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ORIGINAL ARTICLE

RELATIONSHIP OF ANEMIA IN PREGNANCY AND LOW BIRTH WEIGHT INFANTS

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ABSTRACT

Aim: The study was done to understand the relationship between pregnant women with anemia and low birth weight (LBW) in neonates born to them.

Methods and Materials: This cross sectional study was done from medical records of infants born in a tertiary referral hospital between January-March 2019. Total 379 medical records taken by total sampling. Bivariate analysis using chi-square was done to find the relationship between anemia of pregnant women and the incidence of LBW infants. Multivariate binary logistic regression analysis was conducted to find the relationship between maternal age, total parity, gestational age, infant gender, and anemia simultaneously with LBW infants.

Results: From 379 pregnant women, 138 (36.4%) had anemia and 60 (15.8%) pregnant women among them gave birth to LBW infants. Pregnant women who were not anemic amounted to 241 pregnant women (63.6%), which 114 (30.1%) of them gave birth to LBW infants (p=0.47). From the multivariate analysis, the variables anemia in pregnancy, maternal age, and gender of the infant were not associated with LBW, while the amount of parity and gestational age were significantly associated with LBW incidence. Nuliparous women [p=0.039, AOR 1.91 (95% CI 1.03-3.54)] were more likely to deliver LBW infants than multiparous women. Infants born to mothers at preterm gestation [p=<0.001, AOR 32.9 (95% CI 18.28-59.24)] were more likely to experience low birth weight compared to mothers at term gestation.

Conclusion: There was no relationship between anemia in pregnancy and LBW infants.

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Introduction

According to the World Health Organization (WHO) in 2011, the maternal anemia global prevalence was 38.2%, with the largest proportion in Southeast Asia at 48.7%.[1] Based on statistical data from Indonesia Basic Health Research (Riset Kesehatan Dasar/RISKESDAS) there has been an increase in the prevalence of maternal anemia formerly 37.1% in 2013 to 48.9% in 2018.[2] From the same statistical data, it is known that proportion of low birth weight (LBW) infants in Indonesia reached 6.2% in 2018. The province with the highest proportion of LBW infants was in Central Sulawesi with 8.9% prevalence, while West Java had a proportion of LBW infants of around 6.3%.[2] According to the Health Profile of West Java Province in 2017, Bandung is the city with the highest presentation of LBW incidents (7.52%), while the lowest is Sukabumi (0.36%).[3]

The increase in maternal blood plasma volume in pregnancy serves to meet the needs of blood supply from the uterus to the fetus. The increase in blood plasma volume is also accompanied by an increase of red blood cells. However, because the increase in red blood cells is not proportional to the increase of plasma volume, it will cause an unbalanced condition called hypervolemia.[4] Hypervolemia is a condition where there is too much plasma volume in the blood, decreasing the ratio of red blood cells to blood plasma.[5] This can makes the normal concentration of hemoglobin (Hb) of pregnant women to decrease when compared to non-pregnant women.[6] If the Hb concentration continues to drop to less than 11 g/dl during the first, second, or third trimester, this condition can be called anemia in pregnancy or maternal anemia.[1]

About 60% of severe anemia in pregnancy are caused by iron deficiency.[1] The prevalence of maternal anemia was higher in pregnant women who did not take iron supplements (38.8%) compared to those who took iron supplements (29.2%).[7] Iron deficiency anemia in pregnancy occurs due to the need for iron to increase significantly because of the rapid growth and development of the fetus.[8] Various studies have reported that pregnant women with iron deficiency anemia will have a poor outcome for both mother

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and infant. In a systematic review research and international meta analysis using electronic databases, it is stated that anemia in pregnancy is considered to be a factor for the incidence of LBW.[9]

Birth weight is divided into three conditions, LBW, normal birth weight, and large birth weight. Normal birth weight is a infant weighing ≥2500-3999 grams, a infant with large birth weight is weighing ≥4000 grams, while LBW is a infant weighing <2500 grams.[10] LBW infants have a higher risk for developing various health problems as they grow. For example LBW infants in South Asia, especially those weighing less than 2000 grams, have substantial cognitive and motor impairment compared with normal birth weight infants.[11] Children with more disabilities and developmental delay have history of premature and LBW, so there is a need for developmental screening tests and interventions to reduce malnutrition in infants.[12] Regarding the school performance, LBW infants were 2-6 times more likely to have a worse performance than the infants with normal weight.[13]

Based on the explanation above, this study was conducted to find the relationship between anemia in pregnancy and the incidence of LBW infants in a tertiary referral center in Indonesia.

