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Correlation Between Anemia, Sexually Transmitted Infections, and Low Birth Weight Among Pregnant Women

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Abstract

Anemia in pregnancy and sexually transmitted infections (STIs) are global health issues linked to low birth weight. This study explored the correlation between these factors and low birth weight at the General Hospital of Scholoo Keyen, South Sorong, Southwest Papua, Indonesia. A cross-sectional observational analytic study was conducted from September 2022 to March 2023, involving pregnant women who gave birth at the General Hospital of Scholoo Keyen. The correlation between risk factors and low birth weight was analyzed using the chi-square test with a significance threshold of $p<0.05$. Results showed that among 162 pregnant women (average age: 27.72±6.62 years), anemia severity was distributed as follows:severe (3.7%), moderate (16.0%), and mild (40.1%). However, no significant relationship was found between anemia and birth weight ($p=0.850$, $p>0.05$). The incidences of HIV, syphilis, and hepatitis B were 3.1%, 13.6%, and 7.4%, respectively. A significant association was identified between HIV infection and low birth weight ($p=0.000$), while no such association was found for syphilis ($p=0.160$) or hepatitis B infection ($p=0.852$). In conclusion, HIV infection is associated with low-birth-weight newborns, but there are no apparent relationships between anemia, syphilis, or hepatitis B infection and low-birth-weight newborns, This study implies the importance of nutritional support among pregnant mothers with HIV and delaying pregnancy in HIV-positive women to until their immune system improve.

Keywords: Anemia, low birth weight, sexually transmitted infections

Introduction

Low birth weight (LBW) affects 15% to 20% of all births globally, which corresponds to over 20 million births annually. The prevalence of low birth weight varies significantly across different regions.[1] In the Southeast Asian region, the prevalence of low birth weight ranges from 7% to 21%.[2] Based on data analysis from 2017 Indonesia Demographic and Health Survey, the prevalence of low birth weight in Indonesia is recorded at 6.1%.[3] Meanwhile, the prevalence of LBW in West Papua in 2019, based on West Papua Public Health Office, is 10.4%.[4] Several factors contribute to low birth weight during pregnancy, including maternal age, occupation, body weight, number of pregnancies, smoking history, gestational length, previous childbirths, reproductive health, poor nutritional status, socioeconomic disparities, inadequate attention to proper diet and supplement intake during pregnancy, season of birth, frequency of prenatal care, anemia, birth defects, pre-pregnancy health conditions, and the family's socioeconomic status.[5]

Anemia is a common nutritional deficiency that significantly impacts pregnant women. Lower levels of hemoglobin in the blood lead to alterations in placental angiogenesis, which restricts the oxygen supply to the developing fetus.[6] Research on the relationship between anemia during pregnancy and low birth weight remains controversial. Tabrizi, in a study conducted in Iran in 2015, stated that low hemoglobin levels during pregnancy are associated with low birth weight.[7] However,

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a study by Sibuea et al. in 2022 revealed no significant relationship between anemia in pregnant mothers and the occurrence of low birth weight.[8]

Maternal infection is a significant cause of low birth weight.[5] Sexually transmitted infections (STIs) during pregnancy are associated with various adverse birth outcomes, including preterm birth, low birth weight, perinatal death, and congenital infections, which may lead to increased mother-to-child transmission.[9] In addition, Human Immunodeficiency Virus (HIV), Syphilis, and Hepatitis B are included in the "Triple elimination", a government program to prevent the transmission of infections from mother to her child. Moreover, Papua is one province contributing most to sexually transmitted diseases in Indonesia.[2] Furthermore, various studies show that HIV, syphilis, and hepatitis B infections during pregnancy are associated with LBW.[10,11,12] Therefore, this study also assessed the association of these three sexually transmitted diseases with LBW.

The study focused on investigating the risk factors associated with low-birth-weight infants, with specific emphasis on risk factors including anemia and three sexually transmitted diseases including HIV, Hepatitis B, and Syphilis infections at the General Hospital of Scholoo Keyen, located in South Sorong, Southwest Papua.

