

The Correlation Between Anemia and Chronic Energy Deficiency in Pregnant Women With the Incidence of Low Birth Weight at the Ciwaringin Cirebon Health Center in 2020 – 2022

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Abstract

Introduction: In 2020 there were 19.8 million babies born with low birth weight (LBW). The occurrence of LBW is mainly caused by maternal malnutrition or anemia.

Objective: This study aims to analyze the association of anemia and Chronic Energy Deficiency (CED) in pregnant women with the incidence of Low Birth Weight (LBW) in Puskesmas Ciwaringin Cirebon in 2020 – 2022.

Methods: This study was a cross-sectional study with 339 respondents. Medical records were used as secondary data. Data analysis included univariate analysis, bivariate analysis (using chi-square test), and multivariate analysis (using logistic regression test).

Results: The percentage of mothers with a history of LBW based on this study reached 69.6%, pregnant women with anemia reached 68.4%, and pregnant women with CED reached 73%. Similarly, a significant association was found between anemia among pregnant women and LBW (p-value 0.001; PR= 2.940). A significant association was also found between CED and LBW (p-value 0.001; PR= 2.115). Anaemia was a factor that had a greater likelihood of causing LBW (Exp(B) = 12.596) than CED (Exp(B) = 3.707).

Conclusion: There is an association between anemia and CED in pregnant women with the incidence of LBW in Puskesmas Ciwaringin Cirebon in 2020 - 2022.

Keywords: Anaemia; Chronic Energy Deficiency; Low Birth Weight

Hubungan Antara Anemia dan Kekurangan Energi Kronik Pada Ibu Hamil Dengan Kejadian Berat Bayi Lahir Rendah di Puskesmas Ciwaringin Tahun 2020 – 2022

Abstrak

Pendahuluan: Pada tahun 2020 terdapat 19,8 juta bayi lahir dengan berat badan lahir rendah (BBLR). Terjadinya BBLR terutama disebabkan oleh kurang gizi pada ibu atau anemia.

Tujuan: Penelitian ini menganalisis hubungan terkait anemia dan Kekurangan Energi Kronik (KEK) pada ibu hamil dengan kejadian Berat Bayi Lahir Rendah (BBLR) di Puskesmas Ciwaringin Cirebon tahun 2020 – 2022.

Metode: Penelitian ini merupakan penelitian *cross sectional* dengan jumlah subjek sebanyak 339 responden. Rekam medis digunakan sebagai data sekunder. Analisis data meliputi analisis univariat, analisis bivariat (menggunakan uji chi-square), dan analisis multivariat (menggunakan uji regresi logistik).

Hasil: Presentase ibu dengan riwayat BBLR berdasarkan penelitian ini mencapai 69,6%, ibu hamil dengan anemia mencapai 68,4%, dan ibu hamil dengan KEK mencapai 73%. Demikian pula, hubungan yang signifikan juga ditemukan antara anemia pada ibu hamil dan BBLR (p value 0,001; PR= 2,940). Hubungan yang signifikan juga ditemukan antara KEK dengan kejadian BBLR dengan (p value 0,001; PR= 2,115). Anemia merupakan faktor yang memiliki kemungkinan lebih besar menyebabkan BBLR (Exp(B) = 12.596) dibandingkan KEK (Exp(B) = 3.707).

Kesimpulan: Terdapat hubungan antara anemia dan KEK pada ibu hamil dengan kejadian BBLR di Puskesmas Ciwaringin Cirebon tahun 2020 - 2022.

Kata Kunci: Anemia; Kekurangan Energi Kronik; Berat Bayi Lahir Rendah

Introduction

The World Health Organization (WHO) reported 19.8 million cases of low birth weight newborns in 2020.¹ Low birth weight (LBW) occurs when a newborn weighs less than 2,500 grams and is born at 37 weeks gestation or later. Maternal risk factors for low birth weight include maternal age, parity, small upper arm circumference, and hemoglobin levels.² Babies with low birth weight are at risk of developing growth and development issues in the future due to malnutrition.³

Anemia in pregnant women is defined by low hemoglobin levels below normal.⁴ Malnourished pregnant women are more likely to develop anemia, suffer from chronic energy shortage, and have babies with low birth weights. Lower hemoglobin levels during pregnancy result in lower birth weight.⁵ Anemia during pregnancy can harm both the mother and the fetus. Low hemoglobin levels in pregnant women can result in a variety of symptoms such as trouble breathing, fainting, exhaustion, lethargy, tachycardia, and palpitations. Furthermore, anemia diminishes resistance to infection and the risk of bleeding during and after childbirth. On the other side, fetal anemia can result in intrauterine hypoxia and growth retardation.⁶

