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DETERMINANTS OF CHRONIC ENERGY DEFICIENCY AMONG PREGNANT WOMEN AT THE BANGETAYU COMMUNITY HEALTH CENTER, INDONESIA

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ABSTRACT

Chronic Energy Deficiency (CED) among pregnant women remains a significant public health problem at the Bangetayu Community Health Center despite various interventions. The high prevalence of CED is influenced by several factors, including anemia status, educational level, occupation, age, and parity. This study aimed to analyze the association between these factors and the occurrence of CED and to identify the most dominant factor. An observational analytic study with a retrospective case-control design was conducted using secondary data from medical records. A total of 226 respondents (113 cases and 113 controls) were selected through simple random sampling. Data were analyzed using the chi-square test and odds ratios (OR). The results showed a significant association between anemia status and CED ($p < 0.001$; OR = 4.757; 95% CI: 2.639–8.574), as well as educational level ($p = 0.002$; OR = 3.201; 95% CI: 1.510–6.789). No significant associations were found for occupation, age, and parity. Anemia was identified as the most dominant factor. Therefore, prevention strategies should focus on early anemia screening and improving nutritional education among pregnant women.

Keywords: Anemia Status; Education; Occupation; Age; Parity

Introduction

Chronic Energy Deficiency (CED) is a condition of long-term energy deficiency that adversely affects the health of pregnant women and fetal development. CED in pregnancy can be identified using Mid-Upper Arm Circumference (MUAC), with a measurement of less than 23.5 cm indicating risk. This condition is associated with impaired fetal growth and an increased risk of pregnancy complications such as hypertension, preeclampsia, hemorrhage, and premature rupture of membranes⁽¹⁾. Globally,

the prevalence of CED among pregnant women remains high, ranging from 35% to 75%, and contributes to an increased risk of low birth weight and maternal mortality⁽²⁾.

At the local level, Bangetayu Health Center continues to report a relatively high prevalence of CED and ranks among the highest across 37 primary health centers in Semarang City, with a prevalence of 8.17% in 2023. This high prevalence is influenced by several factors, including low adherence to supplementary feeding, limited understanding of CED, lack of family

support, and the persistence of food taboos within the community⁽³⁾.

The occurrence of CED in pregnant women is influenced by multiple factors, including direct, indirect, and biological determinants. Direct factors include anemia status, while indirect factors include education, occupation, and dietary practices, and biological factors include age, parity, and birth spacing⁽¹⁾. Previous studies have shown a significant association between anemia and CED, as deficiencies in macro and micronutrients affect maternal metabolism⁽⁴⁾.

However, findings regarding the determinants of CED remain inconsistent, particularly for socio-demographic factors such as education, occupation, age, and parity. Moreover, most previous studies have not comprehensively examined these variables simultaneously within a single analytical framework, especially in high-prevalence settings such as Bangetayu Health Center. This indicates a research gap in the lack of integrated analyses of multiple risk factors for CED in specific local contexts.

Therefore, this study offers a novel contribution by simultaneously analyzing anemia status, education, occupation, age, and parity in relation to CED among pregnant women using secondary medical record data from Bangetayu Health Center. The findings are expected to provide a more context-specific understanding of the dominant factors influencing CED and to support the development of targeted and effective intervention strategies.

Methods

This study employed an observational analytic design with a retrospective case-control approach using secondary data from medical records of pregnant women at Bangetayu Health Center. A total of 226 respondents (113 cases and 113 controls) were selected using simple random sampling. Inclusion criteria were pregnant women with

complete data on the study variables, while exclusion criteria included incomplete or invalid records. The operational definitions were as follows: CED was defined as mid-upper arm circumference (MUAC) <23.5 cm, anemia as hemoglobin (Hb) <11 g/dL, education level (low/high), occupation (employed/unemployed), maternal age (at risk: <20 or >35 years, not at risk: 20–35 years), and parity (primiparous/multiparous). Data were analyzed using the chi-square test ($\alpha = 0,05$) and odds ratio (OR) to measure risk. Data validity and reliability were ensured by using systematically documented medical records in accordance with healthcare standards and by selecting data based on completeness and consistency. Bias was controlled through random sampling to minimize selection bias, the use of secondary data to reduce information and recall bias, and statistical analysis to control for potential confounders.