Methods & Materials

This cross sectional study was done from the medical records of infants born in Dr. Hasan Sadikin Central General Hospital, Bandung, Indonesia from January to March 2019. Infants born to mothers who had checked their hemoglobin levels just before delivery were included in the study. Infants with major congenital abnormalities, infants of mothers with maternal hypertension, and multiple pregnancy were excluded from the study. Data was collected from the Neonatology Division of the Department of Child Health, Dr. Hasan Sadikin Central General Hospital with the ethical exemption permit number 907/UN6. KEP/EC/2020 by the Research Ethics Commission of Padjadjaran University and online data collection permit by the Director of Human Resources, Education and Research Dr. Hasan Sadikin Central General Hospital.

By total sampling method, data was taken from 379 infant medical records and included maternal age, total parity, history of anemia in pregnancy, gestational age, gender of infant, and birth weight. Maternal gestational age was considered as the duration of gestation measured from the first day of the mother's last menstrual period until the date of examination. Term pregnancy was defined if the pregnancy has reached 37 weeks, below that range was called preterm pregnancy.[10] Maternal anemia was classified into mild and moderate anemia. Mild anemia had a Hb level from 9 to 10.9 g/dL and moderate anemia had a Hb level of 7 to 8.9 g/dL.[14] LBW infant was an infant weighing <2500 grams.[10]

Statistical analysis: The data were analyzed using univariate, bivariate, and multivariate analysis. Univariate analysis used to identify the characteristics of the research subjects. Chi-square test was used to find the relationship between anemia of pregnant women and the incidence of LBW infants, with results of p value, X^2 value, and Prevalence Ratio (PR). Bivariate analysis was also used to see differences in the distribution of LBW in other groups of variables. Multivariate binary logistic regression analysis was conducted to find the relationship between maternal age, total parity, gestational age, infant gender, and anemia simultaneously with LBW infants. Adjusted Odds Ratio (AOR) with 95% Confidence Interval (CI) was used to measure the strength of this relationship. The level of significance in this study was considered to be $p<0.05$.

Results

The characteristics of subjects are shown in Table 1. Based on Table 2 it can be seen that the proportion of LBW in this study was 45.9%. From 379 pregnant women, 138 (36.4%) had anemia and 60 pregnant women (15.8%) among them gave birth to LBW infants. Pregnant women who were not anemic amounted to 241 pregnant women (63.6%), which 114 (30.1%) of them gave birth to LBW infants (p=0.47). Other variables that also showed no difference in distribution of LBW infants were maternal age (p=0.41) and gender of the child (p=0.29). From the multivariate analysis (Table 2), the variable anemia in pregnancy, maternal age, and gender of the infant were not associated with LBW, while the amount of parity and gestational age were significantly associated with LBW incidence. Nuliparous women [p=0.039, AOR 1.91 (95% CI 1.03-3.54)] were more likely to deliver LBW infants than multiparous women. Infants born to mothers at preterm gestation [p=<0.001, AOR 32.9 (95% CI 18.28-59.24)] were more likely to experience low birth weight compared to mothers at term gestation.