Mid-upper arm Circumference (MUAC) <23.5 cm in pregnant women implies chronic energy deficiency. Chronic Energy Deficiency (CED) poses risks to both the mother and the fetus, including anemia, hemorrhage during labor and even miscarriage, fetal anomalies, and the birth of newborns with low birth weight.⁷

According to the Ministry of Health's 2020 Indonesian health profile, low birth weight (LBW) is the leading cause of newborn death, accounting for 35.2%.⁸ In West Java Province, 2.4% of LBW cases were discovered in 2020,⁹ which grew to 2.8%¹⁰ in 2021 and then dropped to 2.7% in

2022.¹¹ Meanwhile, data from the Cirebon Regency Health Office in 2022 revealed that LBW was the leading cause of infant fatalities, with a percentage of 50.72%,¹² up from 41.1% in 2020. The percentage of newborns with low birth weight in 2021 was 3.6%¹³ but fell to 2.6% in 2022.¹⁴ However, some health centers in Cirebon Regency continued to have cases of newborns with low birth weight, including the Ciwaringin Health Center. In 2020, the Ciwaringin Health Center recorded 0.9%¹² of LBW cases, which grew to 2.3% in 2022.¹⁴

According to the World Health Organization (WHO), up to 24% of pregnant women reported anemia in 2021, with developing nations accounting for 89% of cases of anemia-related newborn abnormalities in 2022.¹⁵ In Indonesia, the prevalence of anemia among women in 2022 was reported to be 28.6%, with pregnant women accounting for 25% of the total.⁷ Anemia was prevalent among pregnant women in West Java in 2021, ranging from 25% to 41%, and increased by 51% in 2022.^{10,11} More specifically, 23% of pregnant women's anemia cases occurred in Cirebon Regency in 2021, with a 19% increase in 2022.^{13,14} According to the Cirebon Regency Health Office, Ciwaringin Health Center had the highest percentage of anemia cases in 2022, at 16%, when compared to other health centers in Cirebon Regency.¹⁴

Based on Indonesian Health data, it was reported that there were 4.6 million pregnant women in 2022, of which 9.6% had a LILA <23.5 cm, indicating that the mother was experiencing chronic energy deficiency.⁸ In 2020, data from the West Java Health Office revealed that there were 55 thousand cases of mothers with CED and experienced an increase in cases of 3.9% in 2022.^{10,11} Following this data, Ciwaringin Health Center has the highest percentage of CED cases in Cirebon Regency, at 20%, in 2022.¹⁴

Method

This study employed an observational analytical research method with a cross-sectional research approach. The study included mothers who gave birth at the Ciwaringin Cirebon Health Center between 2020 and 2022. The research sample was drawn from the research population using inclusion criteria (mothers giving birth at the Ciwaringin Cirebon Health Center in 2020–2022 and mothers who had complete medical records) and exclusion criteria (mothers who had complications during pregnancy).

Sampling was carried out using a simple random sampling technique with a total of 339 respondents. This study used secondary data in the form of medical records obtained from the Ciwaringin Cirebon Health Center in 2020–2022.

The data analysis process to determine the frequency distribution of each variable was carried out using univariate analysis. Meanwhile, bivariate analysis was performed using the chi-square test. In the multivariate analysis, a logistic regression test was utilized to identify the variables that had the greatest impact on giving birth to LBW.

Results

The results of research conducted at the

Ciwaringin Cirebon Health Center with 339 respondents found the following results:

Univariate Analysis

According to Table 1, the frequency distribution of anemia in pregnant women at the Ciwaringin Cirebon Health Center in 2020–2022 was 232 (68.4%) respondents who experienced anemia and 107 (31.6%) who did not. Regarding CED, the frequency distribution of CED cases at the Ciwaringin Cirebon Health Center in 2020–2022 revealed that 250 (73.7%) respondents encountered CED, while 89 (26.3%) did not suffer from CED. Furthermore, according to the frequency distribution of LBW cases at the Ciwaringin Cirebon Health Center in 2020–2022, 236 (69.6%) respondents had LBW, while the remaining 103 (30.4%) had normal-weight babies.