Results and Discussion

1. Respondent Characteristics

a. Frequency Distribution of Anemia Status Among Pregnant Women at the Bangetayu Community Health Center

NO	Characteristics	Pregnant Women with CED		Pregnant Women non-CED	
		F	%	F	%
Anemia Status					
1.	Anemia	62	54,9	23	20,4
2.	Not Anemia	51	45,1	90	79,6
Total		113	100	113	100
Education					
1.	General	102	90,2	29	25,7
2.	Academic	11	9,8	84	74,3
Total		113	100	113	100
Occupation					
1.	Employed	44	38,9	52	46,0
2.	Unemployed	69	61,1	61	54,0
Total		113	100	113	100
Age					

1.	Ideal	102	90,3	104	92,0
2.	High Risk	11	9,7	9	8,0
Total		113	100	113	100
Parity					
1.	Primiparous	64	56,6	61	54,0
2.	Multiparous	49	43,4	52	46,0
Total		113	100	113	100

Based on the respondents' characteristics, the majority of pregnant women with CED were anemic, totaling 62 individuals (54.9%). Meanwhile, in the non-CED group, the majority of respondents were not anemic, totaling 90 individuals (79.6%). In terms of educational level, the majority of pregnant women with CED had a general education background, totaling 102 individuals (90.2%), whereas in the non-CED group, the majority had an academic education background, totaling 84 individuals (74.3%). Regarding employed status, the majority of pregnant women with CED were unemployed, totaling 69 individuals (61.1%), and a similar pattern was observed in the non-CED group, where the majority were also unemployed, totaling 61 individuals (54.0%). Based on age, the majority of respondents in both groups fell within the ideal age range of 20–35 years, totaling 102 individuals (90.3%) in the CED group and 104 individuals (92.0%) in the non-CED group. Regarding parity, more than half of the pregnant women with CED were primiparous, totaling 64 individuals (56.6%), and the same was true for the non-CED group, which was also dominated by primiparous women, totaling 61 individuals (54.0%).

Anemia can weaken the immune system, thereby disrupting metabolism and nutrient absorption. Pregnant women with CED who have anemia tend to tire more easily and struggle to meet their nutritional needs, while anemia also reduces the absorption of iron, protein, and calories, thereby worsening the CED condition. A mid-upper arm circumference (MUAC) of <23.5 cm serves as an indicator of CED, and

anemia contributes to poor nutritional status through iron deficiency⁽⁵⁾.

CED reflects not only a deficit in energy and protein, but also a deficiency in micronutrients such as iron, folate, vitamin B12, zinc, and vitamin A, which are essential for hemoglobin production. These nutritional deficiencies impair erythropoiesis, thereby increasing the risk of anemia in pregnant women⁽⁶⁾.

Limited education can hinder a person's ability to access up-to-date information on health and nutrition, thereby affecting a pregnant woman's ability to make decisions regarding food choices and her own health maintenance⁽⁵⁾. Education also plays a role in determining the type of work and family income level, as well as influencing knowledge, attitudes, and behaviors related to maintaining nutritional status. Good knowledge fosters healthy and balanced eating habits, thereby helping to prevent health risks during pregnancy. Pregnant women with higher levels of formal education tend to have greater awareness of the importance of a healthy diet and better access to nutritional information, which contributes to improved nutritional status⁽⁵⁾.

Pregnant women who do not work generally devote their energy to household chores, leaving them with less attention to ensure they meet their nutritional needs. This situation differs from that of working pregnant women, who tend to have their own income and are therefore better able to meet their nutritional needs⁽⁷⁾. Employed also affects mothers' access to health and nutrition information. Mothers who do not work face limitations in accessing information related to health, nutrition, and healthy eating habits, putting them at higher risk of experiencing acute malnutrition. In addition, an excessive domestic workload can jeopardize the health of both the mother and the fetus⁽⁷⁾.

The majority of pregnant women fall within the reproductive age range of 20–35 years, which is considered the ideal age for pregnancy due to relatively low risks associated with pregnancy and childbirth. Physiologically, women in this age group have more optimal ovarian reserve and egg quality for the fertilization process. Conversely, pregnancy at an age of <20 years carries risks because blood supply to the cervix and uterus is not yet optimal, potentially leading to fetal nutritional deficiencies. Pregnancy at an older age also carries a higher risk of associated conditions such as hypertension and diabetes⁽⁷⁾. However age has not been shown to influence the incidence of CED in pregnant women because adequate nutrition can be achieved in all age groups, whether in the ideal age range or at high risk.

