Original Article

Socioeconomic and Health-Related Factors Associated with Chronic Energy Deficiency among Pregnant Women: A Cross-Sectional Study

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ABSTRACT

Background: Pregnant women are a vulnerable group to nutritional problems, particularly Chronic Energy Deficiency (CED). Despite various efforts to improve the nutritional status of pregnant women, the prevalence of CED in the Lintang region remains high. Evidence regarding the determinants of CED in remote and resource-limited areas is limited, and few studies have specifically examined this issue in this area. This study aimed to analyze factors associated with CED among pregnant women.
Methods: This study used a cross-sectional design with a quantitative approach. The sample consisted of 60 pregnant women who met the inclusion and exclusion criteria. The variables studied included Education, income, parity, and history of infectious diseases as factors influencing CED. Data were analyzed using the chi-square test, with effect sizes in the form of odds ratios (ORs) and 95% confidence intervals.
Results: This study showed a significant association between Education (OR = 3.25; p = 0.008), income (OR = 3.45; p = 0.007), parity (OR = 2.95; p = 0.007), and history of infectious diseases (OR = 2.85; p = 0.016) with the incidence of CED among pregnant women. Although these results were statistically significant, conclusions should be viewed with caution, given the observational nature of the analysis.
Conclusion: Socioeconomic and health factors play a significant role in the incidence of CED among pregnant women in this area. To reduce the prevalence of CED, integrated interventions, including nutrition education, economic support, and infectious disease prevention, are needed, particularly in remote areas with limited access to health services. These findings provide important insights for health policy development and further research with more comprehensive designs.

Keywords: Chronic Energy Deficiency; Pregnancy; Maternal Nutrition; Socioeconomic Factors; Indonesia.

Implications for Practice:

- Health practitioners in antenatal care should strengthen routine screening for Chronic Energy Deficiency and provide targeted nutritional counseling for pregnant women, particularly those with low Education, low income, higher parity, or a history of infectious diseases.

Implications for Practice:

- Health policy should prioritize integrated maternal nutrition programs that combine nutrition education, infection prevention, and socioeconomic support to address the underlying determinants of Chronic Energy Deficiency among pregnant women.

Implications for Practice:

- Midwifery education should reinforce competencies in maternal nutrition assessment, early risk identification, and community-based intervention strategies to equip graduates for effective practice in resource-constrained settings, particularly in Low- and Middle-Income Countries where socioeconomic vulnerabilities contribute to maternal undernutrition.

Introduction

indicators in determining the quality of human resources in the future. Healthy pregnant women with good nutritional status play a role in giving birth to a healthy generation. One of the nutritional problems that is still often found in Indonesia, especially in remote areas, is Chronic Energy Deficiency (CED). CED in pregnant women is a condition in which there is a lack of energy and protein intake for a long period of time, which is characterized by an Upper Arm Circumference (MUAC) of less than 23.5 cm. This condition is very risky to cause disorders during pregnancy and childbirth. It has a negative impact on the baby, such as low birth weight, prematurity, and even increasing maternal and infant mortality rates(Harna et al., 2023).

Chronic Energy Deficiency (CED) is one of the most common nutritional disorders experienced by pregnant women. CED occurs when energy and protein intake during pregnancy is insufficient for a long period of time, which can have a negative impact on the health of the mother and fetus. Although pregnancy is a normal and physiological condition, not a disease, health workers - especially midwives - still need to provide attention through a promotive approach. One effective way is to provide communication, information, and Education regarding the importance of monitoring the health of pregnant women and handling discomfort during pregnancy (Rahma Dewi Agustini, 2023).

Fetal brain development begins in the womb, so pregnant women are required to maintain good nutritional status and receive adequate care so that the baby's growth and development are optimal. The nutritional status of pregnant women greatly affects the baby's weight at birth. Pregnant women are included in the vulnerable group to nutritional problems, especially Chronic Energy Deficiency (CED). Babies born to mothers with Chronic Energy Deficiency (CED) are at risk of experiencing Low Birth Weight (LBW), which is less than 2,500 grams (Listiana & Jasa, 2023). Chronic Energy Deficiency (CED) is a condition in which a person experiences prolonged calorie and protein deficiency. In adults, CED can be recognized by calculating the Body Mass Index (BMI), namely if the value is less than 18.5. Meanwhile, the normal BMI in pregnant women is around 19.8 kg/m^2 (Rucitra, 2023). Maternal knowledge, diet, food restrictions, and anemia are factors that are closely related to the occurrence of Chronic Energy Deficiency (CED) in pregnancy (Hasyim et al., 2023; Mahirawati, 2014).