Methods

This observational analytic study with a cross-sectional design was conducted at Scholoo Keyen General Hospital, South Sorong, from September 2022 to March 2023. Ethical approval was obtained from the Faculty of Medicine, Brawijaya University (No. 112/EC/KEPK/05/2024).

Using total sampling, 162 pregnant women delivering at the hospital during the study period were included. Inclusion criteria consisted of newborns born at the General Hospital of Scholoo Keyen, South Sorong, Southwest Papua, during the specified study period, ensuring that they were alive, and that the delivery mothers had completed medication and data collection. Exclusion criteria encompassed newborns born outside the hospital, intrauterine fetal demise (IUFD), premature labor (<36 weeks gestation), cases where delivery mothers left against medical advice, and instances of incomplete data.

The study investigated various variables, including socio-demographic factors, obstetric factors, anemia, and sexually transmitted diseases (STDs) infection. Socio-demographic factors encompassed age, body mass index, and nutritional status. Obstetric factors included labor history and newborn weight. Anemia characteristics were categorized as normal, mild anemia (Hb 9–10.9 mg/dL), moderate anemia (Hb 7–8.9 mg/dL), and severe anemia (Hb <7 mg/dL). Nutritional status was classified into underweight (BMI 17–18.4 kg/m^2), normal (BMI 18.5–25 kg/m^2), overweight (BMI 25.1–27 kg/m^2), and obese (BMI >27 kg/m^2). Sexually transmitted disease infections comprised hepatitis B, syphilis, and HIV infection. Low birth weight infants were defined as those weighing less than 2500 grams.

Data were presented using mean and standard deviation. Categorical data were presented using totals and percentages. The association between risk factors and the incidence of low birth weight

Table 1 Sample Characteristics

Variable	Frequency (n=126)	%
Anemia		
Severe	6	3.7
Moderate	26	16
Mild	65	40.1
Normal	65	40.1
Age (years)		
≤20	27	16.7
21–34	108	66.7
≥ 35	27	16.7
Nutritional status		
Obesity	77	47.5
Overweight	32	19.8
Normal	52	32.1
Underweight	1	0.6
Syphilis		
Yes	22	13.6
No	140	86.4
Hepatitis B (HbsAg)		
Yes	12	7.4
No	150	92.6
HIV		
Yes	5	3.1
No	157	96.9

was analyzed using chi-square test. Data analysis was conducted using IBM SPSS Statistic version 26 with the significance level set at $p<0.05$.

Results

The study participants were selected based on baby weight information gathered from 162 respondents. It was observed that sixteen respondents (9.9%) had babies with low birth weight (LBW), while 146 respondents (90.1%) had babies with normal birth weight. The study results revealed the hemoglobin (Hb) status in pregnant women among the 162 respondents. In the normal category, there were sixty-five respondents (40.1%). In the mild anemia category, there were sixty-five respondents (40.1%). The moderate category included twenty-six respondents (16%), while the severe anemia category consisted of six respondents (3.7%) (Table 1).

Mothers with anemia in the third trimester had eleven babies born with LBW and 102 babies born without LBW. The statistical analysis revealed that there was no association. Most pregnant mothers had an obese nutritional status, specifically seventy-seven participants (47.5%), and most pregnant mothers were in their productive age, specifically between twenty-one and thirty-four years old, totaling 108 mothers (66.7%). Four mothers with syphilis had four babies with LBW, and eighteen mothers with syphilis had no LBW babies. The statistical analysis indicated that there was no association. A mother with positive HbsAg had one baby with LBW, and eleven mothers with

