



**DETERMINANTS OF CHRONIC ENERGY DEFICIENCY (CED) AMONG PREGNANT WOMEN**

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**ABSTRACT**

Maternal health is a crucial global development issue, particularly in developing countries like Indonesia. The health of pregnant women is vital for ensuring the survival and well-being of their unborn children. This study aims to identify factors contributing to Chronic Energy Deficiency (CED) in pregnant women and its effects on maternal health and fetal development. Conducted as an analytical survey with a cross-sectional design, the study's population comprises all pregnant women in their first, second, and third trimesters within the Yendidori Health Center area, totaling 63 individuals. Using a non-probability sampling method with incidental sampling, a sample of 45 participants was selected. Data collection involved observation sheets and a validated questionnaire on maternal knowledge, demonstrating high reliability (Cronbach's alpha = 0.951). Bivariate analysis revealed significant relationships between several factors and CED incidence: education level ( $p = 0.004$ ), family income ( $p = 0.002$ ), and nutritional knowledge ( $p = 0.001$ ). These findings indicate that higher educational attainment, increased family income, and better nutritional knowledge are associated with a lower incidence of CED among pregnant women, highlighting the need for targeted interventions to improve maternal health outcomes.

Keywords: chronic energy; deficiency; determinants; pregnant women

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**INTRODUCTION**

Maternal health is a global development issue, particularly in developing countries like Indonesia and underdeveloped nations. The health of pregnant women is crucial for ensuring the survival and well-being of the unborn child. Poor maternal health can negatively impact the fetus and lead to complications during and after delivery. One factor that affects maternal health is nutritional deficiency. Adequate nutritional intake for pregnant women is essential to meet the increased nutritional demands during pregnancy. If these nutritional needs, in both quantity and quality, are not met, it becomes challenging for the mother and fetus to gain adequate weight. This condition increases health risks for both the mother and the newborn. Pregnant women with poor nutritional and health status are at higher risk of delivering prematurely, having low birth weight infants, and facing increased morbidity and mortality risks for both mother and child. Nutritional deficiencies in mothers can also affect breast milk production and quality. Breast milk from undernourished mothers may lack essential nutrients for the baby, potentially impacting the baby's growth and development and increasing the risk of illness. (Victora, 2016; Quezada-pinedo et al., 2021)

In addition, managing the spacing of pregnancies is one way for couples to be more prepared and ready to have children. Planning when to have another child is an important matter that needs to be communicated between partners. Not all couples of childbearing age clearly understand the long-term benefits of determining pregnancy spacing for a better quality of life (Yanti & Romaina, 2020). Common nutritional issues among pregnant women include deficiencies in both macronutrients and micronutrients, often manifesting as Chronic Energy

Deficiency (CED) and iron-deficiency anemia. These deficiencies typically occur over an extended period, even before pregnancy. A commonly used indicator for early detection of CED in pregnant women is the 'risk' of CED, marked by prolonged low energy reserves, which can be measured by a mid-upper arm circumference (MUAC) of less than 23.5 cm (Suryani et al., 2021; Kemenkes RI, 2023).

Based on routine data reports from 2022, collected from 34 provinces, there were 206,074 pregnant women with a MUAC of less than 23.5 cm (at risk of CED) out of 2,443,494 measured. This figure shows that the prevalence of pregnant women at risk of CED is 8.43%, while the target for 2022 was 13%. This achievement surpasses the Ministry of Health's 2022 strategic plan target. However, comparing this rate to the WHO threshold for public health concerns indicates that Indonesia still falls within the moderate category for CED among pregnant women (5-9.9%) (Kemenkes RI, 2023). The prevalence of CED among women of reproductive age, measured by MUAC, reveals that Papua Province has the highest percentage of pregnant women with CED at 23.05% (Ministry of Health, Directorate General of Public Health, 2022). According to the Biak Numfor District Health Office in 2021, there were 265 pregnant women with CED, including 45 cases at Yendisori Health Center (Dinkes Biak Numfor, 2022). This study aims to identify and analyze the determinants of Chronic Energy Deficiency (CED) among pregnant women in Biak Numfor District, East Biak District

