people (2.9%). Obtained p-value = 1.000, then it can be concluded that there is no significant relationship between anemia and LBW because of the p-value (1,000 > 0.05). The results of this analysis are not in line with the research of Halil Hassen Mosa et al. (2019); women who experience anemia during the current pregnancy are five times more likely to give birth to LBW infants compared to those who are not anemic [AOR = 5.0, 95% CI (2.22, 11.18)]. This study shows that anemia is significantly associated with LBW. This can be explained by during pregnancy reduced nutrients and oxygen to the fetus, causing intrauterine growth restriction and LBW[1318].

The results of this analysis are not in line with the research of Murchana et al. (2020), in their research, that pregnancy caused by hypertension has a significant relationship with LBW infants. A total of 20% (48 out of a total of 238) of mothers who gave birth to LBW had hypertension compared to 6.5% (78 out of a total of 1188) of mothers who gave birth to babies more than or equal to 2.5 kg. Wahabi found while macrocosmic newborns are more likely to experience birth injuries and other related issues, low-birth-weight (LBW) neonates are more likely to experience morbidity and mortality, which are negatively correlated with birth weight. While increasing gestational age was less likely to be related to LBW (aOR = 0.51, 95% CI = 0.46–0.57), LBW was associated with maternal hypertension (aOR = 3.5, 95% CI = 1.62–7.63)[19].

However, this study aligned with Mitao, et.al (2016) who used medical record data to investigate the incidence of low birth weight, risk factors, and perinatal morbidity and mortality among infants born with low birth weight. That study found that the incidence of LBW was 10.6%. Hypertension is a significant risk factor for low birth weight. The common risk factor for delivering an LBW baby was hypertension (RR 2.8; 95% CI 2.1-3.8) was hypertension (RR 2.8; 95% CI 2.1-3.8). In addition, babies born with low birth weight have a greater risk of being born prematurely jaundiced and have low Apgar scores in the first and fifth minutes compared to infants born with average weight[20].

The results of this analysis are not in line with the study of Murchana et al. (2020), in that study 18.2% (260 out of 1426 babies) experienced PROM. The incidence of PROM ranges from 5% to

10% of all deliveries. It has a significant correlation with LBW infants (p=0.000). Her study found that 30% (71 out of 238) of mothers who gave birth to LBW infants had PROM[21].

Conclusion

The number of mothers who experienced LBW was 41.3% in East Nusa Tenggara Province. Overview of maternal risk factors, showing that mothers who have an age at risk of 32.4%, mothers who have a low education of 59.3%, the majority of working mothers 63.1%, the majority of multiparous parity 72%, gestational age < 37 weeks by 37.3%, mothers who experience multiple pregnancies 1.1%, incomplete ANC by 17.2%, mothers who experience anemia by 37.3%, mothers who experience hypertension only 5.5%), placental risk factors: (5.5% of mothers experienced PROM), and environmental risk factors, the majority of mothers who experienced LBW lived in rural areas 76.9%,, in NTT.

Maternal risk factor variables after multiple logistic regression tests were significantly associated with the incidence of LBW: education, parity, and gestational age in NTT. Placental risk factor variables (PROM) after double logistic regression test are not significantly associated with the incidence of LBW in NTT. The environmental risk factor variable (Place of Residence) after the double logistic regression test is not significantly associated with LBW. The most dominant factor associated with the incidence of LBW in East Nusa Tenggara Province in 2018 is gestational age PR = 2.613 (95% CI = 1.525-4.478), so it has a three times greater risk of experiencing LBW.

Declaration

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Conflicts of Interest:

There is no conflict of interests.

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