Table 1. Characteristics of Research Subjects

Characteristics	N (%)
Maternal Age	
≤20 years	60 (15.8)
21-35 years	265 (69.9)
>35 years	54 (14.2)
Total Parity	
1	167 (44.1)
2-3	188 (49.6)
≤4	24 (6.3)
Gestational Age	
Premature	166 (43.8)
Term	213 (56.2)
Gender	
Female	174 (45.9)
Male	205 (54.1)
Anemia Classification	
Mild	110 (79.7)
Moderate	28 (20.3)

Table 2. Distribution and Relationship of Anemia in Pregnancy and other variables and Low Birth Weight (LBW) Infants

	LBW		p value	X2	PR (95% CI)	p value	AOR
	Yes N (%)	No N (%)					
Anemia							
Yes	60 (15.8)	78 (20.6)	0.47	0.52	0.86 (0.56-1.3)	0.43	0.79 (0.43-1.43)
No	114 (30.1)	127 (33.5)				1	1
Maternal Age							
<35 years	152 (40.1)	173 (45.7)	0.41	0.67	1.28 (0.71-2.3)	0.76	1.14 (0.47-2.76)
>35 years	22 (5.8)	32 (8.4)				1	1
Total Parity							
Nulliparous	91 (24)	76 (20.1)	0.003	8.85	1.86 (1.23-2.8)	0.039	
Multiparous	83 (21.9)	129 (34)				1	
Gestational Age							
Premature	141 (37.2)	25 (6.6)	<0.001	181.19	30.76 (17.5-54.1)	<0.001	
Term	33 (8.7)	180 (47.5)				1	
Gender							
Female	85 (22.4)	89 (23.5)	0.29	1.12	1.24 (0.83-1.86)	0.05	
Male	89 (23.5)	116 (30.6)				1	

Note: AOR - Adjusted Odds Ratio, PR - Prevalence Ratio.

Discussion

Anemia is a problem that often occurs in pregnancy. This study found that anemia in pregnancy occurred quite often, namely 36.4%. However, there is a big difference in the proportion of maternal anemia in different countries such as US where only 10% of the mothers were diagnosed with anemia in pregnancy.[15] Proportion of infants born with LBW also varies in different countries from 11.4% in India while our study has 45.9% infants with LBW.[16] This means Indonesia especially Bandung still needs an extra attention to maternal and child healthcare for a better health outcome.

Anemia in pregnancy raise the risks of bad outcomes for the infant, such as premature birth and LBW infant. Anemia can cause LBW in infant due to decreased oxygen supply through the placenta to the fetus.[15] Explanation regarding the relationship between anemia and LBW infants is due to the decreased oxygen supply reducing fetal fat and glycogen stores. If the fat and glycogen stores are reduced, it will cause the fetus to be in a hypoglycemic state. This will make Insulin like Growth Factor-I (IGF-I) decrease, because the regulation is regulated and is directly proportional to the supply of glucose to the fetus. The function of IGF-I is to stimulate proliferation, differentiation, protein and glycogen synthesis from fetal cells, and growth of neurons and brain. Decreased levels of IGF-I have been shown to make the fetal growth rate decrease and when the infant is born it will make his birth weight lower below normal limits.[17,18,19]

Contrary to the above, research by Bencaiova et al. (2014) states that anemia in pregnancy did not have a negative impact on the infant, because mild anemia which was also the most prevalent degree of anemia in this study (79.7%), was not associated with poor outcome in infants due to the protective effect that can still be obtained from adequate iron supplementation.[20] In this study it was found that anemia did not lead to LBW infants.

An infant can have LBW due to fetal growth restriction, premature birth or both. Fetal growth restriction is divided into three main causative factors, that are maternal, fetal and placental factors. Maternal factors are under nutrition, hypertension and preeclampsia. Fetal factors are chromosomal or congenital abnormalities, multiple pregnancy, and infection. Placental factor is the most common cause and generally described as placental insufficiency, i.e., several types of diseases cause reduced transfer of oxygen and nutrients to the fetus.[17,21] The cause of LBW infant due to infants born prematurely occurred in this study. It showed that preterm infants had the chance to be born LBW by 32.9 (95% CI=18.28-59.24).