Bivariate Analysis

Table 2 demonstrates that 232 respondents have anemia during pregnancy, 204 (60.2%) have babies with low birth weight, and 28 (8.3%) have babies with normal weight or no LBW. Of those who did not develop anemia during pregnancy, 32 (94%) gave birth to babies with LBW, whereas 75 (22.1%) did not. The chi-square test resulted in a p-value of $0.001 < 0.05$, indicating a

Table 1 Frequency Distribution of Anemia in Pregnant Women

		Frequency	Percentage
Anemia	Yes (Hb <11 g/dl)	232	68.4%
	No Anemia (Hb $\geq$ 11 g/dl)	107	31.6%
	Total	339	100 %
CED	Yes (MUAC <23,5 cm)	250	73.7%
	No CED (MUAC $\geq$ 23,5 cm)	89	26.3%
	Total	339	100 %
LBW	LBW (Weight <2500 grams)	236	69.6%
	No LBW (Weight $>$ 2500 grams)	103	30.4%
	Total	339	100 %

Table 2 Correlation between Anemia in Pregnant Women and the Incidence of LBW

			LBW		Total	p-value	PR
			Yes	No			
Anemia	Yes (Hb<11g/dl)	N	204	28	232	0.001	2.940
		%	60.2%	8.3%	68.4%		
	No Anemia (Hb ≥ 11 g/dl)	N	32	75	107		
		%	9.4%	22.1 %	31.6%		
Total		N	236	103	339		
		%	69.6%	30.4%	100%		

Table 3 Correlation between CED in Pregnant Women and the Incidence of LBW

		LBW				Total	p-value	PR
		Yes	No					
CED	Yes (MUAC <23.5 cm)	N	202	48	250	0.001	2.115	
		%	59.6%	14.2%	73.7 %			
	No CED (MUAC ≥23.5 cm)	N	34	55	89			
		%	10 %	16.2%	26.3%			
Total		N	236	103	339			
		%	69.6%	30.4%	100%			

significant correlation between anemia and the prevalence of LBW at the Ciwaringin Cirebon Health Center during 2020-2022. The results of the Prevalence Ratio value analysis were 2.940 which can be interpreted that pregnant women with anemia have a prevalence 2.9 times higher risk of giving birth to babies with LBW.

According to the data in Table 2, 202 (59.6%) of the 250 respondents who experienced CED gave birth to babies with LBW, whereas 48 (14.2%) gave birth to babies of normal weight. Furthermore, there are 34 (10%) respondents who did not experience CED who gave birth to babies with LBW and 55 (16.2%) respondents who did not give birth to babies with LBW. The results obtained from the chi-square test showed a p-value of 0.001 <0.05 which indicated a correlation between CED in pregnant women and the

incidence of CED at the Ciwaringin Cirebon Health Center in 2020–2022. Meanwhile, the results of the analysis of the Prevalence Ratio value of 2.115 showed that pregnant women with CED had a 2.1 times higher prevalence of being at risk of giving birth to LBW.

Multivariate Analysis

In Table 3, multivariate analysis with logistic regression revealed a p-value of 0.001 <0.05 for anemia and CED variables. This finding explains the correlation between anemia and CED in pregnant women and the incidence of LBW at Ciwaringin Cirebon Health Center in 2020–2022. The variable having the greatest influence on the incidence of LBW is anemia, as demonstrated by an Exp(B) value of 12.596, showing that anemia is a cause of the risk of pregnant women giving birth to

Table 4 Multivariate Analysis

Variable	B	Sig	Exp(B)	95% C.I. for Exp (B)	
				Lower	Upper
Anemia	2.533	0.001	12.596	6.957	22.806
CED	1.310	0.001	3.707	1.976	6.959
Constant	-2.268	0.001	0.104		

LBW, with a prevalence 12.5 times greater than mothers with CED.

Discussion

The findings of a study conducted at the Ciwaringin Cirebon Health Center in 2020-2022 on the relationship between anemia and CED in pregnant women and the incidence of low birth weight babies revealed that there were more pregnant women who experienced anemia (68.4%) than mothers who did not experience anemia during their pregnancy (31.6%), as shown in Table 2.