Maintaining nutritional intake during pregnancy is important because the fetus grows rapidly. Lack of nutrition can inhibit the growth and development process (Prasad & Sylvester, 2025). One of the indicators used to assess the risk of Chronic Energy Deficiency (CED) in pregnant women is the measurement of the Upper Arm Circumference, with a risk limit of <23.5 cm. Chronic Energy Deficiency (CED) in pregnant women has the potential to cause various complications, such as anemia, bleeding, increased risk of infection, maternal weight that does not increase normally, and is an indirect factor causing maternal death. In addition, Chronic Energy Deficiency (CED) also has an impact on the labor process, such as the risk of premature labor, long and difficult labor, postpartum hemorrhage, and increased

cesarean section procedures. For the fetus, Chronic Energy Deficiency (CED) can cause intrauterine growth retardation (IUGR), even fetal death in the womb (IUFD), as well as the risk of birth with congenital abnormalities, anemia, and Low Birth Weight LBW(Rachman et al., 2023; Susanti et al., 2024).

Chronic Energy Deficiency (CED) often occurs when a pregnant woman's calorie and protein intake is insufficient, which can lead to various complications during pregnancy and childbirth, such as low birth weight (LBW), prematurity, and an increased risk of maternal and infant mortality. Although numerous studies have explored the factors influencing the incidence of CED in pregnant women, particularly in urban areas with better access to healthcare, research conducted in rural and remote areas, particularly in Indonesia, remains very limited. One key gap is the lack of understanding of how socioeconomic factors, such as Education, income, and parity, influence the nutritional status of pregnant women in areas with limited access to healthcare. Furthermore, previous research has not adequately identified the most effective interventions in addressing CED in resource-constrained areas, such as the Lintang Community Health Center in Central Aceh District. This study aims to fill this gap by analyzing factors associated with the incidence of CED in pregnant women in remote areas, as well as providing deeper insights into preventive measures that can be implemented to reduce the prevalence of CED in these areas.

Methods

Study Design

This study used a cross-sectional design to analyze factors associated with the incidence of Chronic Energy Deficiency (CED) among pregnant women at the Atu Lintang Inpatient Community Health Center (Puskesmas Rawat Inap), Central Aceh Regency (Tamaulina Br. Sembiring, SH., M.Hum., Ph.D, 2023). The cross-sectional design was chosen because it allowed researchers to identify the relationship between independent variables, such as Education, income, parity, and history of infectious diseases, and the dependent variable, CED, simultaneously. This study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) reporting guidelines to ensure transparency and accuracy in reporting observational studies.

Participants

Participants in this study consisted of 60 pregnant women registered in the Atu Lintang Inpatient Community Health Center (Puskesmas Rawat Inap) coverage area in 2024. The sample was selected using a purposive sampling technique, based on the inclusion criteria of pregnant women who were willing to participate, lived in the Puskesmas coverage area, and were able to communicate well. Exclusion criteria included pregnant women with chronic diseases that could affect nutritional status and incomplete pregnancy data. A sample size of 60 was selected, considering resource limitations and the estimated prevalence of domestic violence, sufficient for bivariate analysis. No participants dropped out or did not respond during the study, and all participants underwent a face-to-face interview with trained enumerators (Widodo et al., 2023).

Instruments

The instrument used in this study was a structured questionnaire that included questions about participant characteristics, such as age, education, income, parity, and history of infectious diseases, as well as Mid-Upper Arm Circumference (MUAC) measurements to assess domestic violence. The questionnaire's validity and reliability have been tested in previous research and

were found to be suitable for use in this study. The instrument was translated into Indonesian and underwent a translation procedure that meets international standards. MUAC measurements were conducted using a standard, calibrated measuring tape and measured by trained health workers, with two measurements taken to ensure accuracy.

Data Collection

Data collection was conducted by enumerators who had received intensive training in interviewing and MUAC measurements. This training ensured that enumerators could collect data accurately and according to procedures. The collected data were stored and managed using Microsoft Excel, and analyses were performed using SPSS software. To ensure data quality, regular checks were conducted for data consistency and validity, and missing data were managed using imputation. Incomplete or missing data were analyzed to minimize potential bias (Adiputra et al., 2021).

Data Analysis

Data analysis was performed using the chi-square test to assess the relationship between the independent and dependent variables. Effect sizes were calculated using odds ratios (OR) with a 95% confidence interval, and the significance threshold used was $p < 0.05$. All analyses were conducted using SPSS software to ensure valid and accountable results (Henny, 2021).