The study results indicate that the proportion of primiparous pregnant women is slightly higher than that of multiparous women. This may be due to the fact that the 20–35 age group the age range most commonly associated with first pregnancies dominates the respondent profile. Primiparous pregnant women also lack prior pregnancy experience, so their bodies are still adapting to physiological changes that increase the need for energy, protein, folic acid, and iron. Inability to meet these needs can increase the risk of CED. Conversely, multiparous pregnant women generally have more experience and a better understanding of meeting nutritional needs during pregnancy⁽⁷⁾.

2. Bivariate Analysis

a. The Relationship Between Anemia Status and the Incidence of Malnutrition in Pregnant Women

Anemia Status	Pregnant Women				Total	Percentage
	Pregnant Women					
	CED		Non-CED			
	F	%	F	%		
Anemia	62	27,4	23	10,2	85	43,6

Not Anemia	51	22,6	90	39,8	141	62,4
Total	113	50	113	50	226	100

p-value 0,000 dan OR : 4,757(2,639 - 8,574)

The results of the study indicate that anemia status is significantly associated with the incidence of CED, with a *p-value* of 0.000 and an OR > 1, meaning that pregnant women with anemia are approximately 4.8 times more likely to experience CED than those without anemia. These findings are consistent with the study by Adhelna et al., (2022), which also reported a significant association between anemia and CED (*p*=0.000). Anemia in pregnant women with CED is generally associated with poor nutritional intake due to an unbalanced diet, leading to long-term energy and protein⁽⁶⁾.

CED and anemia often occur together due to low nutrient intake during pregnancy, which can increase the risk of complications such as bleeding, prolonged labor, uterine inertia, miscarriage, birth defects, and low birth weight (LBW)⁽⁶⁾. Research by Richa Agusmarinda et al., (2025) also supports these findings by showing that the majority of pregnant women with CED experience anemia, which is influenced by an imbalance in macronutrient and micronutrient intake as well as insufficient iron intake that is not supported by adequate water and vitamin C intake⁽⁷⁾.

b. The Relationship Between Education and the Incidence of CED in Pregnant Women

Education	Pregnant Women				Total	Percentage
	CED		Non-CED			
	F	%	F	%		
General	102	45,1	84	37,2	186	82,3
Academic	11	4,9	29	12,8	40	17,7
Total	113	50	113	50	226	100

p-value 0,002 dan OR : 3,201 (1,510 - 6,789)

The results of the study indicate that educational level is significantly associated with the incidence of CED, as evidenced by a *p-value* of 0.002 and an OR > 1, meaning that

pregnant women with a general education have a 3.2 times higher risk of experiencing CED compared to those with an academic education. This finding aligns with the study by Sihite., (2024), which also reported a significant association between education and CED ($p=0.016$). Education influences a mother's ability to understand nutritional information, access health information sources, and adopt a diet appropriate for pregnancy. Mothers with academic education tend to be better able to understand the importance of consuming nutritious foods, protein, vitamins, and other nutrients, whereas those with general education often have limited capacity to understand and apply such information⁽⁸⁾.

Education is a key risk factor because it is closely linked to knowledge levels. According to Notoatmodjo., (2021) as cited in Aliani., (2021), knowledge encompasses the ability to recognize, understand, apply, analyze, synthesize, and evaluate information. Mothers with higher academic education are better able to absorb, process, and apply nutritional information in daily life, assess the factors causing CED, and integrate information to form healthy eating behaviors. The higher the level of education, the better the critical thinking and problem-solving skills related to nutritional adequacy. This explains why mothers with a general education have a higher risk of experiencing CED.

c. The Relationship Between Occupation and the Incidence of CED in Pregnant Women

Occupation	Pregnant Women				Total	Percentage
	Pregnant Women					
	CED	Non-CED				
	F	%	F	%		
Employed	44	19,5	52	23,0	96	42,5
Unemployed	69	30,5	61	27,0	130	57,5
Total	113	50	113	50	226	100

p -value 0,282 dan OR : 0,748 (0,441 – 1,270)

The results of the study indicate that the employed variable is not significantly

associated with the incidence of CED, as evidenced by a p -value of 0.282. An OR of 0.748 ($OR < 1$) suggests that employed has a protective effect, reducing the risk of CED by approximately 0.7 times compared to non-working mothers. Theoretically, unemployed pregnant women are at higher risk of CED due to heavy household workloads, such as managing the home, caring for children, and managing family needs, which can affect the health of both the mother and the fetus. Conversely, working pregnant women have broader access to information and more stable financial management to meet their nutritional needs⁽⁹⁾.