This study resulted in findings that are consistent with the research conducted by Baiq Iramayasari (2023), who stated that the incidence of anemia in pregnant women at the Aik Mual Health Center can be attributed to a variety of factors, including pregnant women's lack of knowledge about the importance of consuming Fe tablets before pregnancy and nutrition from the food consumed. The cause of anemia in the area is also influenced by the mother's basic education level.¹⁶

The most prevalent cause of anemia is malnutrition. It is a clinically manifested illness characterized by several deficiencies that are associated with infection, nutritional deficiencies, or hereditary problems such as hemoglobinopathy.¹⁷ However, the fundamental causes of nutritional anemia include increased nutrient loss, high but unmet dietary requirements, and inefficient hematopoietic nutrient use.¹⁷ The second most prevalent reason is megaloblastic anemia, which can be caused by a lack of folate or vitamin B12.¹⁷ Rare anemia can

also be caused by hemoglobinopathies, inflammatory processes, chemical toxicity, or malignant tumors.¹⁸

Based on Table 1, the number of mothers who experienced CED during pregnancy was higher (73.7%) than mothers who did not experience CED (26.3%). This study aligns with Hamang's (2022) findings, which revealed that 59 (88.1%) mothers had MUAC <23.5 cm.³ According to theory, pregnant women's bodies experience higher nutrient metabolism. Fetal growth and development necessitate additional energy and minerals. As a result, mothers have to take in an additional 300 calories and 12 grams of protein during pregnancy, bringing their total calorie need to 2500 calories and 75-100 grams of protein. If the expectant mother consumes fewer than 1500 calories per day, she is more likely to give birth to a baby who weighs less than a normal newborn baby.³

In line with Erma Retyaningtyas's research (2020), out of 135 respondents in her research, 78 mothers experienced CED during their pregnancy.¹⁹ According to the study, malnutrition in pregnant women is more likely to cause LBW or global abnormalities than specific anatomical abnormalities.¹⁹ Prolonged and continuous maternal malnutrition during pregnancy has a worse impact on the fetus than acute malnutrition.¹⁹ According to the frequency distribution data, 69.6% of respondents gave birth to LBW, whereas 30.4% did not. This study is consistent with the findings of Baiq Iramayasari (2023), who discovered that 50 (56.8%) of 88 respondents experienced LBW. In this case, newborns with LBW may have

mental and physical issues as they grow and develop in the future.¹⁶

The results are also consistent with Erma Retyaningtyas' research (2020). In her study, 102 (76%) of the 135 respondents had LBW, while 33 (24%) did not give birth to LBW babies.¹⁹ According to her research, practically all babies born with LBW are the result of pregnant women's less-than-optimal nutritional intake, as determined by the MUAC assessment, and the mother's iron deficiency throughout pregnancy.¹⁹

According to Table 2, of the 232 respondents who experienced anemia during pregnancy, 204 (60.2%) gave birth to LBW, whereas 28 (8.3%) did not. Meanwhile, among those who did not experience anemia during pregnancy, 32 (94%) gave birth to LBW, while 75 (22.1%) did not. The chi-square test revealed a significant correlation indicated by a p-value of $0.001 < 0.05$, between anemia and the incidence of LBW at the Ciwaringin Cirebon Health Center during 2020–2022. The analysis of the Prevalence Ratio value of 2.940 shows that pregnant women with anemia are 2.9 times more likely to give birth to LBW. This study is in line with Zelita et al. (2023) who found that from the results of the chi-square test with a p-value of $0.002 < 0.05$, there is a correlation between anemia and the incidence of LBW with the results of the analysis showing $OR = 5.016$ which can be interpreted that pregnant women who experience anemia tend to give birth to LBW with a prevalence of 5.016 times higher.²⁰

Nabila Mar'atush Sholihah's research (2023) revealed a correlation between anemia and the incidence of LBW at the Sukoharjo Regency Health Center (p-value = 0.007).²¹ Anemia in pregnancy is a condition in which the mother's red blood cells are unable to transport oxygen throughout the body.² The condition is highly dangerous for both the mother and the fetus since it increases the possibility of abortion, early birth, and low birth weight.² Anemia in pregnant women is

characterized by a reduction in hemoglobin levels in blood plasma and red blood cells.²

According to the data reported in Table 3, 250 respondents experienced CED, with 202 (59.6%) giving birth to LBW and 48 (14.2%) giving birth to normal-weight babies. Meanwhile, among respondents who did not experience CED, 34 (10%) gave birth to LBW, while 55 (16.2%) did not. The findings of this study are consistent with Dian Safitri et al.'s (2023) research, which found a p-value of $0.0025 < 0.05$, indicating a correlation between CED and LBW incidence. Likewise, the same is true for the research conducted by Rusmiati (2023), that there is a relationship between CED status and the incidence of LBW with a p-value of $0.001 < 0.05$.¹⁸