Ethical Considerations

This study has obtained ethical approval from the Mitra Husada Health College Medan Ethics Committee under No. 125/KEP-MHM/IV/2025. All participants were fully explained the purpose of the study and the procedures to be performed. Written consent was obtained from each participant after they provided informed consent. Confidentiality of participant data is guaranteed in accordance with the standards of the Declaration of Helsinki.

Results

This study was conducted at the Atu Lintang Inpatient Health Center, Atu Lintang District, Central Aceh Regency, Aceh Province in 2024. The study involved 60 pregnant women registered in the working area of the Lintang Inpatient Health Center (Puskesmas Rawat Inap) in 2024. Based on the analysis conducted, it was found that there was a significant relationship between socioeconomic and health factors with the incidence of Chronic Energy Deficiency (KDRT) among pregnant women in this area. **Table 1** shows the frequency distribution of characteristics of pregnant women who participated in the study, including education level, income, parity, and history of infectious diseases.

Table 1. Frequency Distribution of Maternal Characteristics

Category	Frequency	Percentage
Education		
Low Education (No School, Elementary, Junior High School)	19	31.7
Higher Education (High School, University)	41	68.3
Income		
High	35	58.3
Low	25	41.7
Paritas		
Primigravida	37	61.7
Multigravida	23	38.3
History of Infectious Diseases		
No	38	63.3
Yes	22	36.7
CED Incidents		
No	34	56.7
Yes	26	43.3

Based on the results of the analysis of **Table 1** above, the majority of Higher Education (High School, University) are 41 people (68.3%). In terms of income, the majority of High income are 35 people (58.3%). In terms of parity, the majority of primigravida are 37 people (61.7%). In terms of Infectious Disease History, the majority of those who do not experience Chronic Energy Deficiency (CED) are 38 people (63.3%).

Table 2. Relationship between maternal characteristics and the incidence of Chronic Energy Deficiency (CED).

Category	CED				Total		Rasio Odds (OR)	Confidence Interval 95% (CI)	*Score p-value*
	No		Yes						
	f	%	f	%	f	%			
Education							3,25	1,17-8,92	
Low Education (No School, Elementary, Junior High School)	6	31.6	13	68.4	19	100			0.008
Higher Education (High School, University)	28	68.3	13	31.7	41	100			
Total	34	56.7	26	43.3	60	100			
Income									
High	25	71.4	10	28.6	35	100	3.45	1.20-9.98	0.007
Low	9	36	16	64	25	100			
Total	34	56.7	26	43.3	60	100			
Paritas									
Primigravida	26	70.3	11	29.7	37	100	2.95	1.04-8.47	0.007
Multigravida	8	34.7	15	65.2	23	100			
Total	34	56.7	26	43.3	60	100			
History of Infectious Diseases									
No	26	68.4	12	31.6	38	100	2.85	1.10-7.45	0.016
Yes	8	36.4	14	63.6	22	100			
Total	34	56.7	26	43.3	60	100			

Table 2 illustrates the relationship between maternal characteristics and the incidence of Chronic Energy Deficiency Syndrome (CED). The analysis shows a significant association between socioeconomic and health factors, namely Education, income, parity, and history of infectious diseases, and the incidence of CED in pregnant women. Table 2 shows that the p-value for maternal Education is 0.008, for income 0.007, for parity 0.007, and for history of infectious diseases 0.016. All p-values are less than 0.05, indicating statistical significance.

The odds ratio (OR) and 95% confidence interval (CI) analysis showed that several variables were significantly associated with the outcome. Education had an OR of 3.25 (95% CI: 1.17–8.92; p = 0.008), while income demonstrated an OR of 3.45 (95% CI: 1.20–9.98; p = 0.007). Parity was also significantly associated with

an OR of 2.95 (95% CI: 1.04–8.47; p = 0.007). In addition, a history of infectious disease showed an OR of 2.85 (95% CI: 1.10–7.45; p = 0.016). These findings indicate that all tested variables had a statistically significant relationship with the outcome.

This table also provides the OR and CI values for each tested variable, clarifying the effect sizes found in this study. All reported results indicate a significant association between the tested factors and the incidence of domestic violence among pregnant women in the study area, with p-values less than 0.05, indicating statistical significance. These findings strengthen the understanding of the importance of socioeconomic and health factors in determining the risk of domestic violence among pregnant women in the area.

Discussion

The findings of this study indicate that most respondents had a relatively higher educational background, stable household income, and were experiencing their first pregnancy. In addition, the majority of pregnant women did not report a history of infectious diseases. These characteristics suggest that socioeconomic and health conditions among the respondents varied, yet several factors still contributed to the occurrence of Chronic Energy Deficiency (CED) among pregnant women (Rosadi et al., 2025; Simanjuntak et al., 2024).