These findings are consistent with the study by Sovita & Rosa., (2022), which reported no significant association between employed and the incidence of CED ($p=0.566$). Employed is not a determinant of nutritional status because pregnant women who regularly attend ANC, receive health education, and understand their nutritional status can avoid CED regardless of their employed status. Occupation is an indirect factor that does not determine the fulfillment of physiological⁽¹⁰⁾.

According to Maslow's theory (1943) as cited in Naibili et al., (2023), food is a basic need that must be met by pregnant women, whether they are employed or not. Therefore, the risk of undernutrition can occur in both groups, particularly when nutritional knowledge is low or dietary behaviors are inappropriate. Furthermore, the fact that the majority of respondents were homemakers also contributed to the absence of significant differences between occupational groups⁽¹¹⁾.

d. The Relationship Between Age and the Incidence of CED in Pregnant Women

Age	Pregnant Women				Total	Percentage
	CED		Non-CED			
	F	%	F	%		
Ideal	102	45,1	104	46,0	206	91,1
High Risk	11	4,9	9	4,0	20	8,9

Total	113	50	113	50	226	100
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p-value 0,639 dan OR : 0,802 (0,319 – 2,018)

The results of the study indicate that age is not significantly associated with the incidence of CED, as evidenced by a *p-value* of 0.639. An OR of 0.802 ($OR < 1$) suggests that an ideal age has a protective effect, reducing the risk of CED by approximately 0.8 times compared to high risk age groups. In theory, age can influence nutritional status because nutritional needs differ between younger and older individuals. However, in this study, age was not a primary determinant and thus did not affect the incidence of CED. The majority of respondents were aged 20-35 years, which is the recommended age range for pregnancy, resulting in a relatively lower risk of CED.

These findings are consistent with the study by Suryani et al., (2021), which reported that age was not significantly associated with the incidence of CED ($p=0.490$). Younger women require higher nutritional intake to support maternal and fetal growth, whereas older women require additional energy due to declining organ function. However, these differences in nutritional needs did not have a significant effect on the incidence of CED in this study⁽¹²⁾.

e. The Relationship Between Parity and the Incidence of CED in Pregnant Women

Parity	Pregnant Women				Total	Percentage
	CED		Non-CED			
	F	%	F	%		
Primiparous	64	28,3	61	27,0	125	55,3
Multiparous	49	21,7	52	23,0	101	44,7
Total	113	50	113	50	226	100

p-value 0,688 dan OR : 1,113 (0,659 – 1,882)

The results of the study indicate that parity is not associated with the incidence of CED, as evidenced by a *p-value* of 0.688 and an OR of 1.113, suggesting no difference in risk between primiparous and multiparous mothers. These findings are consistent with the study by Handayani., (2021), which

reported a *p-value* of 0.357, indicating that parity is not a determining factor for the occurrence of CED. Although repeated pregnancies may increase physiological needs, adequate nutritional intake remains the primary factor influencing the energy status of pregnant women⁽¹³⁾.

Parity is a biological factor that does not directly affect malnutrition, as both primiparous and multiparous women can avoid malnutrition if their nutritional needs are met. Conversely, women in both groups remain at risk of malnutrition if their dietary intake is inadequate. In this study, the distribution of primiparous and multiparous women was relatively balanced, so it did not result in differences that could influence the analysis results.

Conclusion

Anemia status and educational level were significantly associated with Chronic Energy Deficiency (CED) among pregnant women, with anemia identified as the most dominant factor.

In contrast, occupation, age, and parity were not significantly associated with CED. Therefore, prevention efforts should prioritize early anemia detection and improved nutritional education to reduce the risk of CED.

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