## **METHOD**

The type of research used in this study is an Analytical Survey, which aims to identify the risk factors that contribute to disease occurrence. The research design employed in this study is Cross Sectional. This study will be conducted from May to September 2024. The research will take place in the working area of the Yendisori Health Center in Yendisori District, Biak Numfor Regency. The population in this study consists of all pregnant women (in their first, second, and third trimesters) in the working area of the Yendisori Health Center, Yendisori District, Biak Numfor Regency, totaling 63 individuals. Sampling for this study was conducted using a non-probability sampling method with incidental sampling techniques, resulting in a sample size of 45 participants. Data for this study were collected using an observation sheet and a questionnaire on maternal knowledge, which have been validated and shown to be reliable, with a Cronbach's alpha of 0.951. The results of this study will involve statistical analysis using the chi-square test with a 95% confidence interval.

## **RESULT**

Based on the data, it can be concluded that the characteristics of respondents regarding birth spacing indicate that there are more respondents with long birth spacing, totaling 23 (51.1%), compared to those with short birth spacing, which totals 22 (48.9%). Regarding the age of pregnant women, those in the safe age group are significantly higher, with 32 respondents (71.1%), compared to those in the unsafe age group, which totals 13 respondents (28.9%). In terms of parity, the number of respondents classified as high-risk parity is 29 (64.4%), while those classified as low-risk parity are 16 respondents (35.6%). Regarding education level, there are 38 respondents (62%) with a high education level compared to 17 respondents (28%) with a low education level. When considering family income, there are more respondents with low family income, totaling 36 (80%), compared to those with high family income, which totals 9 respondents (20%). Concerning knowledge level, the number of respondents with insufficient knowledge is greater, with 23 (51.1%) compared to those with sufficient knowledge, totaling 22 respondents (48.9%). Finally, regarding Chronic Energy Deficiency (CED) among pregnant women, those with CED account for 33 respondents (73.3%), while those without CED total 12 respondents (26.7%).

Table 1.  
Distribution of Respondent Characteristics Based on Birth Spacing

Variable	F	%
Long Birt Spacing		
Long	23	51,1
Short	22	48,9
Age		
Productif	32	71,1
Risk	13	28,9
Risk Parity		
Yes	29	64,4
No	16	35,6
Education		
Low	17	38
High	28	62
Income		
Low	36	80
High	9	20
Knowledge		
Good	22	48,9
less	23	51,1
CED		
No	12	26,7
Yes	33	73,3

Table 2.  
The Relationship Between Education Level and Chronic Energy Deficiency (CED) in Pregnant Women

Education	CED				Amount		P Value	OR
	No		Yes		f	%		
	f	%	f	%				
Low	0	0	17	57	17	38	0,004	1,667
High	15	100	13	43	28	62		

The results of the bivariate analysis indicate a significant relationship between the education level of pregnant women and the incidence of Chronic Energy Deficiency (CED) (p-value = 0.004, where  $p < 0.05$ ). Among the pregnant women with low education levels, 17 respondents (57%) experienced CED compared to those with higher education levels. This demonstrates that education plays an important role in influencing the nutritional status of mothers during pregnancy.

Table 3.  
The Relationship Between Family Income and Chronic Energy Deficiency (CED) in Pregnant Women

Income	CED				Amount		P Value	OR
	No		Yes		f	%		
	f	%	f	%				
Less	6	50	30	91	36	80	0,002	6,371
High	6	50	3	9	9	20		

The results of the bivariate analysis indicate a significant relationship between family income and the incidence of Chronic Energy Deficiency (CED) in pregnant women (p-value = 0.002, where  $p < 0.05$ ). Among the pregnant women from families with low income, 30 respondents (91%) had a higher risk of experiencing CED compared to those from higher-income families. These findings suggest that family income plays a crucial role in determining pregnant women's access to nutritious food and adequate healthcare sertes, thereby affecting their nutritional status during pregnancy.

Table 4.