Table 2 Association Between Risk Factors and Low Birth Weight

Risk Factor	Low Birth Weight		p-value
	Yes	No	
Anemia			
Severe	1 (0.6%)	5 (3.1%)	0.85
Moderate	3 (1.9%)	23 (14.2%)	
Mild	7 (4.3%)	58 (35.8%)	
Normal	5 (3.1%)	60 (37%)	
Nutritional Status			
Obesity	7 (4.3%)	70 (43.2%)	0.95
Overweight	3 (1.9%)	29 (17.9%)	
Normal	6 (3.7%)	46 (28.4%)	
Underweight	0 (0.0%)	1 (0.6%)	
Age			
≥35 Years Old	2 (1.2%)	25 (15.4%)	0.25
21–34 Years Old	9 (5.6%)	99 (61.1%)	
≤20 Years Old	5 (3.1%)	22 (13.6%)	
Syphilis			
Yes	4 (2.5%)	18 (11.1%)	0.16
No	12 (7.4%)	128 (79.0%)	
Hepatitis B (HbsAg)			
Yes	1 (0.6%)	11 (6.8%)	0.85
No	15 (9.3%)	135 (83.3%)	
HIV			
Yes	3 (1.9%)	2 (1.2%)	*0.001
No	13 (8%)	144 (88.9%)	

*Chi-square test, statistically significant ($p<0.05$)

positive HbsAg had no LBW babies. The statistical analysis indicated that there was no significant difference. Three mothers with positive HIV had three babies with LBW, and two others with positive HIV had no LBW babies (Table 2).

Discussions

This study investigated 162 mothers who delivered at Scholoo Keyen General Hospital, Southwest Papua, to examine associations between LBW and maternal anemia, HIV, hepatitis B, and syphilis. The findings showed no significant association between LBW and maternal anemia, syphilis, or hepatitis B, whereas HIV infection was significantly associated with LBW.

Pregnancy-related anemia can result from insufficient nutrient intake, failure to adhere to the prescribed iron and folic acid supplementation, inadequate preconception and conception care, pregnancy-related health issues such as helminthiasis, and suboptimal dietary habits. These elements, either directly or indirectly, contribute to the occurrence of low birth weight.[13]

Maternal anemia reduces hemoglobin levels and alters placental angiogenesis, restricting oxygen supply to the fetus and potentially impairing intrauterine growth.[14] Inadequate hemoglobin levels impede the mother's capacity to provide oxygen and nutrients to the fetus, impacting both oxygen delivery in the body and placental growth. These negative effects result in prolonged fetal hypoxia and insufficient nutrient supply, leading to suboptimal fetal weight gain and unfavorable birth outcomes, including low birth weight. However, other research showed that birth weight is not exclusively determined by the hemoglobin levels of pregnant mothers. It is influenced by two maternal factors that impact intrauterine fetal growth, the internal and external factors related to pregnant mothers. Hemoglobin levels are categorized as one of the internal factors associated with pregnant mothers.[15]

HIV infection was significantly associated with LBW, consistent with findings from prior studies. For example, a retrospective cohort study in Southern Ethiopia reported that infants born to HIV-negative women had significantly higher mean birth weight (3.1±0.7 kg) compared to those born to HIV-positive mothers (3.0±0.6 kg), with a higher prevalence of LBW in the HIV-exposed group (22.2%) compared to the non-exposed group (13.7%). The multivariable analysis revealed that HIV-positive women had a fourfold increased odds of giving birth to LBW infants.[16] Another research in China also showed that HIV infection was strongly associated with increased risks of LBW and preterm.[17]

Exposure to HIV before or during pregnancy is associated with an increased risk of adverse pregnancy outcomes (APOs) through various mechanisms. Firstly, HIV infection can compromise the immune system, leading to lower immune activation and an elevated risk of preterm birth (PTB). Additionally, immunosuppression and decreased CD4+T cells in HIV-infected pregnancies are linked to low birth weight (LBW). Secondly, HIV-infected mothers exhibit abnormal placenta characteristics and altered placental angiogenesis, contributing to lower placental weight and area, which are significantly associated with reduced infant birth weight. Lastly, the ascending genital tract infection is proposed as a potential mechanism for HIV-associated PTB, with correlations observed between genital-tract matrix-metalloproteinase-9 (MMP-9) and tissue inhibitor of metalloproteinases-1 (TIMP-1) levels, inflammation, and vaginal bacteria in HIV-positive pregnant women. These findings highlight the complex interplay of factors contributing to APOs in the context of HIV exposure during pregnancy.[17] However, another study in the General Hospital of dr. Soebandi, Jember, East Java reported no correlation between LBW and HIV infections in pregnancy, which contrasts with this study.[18]

