Enferm Clin. 2020;30(S2):92–95

Enfermería Clínica

www.elsevier.es/enfermeriaclinica

Maternal hemoglobin concentration and birth weight: A report from mother and child tertiary hospital☆

D.S. Riu[a,*], N.A. Mappaware[a], Fujiyanto[b], M.N. Asmi[b], A.R. Tansil[b]

[a] Obstetric and Gynecologic Department, Hasanuddin University, Makassar, Indonesia
[b] Obstetric and Gynecologic Residency Program, Medicine Faculty, Hasanuddin University, Makassar, Indonesia

Received 29 May 2019; accepted 15 July 2019

KEYWORDS
Anemia;
Pregnancy;
Low birth weight

Abstract
Objective: To evaluate the prevalence of anemia in pregnancy and determine the relationship between maternal anemia during pregnancy and low birth weight, babies.
Methods: This study was a cross-sectional design which was conducted at Siti Khadijah 1 Tertiary Hospital from January 2017 to October 2018. The total sample of the study was 6876 samples.
Results: Anemia prevalence was 46.6%. Mothers with anemia were more likely to give birth to babies with low birth weight compared to mothers who were not anemic, which is 373 respondents (11.7%) versus 265 respondents (7.2%). Respondents with severe anemia gave birth to more babies with low birth weight than babies with normal birth weight, which is 49 people (92.5%) versus 4 (7.5%) ($p = 0.000$, $p < 0.05$).
Conclusion: There was a significant association between maternal hemoglobin and birth weight.

Introduction

Approximately 7–15% of newborns worldwide are born with a low birth weight per year. Poor pregnancy outcomes are still a significant health problem and are more common in developing countries with low to middle socio-economic conditions.[1] World Health Organization (WHO) has defined low birth weight as the birth weight of an infant less than 2500 g.[2] Babies born with low birth weight are more likely to experience morbidity and mortality. Nutritional elements, as well as inadequate nutrition such as vitamin B and iron deficiency and lack of weight gain during pregnancy, contribute to the incidence of low birth weight babies.[1]

One of the primary goals of the United Nations resolution in 2025 is to reduce the prevalence of low birth weight by 30%, from a baseline of 15%. This target has an important contribution to the Sustainable Development Goals (SDG) in

☆ Peer-review under responsibility of the scientific committee of the International Conference on Women and Societal Perspective on Quality of Life (WOSQUAL-2019). Full-text and the content of it is under responsibility of authors of the article.

* Corresponding author.
E-mail address: virayariu@gmail.com (D.S. Riu).

https://doi.org/10.1016/j.enfcli.2019.07.042
1130-8621/

reducing child mortality to 12 deaths per 1000 live births and under-five deaths to 25 deaths per 1000 live births.[3]

Iron is a mineral needed for the formation of new hemoglobin and is the main source of energy and transportation of oxygen to the organs of the body. Maternal anemia can occur because of the lack of iron reserves that interfere with the erythropoiesis process and can also be caused by an infection process, which can affect the new hemoglobin metabolism.[4]

The prevalence of anemia all over the world is 51%.[5,6] Rates of anemia are highest in low-income countries, especially in Africa (44.6%), Central and West Africa (48% of reproductive-age women and 56% of pregnant women), Asia (39.3%), South Asia (47% of reproductive-age women and 52% of pregnant women), Latin America and the Caribbean (28.3%) and Oceania (29%).[7,8]

The relationship between hemoglobin levels in mothers and the incidence of low birth weight is still controversial. Some studies report anemia occurring in the early phase of pregnancy-associated with poor pregnancy outcomes such as low birth weight, although other studies report no significant relationship.[9,10] Therefore, considering the controversy in maternal anemia in pregnancy and low birth weight, this study aimed to find the prevalence anemia in pregnancy and determine the relationship between maternal anemia during pregnancy and low birth weight, babies.

Methods

Study design and sample population

This study used a cross-sectional design, which is secondary research using records from a hospital health record system of mothers who delivered at Siti Khadijah 1 Hospital, Makassar, between January 2017 and October 2018, demographic and obstetric information was collected. Data regarding age, weight, parity, past medical history and complication (i.e., hypertension, autoimmune disease, Basedow's disease (i.e., hyperthyroidism and hypothyroid disease), history of drug consumption, smoking and drinking status were taken from medical records and antenatal care books. The institutional review board at the Siti Khadijah 1 approved this study.

Inclusion criteria were; singleton pregnancy, hemoglobin was measured when first admitted to the hospital and participants who delivered at Siti Khadijah 1 hospital between 37 and 42 weeks of gestation. The patient remembers her last menstrual period correctly. Excluded criteria were preterm births (i.e., <37 weeks of pregnancy), subjects with prepregnancy diabetes mellitus (DM), gestational diabetes mellitus (GDM), placenta previa, preeclampsia, thyroid disease and fetal anomalies, incomplete medical record data (missing data). A total of 7589 samples delivered at the Siti Khadijah 1 hospital during the study period. Of these, the following were excluded: 42 twin births, 459 preeclampsia, 54 with placenta previa, and 4 with fetal anomalies, 91 deliveries before 37 weeks of gestation, six post-term deliveries, 34 with missing Hemoglobin values, 23 with missing data of birth weight. Thus, a total of 6876 pregnancies were included in the analysis (Fig. 1).