The Relationship Between Knowledge Level and Chronic Energy Deficiency (CED) in Pregnant Women

Knowledge	CED				Amount		P value	OR
	No		Yes		f	%		
	f	%	f	%				
Good	11	92	11	33,3	22	49	0,001	81,798
Less	1	8	22	66,7	23	51		

The results of the bivariate analysis indicate a significant relationship between pregnant women's knowledge of nutrition and the incidence of Chronic Energy Deficiency (CED) (p-value = 0.001, where  $p < 0.05$ ). Among the pregnant women with low knowledge levels, 22 respondents (66.7%) had a higher prevalence of CED compared to those with better knowledge. These findings suggest that adequate nutrition knowledge plays a crucial role in preventing CED, as mothers who understand the importance of nutrition are more likely to adopt healthier eating patterns during pregnancy.

**DISCUSSION**

**The Relationship Between Maternal Education Levels and Chronic Energy Deficiency (CED) in Pregnant Women**

Research findings and bivariate analysis tests indicate a significant relationship between maternal education levels and Chronic Energy Deficiency (CED) incidence (p-value = 0.004, where  $p < 0.05$ ). This demonstrates that education plays a role in influencing maternal nutritional status during pregnancy. These findings align with previous research by Ervinawati, Aslis Wirda Hayati, Nurlisis (2018), Rosdiana Syakur, Musaidah, Jusman Usman, Nur Ismala Dewi (2020), Hardianti Mukkadas, Wa Ode Salma, I Made Cristian B (2021), and Ocik Lestari (2022), which reported a significant association between education levels and CED incidence in pregnant women. The findings suggest that pregnant women with lower education levels have a higher risk of CED compared to those with higher education levels. This may be due to a lack of knowledge about nutrition and limited access to health information, which is often associated with education levels. Thus, improving maternal education and nutritional counseling is essential for preventing CED and promoting maternal and fetal health.

The relationship between maternal education levels and Chronic Energy Deficiency (CED) in Biak Numfor Regency, Papua Province, is significant. Studies show that higher education levels correlate with better nutritional knowledge and practices, which are crucial in preventing CED. This correlation is supported by several studies highlighting the impact of education on dietary choices and health outcomes for pregnant women. Higher education levels often lead to increased awareness of nutritional needs during pregnancy, which can reduce the risk of CED (Dhiu et al., 2022; Yunita et al., 2023). Educated women are more likely to understand the importance of a balanced diet and the consequences of energy deficiency on maternal and fetal health (Auliana et al., 2016). In Indonesia, CED prevalence among pregnant women is high, with studies showing that lower education levels are associated with higher CED rates. For example, a study found that 71.5% of women with low education levels experienced CED, indicating a direct link between education and nutritional status (Auliana et al., 2016; Yunita et al., 2023)

Education is related to socioeconomic status, which also influences access to nutritious food. Educated women often have better economic opportunities, allowing for improved dietary intake. However, while education plays a crucial role in reducing CED, other factors like family income and cultural practices also significantly impact nutritional status. Therefore, a multifaceted approach is needed to address CED effectively among pregnant women (Akbarini

et al., 2024; Rohiman et al., 2019). Maternal education plays a vital role in determining health and nutrition status during pregnancy, including the risk of Chronic Energy Deficiency (CED). Higher education levels generally provide mothers with better access to health information, including knowledge about nutritional needs and healthy eating patterns during pregnancy (Rahman & West, 2018). This knowledge enables pregnant women to understand the importance of adequate nutrient intake for their health and fetal development, making them more likely to meet the necessary nutritional needs (World Health Organization., 2016)