A study suggested that in HIV-HBV co-infected women, high HBV viral loads increase the risk of low birth weight and potentially HIV perinatal transmission.[11] Maternal HBV status was not associated with low birth weight in this study, which is in line with several other studies.[19,20,21] In this study, maternal HBV status was not associated with LBW, consistent with several reports. However, Sirilert et al. found that maternal positivity for HBsAg and HBeAg increased the likelihood of LBW.[22]

Additionally, syphilis has also been identified as a risk factor for low birth weight.[11] Several studies showed that maternal syphilis is associated with low birth weight.[23,24] During pregnancy, syphilis can lead to these outcomes through the mechanism by which *T. pallidum* sp. *pallidum* spreads to different organs of the fetus, causing damage to the placenta and umbilical cord, usually from the 16th gestational week. Thus, gestational syphilis involves an inflammatory response that can negatively

impact the unborn child, resulting in stillbirth, premature birth, and low birth weight.[25] However, this study showed no association between LBW and syphilis infection. This could be due to the small sample size applied in this study.

This study has several limitations. First, the sample size was relatively small. Second, the analysis focused on selected risk factors and may have overlooked other determinants of LBW. Third, socioeconomic factors were not fully addressed, though they can strongly influence birth outcomes. Therefore, further research with a larger sample size is necessary. In summary, this study concludes that there is a correlation between HIV infection and low birth weight incidence at the General Hospital of Scholoo Keyen, Southwest Papua.

References

1. Thapa P, Poudyal A, Poudel R. Prevalence of low birth weight and its associated factors: hospital-based cross-sectional study in Nepal. PLOS Global Public Health. 2022;2(11):e0001220. doi:10.1371/journal.pgph.0001220
2. Wulandari F, Mahmudiono T, Rifqi MA. Maternal Characteristics and socio-economic factors as determinants of low birth weight in Indonesia: analysis of 2017 Indonesian Demographic and Health Survey (IDHS). Int J Environ Res Public Health. 2022;19(21):13892. doi:10.3390/ijerph192113892.
3. Sadarang, RAI. The study on low birth weight in Indonesia: Analysis on the 2017 Indonesia Demographic and Health Survey. Jurnal Kesehatan Jambi. 2021;5(2):28–35.
4. West Papua Provincial Health Office (WP-PHO). Health profile of West Papua. Manokwari: WP-PHO; 2019.
5. Khazaei S, Mansori K, Khazaei Z, Sani M, Ayubi E. Infant and young child feeding status in Iran compared the different United Nation Regions. Int J Pediatr 2016;4:3639–41.
6. Figueiredo ACMG, Gomes-Filho IS, Silva RB. Maternal anemia and low birth weight: a systematic review and meta-analysis. Nutrients. 2018;10(5):601. doi:10.3390/nu10050601.
7. Tabrizi Moghaddam F, Barjasteh S. Maternal hemoglobin levels during pregnancy and their association with birth weight of neonates. Iran J Ped Hematol Oncol. 2015;5(4):211–7.
8. Sibuea R, Raja SNL. Correlation of anemia in pregnancy and low birth weight in public health centers. Sci Midwifery. 2022;10(4):2985–91.
9. Medina-Marino A, Cleary S, Muzny CA. Sexually transmitted infection screening to prevent adverse birth and newborn outcomes: study protocol for a randomized-controlled hybrid-effectiveness trial. Trials. 2022;23(1):441. doi:10.1186/s13063-022-06400-y.
10. Fentie EA, Yeshita HY, Bokie MM. Low birth weight and associated factors among HIV positive and negative mothers delivered in northwest Amhara region referral hospitals, Ethiopia, 2020: a comparative cross-sectional study. PLoS One. 2022;17(2):e0263812. doi:10.1371/journal.pone.0263812.
11. Bhattacharya D, Guo R, Tseng CH. Maternal HBV viremia and association with adverse infant outcomes in women living with HIV and HBV. Pediatr Infect Dis J. 2021;40(2):e56–e61. doi:10.1097/INF.0000000000002980.
12. Wan Z, Zhang H, Xu H. Maternal syphilis treatment and pregnancy outcomes: a retrospective study in Jiangxi Province, China. BMC Pregnancy Childbirth. 2020;20(1):648. doi:10.1186/s12884-020-03314-y.
13. Engidaw MT, Eyayu T, Tiruneh T. The effect of maternal anaemia on low birth weight among newborns in Northwest Ethiopia. Sci Rep. 2022;12:15280.
14. Stangret A, Wnuk A, Szewczyk G, Pyzlak M, Szukiewicz D. Maternal hemoglobin concentration and hematocrit values may affect fetus development by influencing placental angiogenesis. J Matern Fetal Neonatal Med. 2017;30(2):199–204. doi:10.3109/14767058.2016.1168395.
15. Sah SK, Sunuwar DR, Baral JR, Singh DR, Chaudhary NK, Gurung G. Maternal hemoglobin and risk of low birth weight: A hospital-based cross-sectional study in Nepal. Heliyon. 2022;8(12):e12174. doi:10.1016/j.heliyon.2022.e12174.
16. Zenebe A, Eshetu B, Gebremedhin S. Association between maternal HIV infection and birthweight in a tertiary hospital in southern Ethiopia: retrospective cohort study. Ital J Pediatr. 2020;46(1):70. doi:10.1186/s13052-020-00834-3.
17. Yingjuan L, Peng J, Liu Y. Association between maternal HIV infection and the risks of preterm birth and low birth weight in Chengdu, China: a propensity score matching approach. BMJ Open. 2023;13(9):e071205.