Hemoglobin and birth weight measurements

Hemoglobin measurements were performed once the patient came to the hospital for delivery. Hemoglobin levels were measured immediately after blood sample collection with a Mindray BC-3000 plus hematology analyzer that has been calibrated. Anemia is defined as hemoglobin <11.0 g/dL, according to the World Health Organization definition. Birth outcomes were measured with a calibrated baby scale (Serenity). Low birth weight is defined as the weight of less than 2500 g.

Statistical analysis

Association was examined with chi-square (X^2) for statistical significance.

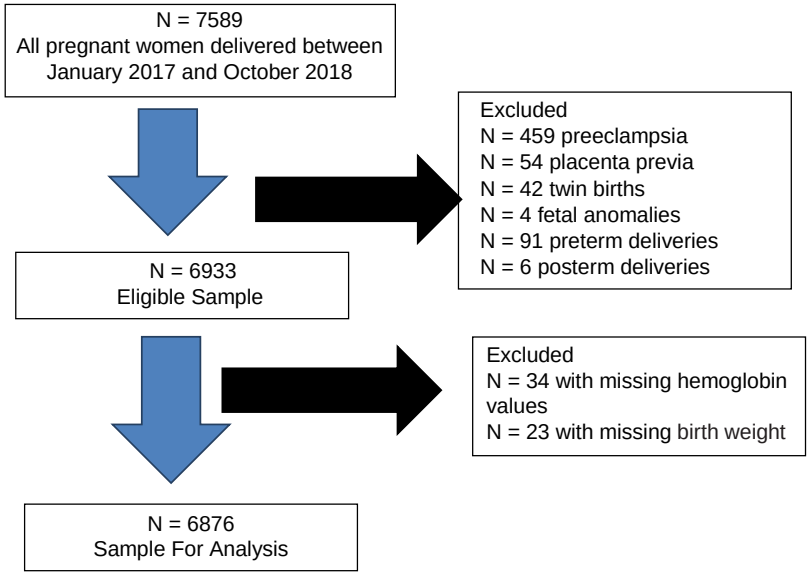

Figure 1 Participant flow chart.

Table 1 Demographic characteristics of respondents.

Characteristics	*n*	%
Age		
<20	180	2.6
20–35	5574	81.1
>35	1122	16.3
Education		
Elementary school	952	13.8
Junior high school	1365	19.9
Senior high school	2992	43.5
Diploma	12	0.2
Bachelor degree	1555	22.6
Gravidity		
Primigravidity	2485	36.1
Multigravidity	3954	57.5
Grande multigravidity	437	6.4
Anemia		
Anemia	3200	46.6
Normal	3676	53.4
Anemia status		
Normal	3676	53.4
Mild anemia	2701	39.3
Moderate anemia	446	6.5
Severe anemia	53	0.8
Birth weight		
Low birth weight	638	9.3
Normal birth weight	6238	90.7

Results

Table 1 shows that 81.1% of respondents aged 20–35 years (5574 respondents). The majority of respondents are high school graduates (43.5%/2992 respondents), multigravidity (57.5%/3954 respondents), 53.4% (3676 respondents) of participants were found with normal hemoglobin levels and 46.6% were anemic. 39.3% of 46.6% of anemic participants have mild anemia. 90.7% (6238 babies) were born with normal birth weight, and 9.3% (638 babies) were born with low birth weight.

Table 2 shows that respondents with severe anemia gave birth to more babies with low birth weight than babies with normal birth weight, which is 49 people (92.5%) versus 4 (7.5%). Respondents with mild anemia gave birth to more babies with normal birth weight than babies with low birth weight, which is 2493 respondents (92.3%) versus 208 (7.7%). Based on the statistical test, the value of $p = 0.000$ ($p < 0.05$) was obtained which means there is a relationship between anemia status and low birth weight incidence in which severe anemia is a major risk factor.

Discussion

The current study results agree with the findings from various studies that found the general occurrence of anemia among pregnant women was assessed to be 72.5%, 61.2%, 43%, 36%, and 13% in India, Nigeria, Turkey, Bangladesh, and New Zealand, respectively.[11–14] During pregnancy, the plasma volume expansion and lowered hematological indices could be observed as a physiologic response. In a healthy pregnancy, maternal concentrations of hemoglobin decrease in the first 20 weeks remain constant up to week 30 gestational age and then increase slightly.[15] Therefore, the mild anemia that is observed in pregnant women can be due to significant plasma expansion or can be a result of iron deficiency. It must be considered clearly to decide on iron or other vitamin administration to prevent anemia in pregnant women.[6]

This study revealed, most types of anemia found were mild anemia, with a percentage of 39.2% (2701 respondent). It is most likely due to the expansion of physiological volume that occurs during pregnancy, which causes mild anemia plus another factor such as iron deficiency. Maternal anemia was related to the incidence of low birth weight, especially severe anemia.