Research shows that pregnant women with lower education levels are more vulnerable to CED risks, as they may have limited access to nutritional information and may not fully understand the importance of a balanced diet. Studies across various regions in Indonesia demonstrate a significant association between education levels and maternal nutritional status, with lower-educated mothers tending to have poorer nutritional status (Kementerian Kesehatan RI, 2022). Conversely, higher-educated mothers are more likely to have better knowledge about obtaining adequate nutrition and adopting healthy eating patterns during pregnancy (Darmawan & Kusuma, 2019). Moreover, mothers with lower education levels often have lower incomes, affecting their ability to purchase nutritious foods and access healthcare services. This situation is compounded by the geographic and economic conditions in areas like Biak Numfor Regency, where access to healthcare facilities and nutritious food distribution is limited (Dinkes Biak Numfor, 2022).. Therefore, maternal education levels significantly impact their ability to access adequate nutritional information and healthcare services. This study emphasizes the importance of education and improved access to health and nutrition information for pregnant women, especially in areas with high CED rates, such as Papua. Raising nutritional awareness among less-educated pregnant women should be prioritized to help them understand the importance of maintaining nutrient intake during pregnancy to prevent CED risks and other health complications (Kementerian Kesehatan RI, 2022).

### **The Relationship Between Family Income of Pregnant Women and Chronic Energy Deficiency (CED) in Pregnant Women**

The results of the study and bivariate analysis tests indicate a significant relationship between family income and the occurrence of Chronic Energy Deficiency (CED) in pregnant women ( $p$ -value = 0.002, where  $p < 0.05$ ). This finding is consistent with previous research conducted by Kiki Fazirah, Akmal Novrian, Syahrudin, and Irmawati (2022), which found a significant relationship between family income and the incidence of CED. These findings suggest that pregnant women from low-income families have a higher risk of experiencing CED compared to those from higher-income families. Low family income often implies limited access to nutritious food and adequate healthcare services, which are critical factors in maintaining the health of pregnant women. Therefore, it is essential for public health programs to consider the economic conditions of families when designing effective interventions to reduce the risk of CED, including providing better access to nutritional resources and healthcare services for pregnant women from low-income families.

Pregnant women require increased nutritional intake, which is often unmet in low-income families, leading to CED (Rahmi, 2017). Studies show that a significant percentage of pregnant women from low-income backgrounds experience CED, highlighting economic barriers to adequate nutrition (Yunita et al., 2023; Ikrawati & Tempali, 2023). Higher education levels and awareness about nutrition positively influence the nutritional status of pregnant women, indicating that income alone does not determine the prevalence of CED (Akbarini et al., 2024). Access to antenatal care and nutritional education is often limited for

low-income families, exacerbating the risk of CED (Ningsih & Eviyanti, 2021; Mutika et al., 2024). Conversely, while family income is an important factor, it is also crucial to consider that education, access to healthcare, and community support systems play significant roles in addressing CED among pregnant women. Thus, a multifaceted approach is necessary to effectively combat this issue. Family income is a critical determinant of the nutritional status of pregnant women, influencing the risk of Chronic Energy Deficiency (CED). Families with higher incomes generally have better access to various essential needs, including nutritious food and healthcare services, thereby reducing the risk of CED among pregnant women (Christina et al., 2020). In contrast, low income often results in limitations in meeting the nutritional needs of pregnant women, as economic constraints can restrict access to quality food items, such as animal proteins, vegetables, and fruits, which are vital during pregnancy (Fitrianingtyas et al., 2018; Rahmi, 2017).

Studies show that pregnant women in low-income families are more likely to experience CED. In areas like Biak Numfor Regency, where the prevalence of CED among pregnant women is relatively high, low income emerges as a primary determinant hindering their ability to obtain nutritious food. This situation is aggravated by geographical challenges in regions like Papua, where the cost of food and access to healthcare services may be higher compared to other parts of Indonesia (Dinkes Biak Numfor, 2022). Research also indicates that pregnant women from low-income families often have limited access to healthcare services and nutritional education, which are essential for understanding nutritional needs during pregnancy. This condition is exacerbated by the lack of social and health support programs targeting pregnant women in impoverished areas. Previous studies have shown that families with low-income levels are less likely to participate in public health programs, making them more vulnerable to malnutrition and CED (Darmawan & Kusuma, 2019; Koletzko et al., 2019).