doi:10.1136/bmjopen-2022-071205.
18. Shodikin MA, Kusumastuti I, Indasyah WA. The Correlation Between Human Immunodeficiency Virus (HIV) Infection in Pregnancy and Low Birth Weight Infants. JHS. 2021;14(3):209–13. doi: 10.33086/jhs.v14i3.2186
19. Cui AM, Cheng XY, Shao JG, Li HB, Wang XL, Shen Y, et al. Maternal hepatitis B virus carrier status and pregnancy outcomes: A prospective cohort study. BMC Pregnancy Childbirth. 2016;16:87. doi: 10.1186/s12884- 016-0884-1.
20. Bajema KL, Stankiewicz Karita HC, Tenforde MW, Hawes SE, Heffron R. Maternal hepatitis B infection and pregnancy outcomes in the United States: a population-based cohort study. Open Forum Infect Dis. 2018;5(6):ofy134. doi: 10.1093/ofid/ofy134.
21. Tan J, Huang S, He G, Tang L, Ren Y, Zheng J, et al. Maternal hepatitis B surface antigen carrier status and its impact on neonatal outcomes: A cohort study of 21 947 singleton newborns in China. J Matern Fetal Neonatal Med. 2017;30(18):2219–24. doi: 10.1080/14767058.2016.1243098.
22. Sirilert S, Traisrisilp K, Sirivatanapa P, Tongsong T. Pregnancy outcomes among chronic carriers of hepatitis B virus. Int J Gynaecol Obstet. 2014;126(2):106–10. doi: 10.1016/j.ijgo.2014.02.019
23. Sun M, Luo M, Wang T, Zhong T, Chen Q, Liu H. Associations between maternal syphilis infection during pregnancy and low birth weight and preterm birth: a prospective cohort study. Arch Gynecol Obstet. 2024;310(1):203–211. doi:10.1007/s00404-023-07321-0
24. da Silva HBM, de Cássia Ribeiro-Silva R, Junior EPP, Barreto ML, Paixão ES, Ichihara MY. Syphilis in pregnancy and adverse birth outcomes: A nationwide longitudinal study in Brazil. Int J Gynaecol Obstet. 2024;166(1):80–89. doi:10.1002/ijgo.15561
25. Tsai S, Sun MY, Kuller JA, Rhee EHJ, Dotters-Katz S. Obstet Gynecol Surv. 2019;74(9):557–64. doi:10.1097/OGX.0000000000000713