Based on the explanation above, the internal risk factors for LBW infant can be due to various things. The assumption for the results of this study that there is no relationship between anemia in pregnancy and LBW infants is because there are still many factors that cannot be excluded as confounding factors in this study. Moreover, Dr. Hasan Sadikin Central General Hospital Bandung is a class A hospital which is the highest referral hospital in West Java Indonesia. This hospital accepts many patients from other hospitals with various conditions of pregnant women including diseases that have been mentioned in the previous paragraph.

Another result obtained in this study was no relationship between pregnant women aged ≤35 years and >35 years with the LBW infants (p=0.76). According to Goisis et al. (2017), there was no relationship between advanced maternal age and LBW infant due to unobserved factors such as the social background of parents and genetic factors.[22]

It was found that nulliparous women had a chance of giving birth to LBW 1.91 times more than multiparous women (95% CI 1.03-3.54). Nulliparous women often have complications because the mother is probably can not adapt well to pregnancy, causing excessive anxiety which results in stress and affects the development of the fetus.[23] However according to a cohort study by Tellapragada et al. in India, amount of parity was not a risk factor for LBW, but rather periodontitis, hypertension, maternal height <150 cm, and late-pregnancy genital infection.[16]

Even though the data sample consists of more male infants than female infants, but the proportion of female was higher in LBW infants (48.8%) than those without LBW infants (43.4%). The proportion of male was higher in non LBW infants (56.6%) compared to LBW infants (51.1%). This proportion was in accordance with other studies, although statistically there was no relationship between gender and LBW (p=0.05). Andayasari et al. concluded that most of the LBW infants were female (55.2%) and the risk of giving birth to LBW was higher in female than male (ORa=1.42; P=0.017).[24] The exact mechanism of gender differences on the effect on infant birth weight is still unknown, but several studies have hypothesized that these differences in birth weight were due to differences in the effect of androgens on body composition.[25]

The weakness of this research was due to confounding factors that cannot be fully controlled. Confounding factors greatly influence the relationship between the independent and dependent variables. In this study, the confounding factors assumed to have a lot of influence were conditions that can cause impaired fetal growth, such as diabetes in pregnancy, maternal nutritional status before and during pregnancy, and maternal infections. This study also could not identify the timing of anemia during pregnancy because of the limited data.

Conclusion

The result showed that there was no relationship between anemia in pregnancy and LBW infants. Most of the anemia in this study was mild anemia, therefore iron supplementation can be promoted to pregnant women and preconception women as the preventive measure for more severe anemia.

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Compliance with Ethical Standards

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References:

1. World Health Organization (WHO). The global prevalence of anaemia in 2011 [Internet]. WHO. 2015. Available from: https://apps.who.int?iris/hendle/10665/177094. Accessed on 7th July 2021
2. RISKESDAS. Hasil Utama Riset Kesehatan Dasar. Kementrian Kesehat Republik Indones [Internet]. 2018;1-100. Available from: http://www.depkes.go.id/resources/download/info-terkini/hasil-riskesdas-2018.pdf. Accessed on 7th July 2021
3. Dinas Kesehatan Jawa Barat. Profil Kesehatan Provinsi Jawa Barat Tahun 2017 [Internet]. 2017. Available from: http://diskes.jabarprov.go.id/dmdocuments/01b3018430a412a520e2b4a4b9d9864f.pdf. Accessed on 7th July 2021
4. Cunningham FG, Leveno KJ, Bloom SL, Dashe JS, Hoffman BL, Casey BM, et al. Maternal Physiology. In: Moyer A, Brown RY, eds. Williams Obstetrics. 25th ed. New York City: McGraw-Hill Education; 2018:57-58.
5. Akinbami AA, Ajibola SO, Rabiu KA, Adewunmi AA, Dosunmu AO, Adediran A, et al. Hematological profile of normal pregnant women in Lagos, Nigeria. Int J Womens Health. 2013;5:227-232.
6. Bakrim S, Motiaa Y, Ouarour A, Masrar A. Hematological parameters of the blood count in a healthy population of pregnant women in the northwest of Morocco (Tetouan-M'diq-Fnideq provinces). Pan Afr Med J. 2018;29:1-12.
7. Ononge S, Campbell O, Mirembe F. Haemoglobin status and predictors of anaemia among pregnant women in Mpigi, Uganda. BMC Res Notes. 2014;7:1-8.
8. World Health Organization (WHO). Nutritional Anaemias: Tools for Effective Prevention and Control [Internet]. Geneva: 2017. Available from: https://apps.who.int/iris/handle/10665/259425. Accessed on 7th July 2021
9. Figueiredo ACMG, Gomes-Filho IS, Silva RB, Pereira PPS, Da Mata FAF, Lyrio AO, et al. Maternal anemia and low birth weight: A systematic review and meta-analysis. Nutrients. 2018;10:1-17.
10. World Health Organization (WHO). International Classification of Diseases for Mortality and Morbidity Statistics [Internet]. 2018 [cited 2020 Aug 13]. Available from: https://icd.who.int/browse11/l-m/en#/http%3A%2F%2Fid.who.int%2Ficd%2Fentity%2F1950379483?view=G0. Accessed on 7th July 2021
11. Upadhyay RP, Naik G, Choudhary TS, Chowdhury R, Taneja S, Bhandari N, et al. Cognitive and motor outcomes in children born low birth weight: A systematic review and meta-analysis of studies from South Asia. BMC Pediatr. 2019;19:1-15.
12. Ahishakiye A, Abimana MC, Beck K, Miller AC, Betancourt TS, Magge H, et al. Developmental Outcomes of Preterm and Low Birth Weight Toddlers and Term Peers in Rwanda. Ann Glob Heal. 2019;85:147.
13. Islam MM. The Effects of Low Birth Weight on School Performance and Behavioral Outcomes of Elementary School Children in Oman. Oman Med J. 2015;30:241-251.
14. Goonewardene M, Shehata M, Hamad A. Anaemia in pregnancy. Best Pract Res Clin Obstet Gynaecol. 2012;26:3-24.
15. Beckert RH, Baer RJ, Anderson JG, Jelliffe-Pawlowski LL, Rogers EE. Maternal anemia and pregnancy outcomes: a

population-based study. J Perinatol. 2019;39:911-919.

16. Tellapragada C, Eshwara VK, Bhat P, Acharya S, Kamath A, Bhat S, et al. Risk factors for preterm birth and low birth weight among pregnant Indian women: A hospital-based prospective study. J Prev Med Public Heal. 2016;49:165-175.
17. Malhotra A, Allison BJ, Castillo-Melendez M, Jenkin G, Polglase GR, Miller SL. Neonatal morbidities of fetal growth restriction: Pathophysiology and impact. Front Endocrinol (Lausanne). 2019;10:3-5.
18. Niknafs P, Sibbald J. Intrauterine growth retardation index. Ultrasound Q. 2001;17:255-260.
19. Sharma D, Shastri S, Sharma P. Intrauterine Growth Restriction: Antenatal and Postnatal Aspects. Clin Med Insights Pediatr. 2016;10:67-83.
20. Bencaiova G, Breymann C. Mild anemia and pregnancy outcome in a swiss collective. J Pregnancy. 2014;2014:307535.
21. Cutland CL, Lackritz EM, Mallett-Moore T, Bardají A, Chandrasekaran R, Lahariya C, et al. Low birth weight: Case definition & guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2017;35:6492-500.
22. Goisis A, Remes H, Barclay K, Martikainen P, Myrskylä M. Advanced Maternal Age and the Risk of Low Birth Weight and Preterm Delivery: A Within-Family Analysis Using Finnish Population Registers. Am J Epidemiol. 2017;186:1219-1226.
23. Ertiana D. Age and Parity of Mother with Incidence and Degree of Newborn (LBW). EMBRIO. 2020;12:66-78.
24. Andayasari L, Opitasari C. Parity and risk of low birth weight infant in full term pregnancy. Heal Sci J Indones. 2016;7:13-16.
25. Hiort O. The differential role of androgens in early human gender development. BMC Med. 2013;11:2-3.