The chi-square test resulted in a p-value of $0.001 < 0.05$, indicating a correlation between CED in pregnant women and the incidence of LBW at Ciwaringin Cirebon Health Center in 2020–2022. The Prevalence Ratio analysis of 2.115 revealed that pregnant women with CED were 2.1 times more likely to give birth to LBW. This finding is consistent with the findings of Zakiah et al. (2023), who demonstrated a correlation between CED during pregnancy and the occurrence of LBW with an OR of 12.571. This suggests that mothers with a history of CED are 12.571 times more likely to give birth to LBW than mothers without a history of CED.²²

Chronic Energy Deficiency (CED) is a malnutrition condition in humans caused by a lack of macro and micronutrient-rich dietary sources. Pregnant women require more nutrients than usual to meet the demands of both mother and fetus, as calorie shortages can result in malnutrition and inflammatory bowel disease. This incidence may have an impact on fetal growth and development, as well as the birth of newborns with low birth weight.²³

The multivariate analysis with logistic regression results in a p-value of $0.001 < 0.05$

for anemia and CED factors, as shown in Table 4. Thus, it can be concluded that there is a connection between anemia and CED in pregnant women and the occurrence of LBW at the Ciwaringin Cirebon Health Centre in 2020-2022. The variable with the greatest influence on the incidence of LBW is anemia, as demonstrated by the Exp (B) value of 12.596, which can be interpreted as pregnant women having a 12.5 times higher risk of giving birth to LBW than mothers with CED. The findings of this study are consistent with those of Erna Retyaningtyas et al. (2020), who discovered a relationship between anemia and the incidence of LBW (p-value 0.005), as well as a relationship between CED and the incidence of LBW (p-value 0.001). The Exp(B) data suggest that the variable with the greatest influence on the occurrence of LBW is anemia, with a value of 12.941, while CED has an Exp(B) value of 7.903.¹⁹

Mothers who suffer from anemia during pregnancy are typically deficient in vitamins and minerals that the body needs to form red blood cells.¹⁶ During pregnancy, mothers must have a thorough understanding of anemia, including its definition, causes, and symptoms, because anemia will have an impact on the fetus's growth and development, with the greatest risk being that the mother will give birth to a baby with a low birth weight.¹⁶ According to Mulianisaa et al's research in the year (2021), which was based on a literature review in the form of four journals covering anemia in pregnant women, anemia has a percentage of 100%, which is strongly associated with the incidence of low birth weight. The outcomes of this study provide evidence that pregnant women with a history of anemia are more likely to have LBW than pregnant women without a history of anemia.²⁴

These findings are corroborated by studies by Tazeen Shah et al. (2022), who discovered that anemia during pregnancy dramatically increases the chance of low

APGAR, LBW, premature birth, and an increased risk of cesarean section.²⁵ ED might result from an imbalance between energy intake and expenditure.²⁶ Malnourished pregnant women can develop anemia and chronic energy deficiency, both of which can lead to low birth weight in their newborns.²⁷

Based on the preceding discussion, researchers believe that mothers who suffer from anemia during pregnancy are more likely to have kids with low birth weight because anemia in pregnant women disrupts the availability of oxygen and nutrients. This will eventually impact the fetus' nutritional demands, interfering with its growth and development.¹⁸

Conclusion

In 2020-2022, the prevalence of anemia among pregnant women at the Ciwaringin Cirebon Health Center was 68.4%. Meanwhile, at the same health center, the incidences of CED and low birth weight in pregnant women were 73.7% and 69.6%, respectively. The study's findings revealed a correlation between anemia in pregnant women and the prevalence of low birth weight at the Ciwaringin Cirebon Health Center in 2020-2022. In the same year, chronic energy deficiency in pregnant women was linked to an increased risk of low birth weight at the Ciwaringin Cirebon Health Center. At the health center, it was discovered that the prevalence of anemia and chronic energy shortage in pregnant women had an impact on the birth of kids with low birth weight. Anemia in pregnant women increases the risk of having low birth weight babies by 12.5 times, whereas pregnant women with CED (Exp(B)=3.707) had a 3.7 times greater risk of having low birth weight babies.

More investigation is needed to determine the relationship between the incidence of LBW and other variables associated with infant and maternal factors.

Furthermore, healthcare workers should educate expectant mothers and pregnant women about the prevalence of LBW, as well as pay special attention to pregnant women who are at risk of LBW. Suggestions for the Ciwaringin Cirebon Health Center, where the research was done, include the implementation of electronic medical records, which will improve the health center's medical record system. It is also suggested that mothers with anemia take iron tablets before and during pregnancy. The necessity of paying attention to diet and nutrition from food ingested by pregnant women with CED must also be enhanced so that the baby receives optimal nutrition while also maintaining the pregnant woman's condition so that she remains fit and healthy.

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