Chronic Energy Deficiency (CED) among pregnant women is a serious public health issue, especially in regions with economic challenges and limited access to healthcare services. CED in pregnant women is defined as a long-term caloric deficiency that can adversely affect maternal health and fetal development. Research indicates that low family income can impact both the quality and quantity of nutritional intake among pregnant women, which, in turn, affects the incidence of CED. Family income plays a crucial role in determining the nutritional intake of pregnant women. Low income can lead to limited access to nutritious foods and an inability to provide sufficient quantities and quality of food. These economic limitations directly influence dietary patterns, caloric intake, and the micronutrients essential for fetal development and maternal health. In Biak Numfor Regency, Papua Province, where the poverty rate is relatively high, low-income families are more vulnerable to limited access to nutritious food. Families in economically weak conditions often rely on cheap staple foods that are low in nutritional value, such as rice and instant noodles, neglecting the intake of proteins, healthy fats, and vegetables and fruits. This contributes to the increasing cases of CED among pregnant women (Paknahad et al., 2019).

According to research conducted by Yusuf et al., (2020), there is a significant correlation between family income and the occurrence of CED in pregnant women in eastern Indonesia, including Papua. Pregnant women from low-income families show a higher prevalence of CED compared to those from middle and high-income families. Additionally, another study by Rahmawati et al., (2019) indicates that education and family income are two main factors influencing dietary patterns in pregnant women, ultimately impacting their nutritional status. Family income significantly affects the risk of CED among pregnant women in Biak Numfor

Regency. Therefore, efforts to improve the economic status of communities and access to nutritious food are crucial in reducing the incidence of CED. Interventions focusing on economic empowerment and nutritional education are expected to have a positive impact on the health of pregnant women and fetal development in the region. The results of this study emphasize the importance of government interventions in providing nutritional support and healthcare services for pregnant women from low-income families in remote areas like Biak Numfor Regency. By improving access to nutritious food and affordable healthcare services, the risk of CED among pregnant women can be reduced. Additionally, social and economic assistance programs for low-income families need to be strengthened to support the nutritional needs of pregnant women, which directly impacts maternal health and fetal development (Kemenkes RI, 2023).

### **The Relationship Between Pregnant Women's Knowledge Level and Chronic Energy Deficiency (CED) Among Pregnant Women**

The results of the study and the bivariate analysis indicate a significant relationship between pregnant women's knowledge level and the incidence of Chronic Energy Deficiency (CED) ( $p$ -value = 0.001, where  $p < 0.05$ ). These findings align with previous research conducted by Rosdiana Syakur, Musaidah, Jusman Usman, and Nur Ismala Dewi (2020), as well as Avliya Quratul Marjan, Antania Hermada Aprillia, and Iin Fatmawati (2021), which both found that knowledge level has a significant relationship with the incidence of CED among pregnant women. These findings emphasize that pregnant women with lower levels of nutrition knowledge tend to experience CED at higher prevalence rates. This may be due to a lack of understanding regarding the importance of nutrition during pregnancy, which can directly impact eating patterns and health behaviors. Therefore, increasing nutrition knowledge through targeted educational programs becomes crucial in preventing CED, allowing pregnant women to adopt healthier eating habits that better support fetal growth and development. Pregnant women's knowledge about nutritional needs during pregnancy significantly influences their daily food consumption patterns. Mothers with a good understanding of nutrition are generally better equipped to meet their daily nutritional needs. Conversely, a lack of nutrition knowledge often leads pregnant women to underestimate the importance of adequate calorie, protein, vitamin, and mineral intake during pregnancy. This is particularly common in remote areas, including Biak Numfor, where access to adequate nutrition information and education is still limited.

Pregnant women with higher nutrition knowledge are less likely to experience CED. For example, a study found that those with normal nutritional status had significantly higher knowledge levels ( $p = 0.018$ ) compared to those with CED (Ramdhani et al., 2024). Educational programs have proven to increase knowledge by 20 points after counseling, demonstrating a direct impact on awareness and understanding of CED. Low knowledge levels contribute to higher incidents of CED, with research showing that 34% of women with low knowledge experienced CED (Sudarmi et al., n.d.). The prevalence of CED among pregnant women remains a critical issue, with 17.3% affected in Indonesia, highlighting the need for targeted educational efforts (Ramdhani et al., 2024). While the evidence strongly supports the relationship between knowledge and CED, it is also important to consider other factors such as socioeconomic status and dietary diversity, which can independently affect nutritional outcomes (Fitriani et al., 2024). Research by Susanto et al. (2019) found that pregnant women with low nutrition knowledge in eastern Indonesia tend to experience CED more frequently than those with adequate nutrition knowledge. Women who lack an understanding of the importance of nutritious eating may consume unbalanced diets more often due to cost or availability, without realizing the impact on their health and that of their