Iron is a crucial component in the metabolic processes involved in tissue oxygenation. Lowered iron stores in their newborn baby will increase the risk of subsequent iron deficiency anemia. Prematurity and early weaning off breastfeeding increase the risk further, because of reduced iron stores.[16] Anemia effect gradually increases due to growing fetus needs iron compensation from the mother directly. Baby birth weight is compensated because placental perfusion becomes more favorable for maternal–fetal gas and nutrient exchange with reduced blood viscosity.[17]

The most common cause of iron deficiency anemia in infancy and childhood is iron deficiency anemia in the mother during pregnancy. Anemia affects cognitive function,

Table 2 Association between anemia and the incidence of low birth weight.

	Birth weight				Total		*P*-value
	Low		Normal		*n*	%	
	n	%	*n*	%			
Normal	265	7.2	3411	92.8	3676	100.0	
Mild anemia	208	7.7	2493	92.3	2701	100.0	
Moderate anemia	116	26	330	74	446	100.0	0.000*
Severe anemia	49	92.5	4	7.5	53	100.0	
Total	638	9.3	6238	90.7	6876	100.0	

* Chi square.

growth, and physical development of babies, preschoolers, and school age.[18]

Conclusion

Our study concluded that there was a significant association between maternal hemoglobin and birth weight.

Conflict of interest

The authors declare no conflict of interest.

References

1. Figueiredo A, Gomes-Filho I, Silva R, Pereira P, Mata F, Lyrio A, et al. Maternal anemia and low birth weight: a systematic review and meta-analysis. Nutrients. 2018;10: 601.
2. Sharma M, Mishra S. Effects of maternal health and nutrition on birth weight of infant. Int J Sci Res. 2014;3:855–8.
3. Branca F, Grummer-Strawn L, Borghi E, Blössner Md, Onis Md. Extension of the WHO maternal, infant and young child nutrition targets to 2030. SCN News. 2015: 55–8.
4. Grotto HZ. Metabolismo do ferro: uma revisão sobre os principais mecanismos envolvidos em sua homeostase. Revista Brasileira de Hematologia e hemoterapia. 2008.
5. Singal N, Taneja BK, Setia G, Singal KK. Foetal outcome in pregnant women with anaemia. Bangladesh J Med Sci. 2019;18:63–72.
6. Al-Hajjiah NN, Almkhadree MA. The effect of maternal anaemia on the anthropometric measurements in full-term neonates. Asian J Pharm Clin Res. 2018;11:3680–1.
7. Rahman MM, Abe SK, Rahman MS, Kanda M, Narita S, Bilano V, et al. Maternal anemia and risk of adverse birth and health outcomes in low-and middle-income countries: systematic review and meta-analysis, 2. Am J Clin Nutr. 2016;103:495–504.
8. Organization WH. World health statistics 2015: World Health Organization; 2015.
9. Badfar G, Shohani M, Soleymani A, Azami M. Maternal anemia during pregnancy and small for gestational age: a systematic review and meta-analysis. J Matern Fetal Neonatal Med. 2019;32:1728–34.
10. Jwa SC, Fujiwara T, Yamanobe Y, Kozuka K, Sago H. Changes in maternal hemoglobin during pregnancy and birth outcomes. BMC Pregnancy Childbirth. 2015;15:80.
11. Malhotra M, Sharma J, Batra S, Sharma S, Murthy N, Arora R. Maternal and perinatal outcome in varying degrees of anemia. Int J Gynaecol Obstet. 2002;79:93–100.
12. Akinola O, Fabamwo A, Tayo A, Oshodi Y. Maternal haemoglobin and foetal birth weight-any relationship? Niger Med Pract. 2008;54:50–2.
13. Telatar B, Comert S, Vitrinel A, Erginoz E, Akin Y. The effect of maternal anemia on anthropometric measurements of newborns. Saudi Med J. 2009;30:409–12.
14. Brough L, Rees GA, Crawford MA, Morton RH, Dorman EK. Effect of multiple-micronutrient supplementation on maternal nutrient status, infant birth weight and gestational age at birth in a low-income, multi-ethnic population. Br J Nutr. 2010;104:437–45.
15. Tunkyi K, Moodley J. Anemia and pregnancy outcomes: a longitudinal study. J Matern Fetal Neonatal Med. 2018;31:2594–8.
16. Abu-Ouf NM, Jan MM. The impact of maternal iron deficiency and iron deficiency anemia on child's health. Saudi Med J. 2015;36:146.
17. Vural T, Toz E, Ozcan A, Biler A, Ileri A, Inan AH. Can anemia predict perinatal outcomes in different stages of pregnancy? Pak J Med Sci. 2016;32:1354.
18. Khanal V, Zhao Y, Sauer K. Role of antenatal care and iron supplementation during pregnancy in preventing low birth weight in Nepal: comparison of national surveys 2006 and 2011. Arch Public Health. 2014;72:4.