The analysis showed that maternal Education, household income, parity, and history of infectious diseases were associated with the occurrence of CED. These findings highlight the importance of socioeconomic and health-related determinants in shaping the nutritional status of pregnant women. Maternal Education plays a crucial role in influencing knowledge and awareness related to nutrition, health practices, and the utilization of maternal health services. Women with higher educational attainment tend to have better access to health information and are more likely to adopt healthy dietary behaviors during pregnancy (Shinta, 2021).

These findings are consistent with a study conducted by Mardiyana (2023), which reported that economic conditions are closely related to the incidence of CED among pregnant women. Household financial capacity greatly influences the ability to meet nutritional requirements during pregnancy. Adequate intake of essential nutrients, including minerals, iron, and vitamins, is necessary to support maternal health and fetal development. When economic resources are limited, pregnant women may face difficulties in obtaining nutritious food and maintaining adequate dietary intake (Mardiyana, 2023).

Regarding parity, repeated pregnancies may contribute to the depletion of maternal nutritional reserves. Insufficient spacing between pregnancies may limit the mother's ability to restore her nutritional status before the next pregnancy occurs. High parity is therefore considered a potential risk factor that can negatively affect both maternal and fetal health outcomes (Anggraeni, 2019; Chici Riansih, 2023).

However, several previous studies have reported different findings. Research conducted by Mahirawati (2014) did not identify a significant association between education level and the incidence of CED among pregnant women in Kamoning and Tambelangan Subdistricts, Sampang Regency, East Java. Similarly, a study by Albugis (2008) also found no significant relationship between educational attainment and CED among pregnant women at the Jembatan Serong Health Center(Rahayu & Purnomo, 2024; Retni et al., 2025). Variations may influence these differences in study settings, population

characteristics, and access to health services.

Overall, the results of this study emphasize that a combination of socioeconomic and health-related factors influences maternal nutritional status during pregnancy. Education, household income, reproductive history, and maternal health conditions collectively shape the risk of CED among pregnant women. Therefore, comprehensive strategies that integrate nutrition education, economic empowerment, and disease prevention are needed to improve maternal nutrition and reduce the burden of CED in the community.

Implications and limitations

This study contributes to understanding the factors influencing chronic energy deficiency (CED) among pregnant women, particularly in areas with limited access to health services, such as Atu Lintang, Aceh. The findings highlight the important role of socioeconomic and health-related factors, including Education, income, parity, and history of infectious diseases, in shaping maternal nutritional status. These results emphasize the need for integrated health policies that address not only maternal nutrition but also broader socioeconomic conditions through nutrition education, economic support, and infectious disease prevention. The findings also provide direction for future research to explore additional determinants such as dietary diversity, food habits, and adherence to nutritional supplementation. However, the relatively small sample size and the focus on a single health center limit the generalizability of the results, indicating the need for further studies with larger samples and more comprehensive variables.

Relevance to Practice

The findings of this study have important implications for nursing and midwifery practice, particularly in remote areas with limited access to health services. Based on the research findings, several practical steps can be implemented, such as integrating mid-upper arm circumference (MUAC) measurements into routine antenatal care, providing clear and structured nutrition education for pregnant women, and an interdisciplinary approach involving health, social, and economic workers to support pregnant women from low-income families. Socioeconomic-based interventions, intensive health monitoring for mothers with high parity, and increased prevention of infectious diseases also need to be prioritized. Implementing these measures is expected to reduce the prevalence of Chronic Energy Deficiency (CED), improve the quality of antenatal care, and improve maternal and infant health in resource-limited areas.

Conclusion

This study found that maternal Education, income, parity, and history of infectious diseases were significantly associated with Chronic Energy Deficiency (CED) among pregnant women at Atu. Lintang Health Center. Socioeconomic and health factors, such as Education, income, parity, and history of infectious diseases, were significantly associated with the incidence of Chronic Energy Deficiency (CED) among pregnant women in remote areas. These findings underscore the importance of an integrated approach to antenatal care, which includes nutrition education, routine screening using MUAC measurements, and socioeconomic-based interventions. To reduce the prevalence of domestic violence, increased understanding among health workers regarding existing risk factors and the implementation of more comprehensive preventive measures are needed.

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CrediT Authorship Contributions Statement
Eva Ratna Dewi: Conceptualization, Methodology, Supervision, Writing - Original Draft
Ingka Kristina Pangaribuan: Validation, Formal Analysis, Writing - Review & Editing
Ribur Sinaga: Investigation, Resources, Data Curation, Project Administration
Kiki Miftasari: Visualization, Funding Acquisition

Conflicts of Interest
There is no conflict of interest.

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