fetus. Additionally, research by Karim et al. (2020) showed that providing ongoing nutrition education could reduce CED rates by up to 30% among previously low-knowledge pregnant women. Low education levels, lack of access to information, and limited healthcare services providing nutritional information often contribute to low nutrition knowledge among pregnant women. In Biak Numfor, these challenges are exacerbated by geographical distance from comprehensive healthcare facilities and a shortage of qualified medical personnel to deliver comprehensive nutrition education. Furthermore, local culture and inherited eating habits play a crucial role in pregnant women's dietary patterns.

Interventions in the form of counseling and nutrition education for pregnant women should be conducted regularly to enhance their understanding of appropriate nutritional intake. Programs that involve local health workers and community leaders can be strategic steps to reach communities, especially in remote areas like Biak Numfor. Providing information about the importance of nutrition during pregnancy and how to choose affordable yet nutritious foods is expected to help reduce the incidence of CED among pregnant women (Hasanah et al., 2023). Pregnant women's knowledge about nutrition significantly affects their health status during pregnancy, including the risk of Chronic Energy Deficiency (CED). Nutrition knowledge enables pregnant women to understand the importance of consuming nutritious foods, both in terms of quantity and quality, necessary for maternal health and fetal development. Studies have shown that mothers with a good understanding of nutritional needs during pregnancy are more capable of managing their diets and selecting foods with sufficient nutritional content, thus reducing the risk of CED (Rejeki et al., 2019).

Conversely, pregnant women with low levels of nutrition knowledge often do not recognize the importance of consuming a balanced and high-quality diet. This can lead to inadequate nutrient intake and increase the risk of CED. The lack of adequate information, particularly in remote areas like Biak Numfor, is one of the causes of low nutrition knowledge among pregnant women (Dinkes Biak Numfor, 2022). Insufficient knowledge regarding calorie, protein, vitamin, and mineral needs during pregnancy makes pregnant women more vulnerable to experiencing CED, negatively impacting maternal health and fetal growth (World Health Organization., 2016). Several studies have shown a significant relationship between mothers' knowledge of nutrition and nutritional status during pregnancy. For example, pregnant women with good knowledge of nutritious foods are more likely to meet their daily energy and nutrient needs, leading to better nutritional status (Darmawan & Kusuma, 2019). In the context of Biak Numfor, access to health information and nutrition education services is critical. Community health centers and local health workers play a strategic role in enhancing pregnant women's knowledge through nutrition counseling and regular consultations. These findings suggest that improving nutrition knowledge among pregnant women in the area could be an essential step in reducing the incidence of CED. Interventions through ongoing nutrition education programs need to be implemented, especially in regions with high CED rates like Papua. Additionally, the government can optimize public health programs to improve nutrition literacy among pregnant women, which could ultimately support efforts to prevent CED and other health complications.

## **CONCLUSION**

This study concludes that there is a significant relationship between education level, family income, and the knowledge level of pregnant women regarding Chronic Energy Deficiency (CED) in Biak Numfor District, Papua Province. Pregnant women with higher education levels tend to have better knowledge and access to information about nutrition and pregnancy health, which positively contributes to reducing the risk of CED. Family income is closely

related to access to sufficient nutritious food. Families with higher income generally have the means to provide quality food, thus reducing the risk of CED among pregnant women. Adequate knowledge about nutritional needs during pregnancy enhances mothers' understanding of how to choose the right foods and the importance of monitoring pregnancy health, ultimately contributing to the prevention of CED. Overall, this research emphasizes that efforts to improve education, income, and nutritional knowledge among pregnant women can be important strategies for lowering the prevalence of CED in the region. Health programs focusing on nutrition education and economic access can be effective approaches to reduce CED cases.

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