Journal Of Nursing Practice
https://thejnp.org/
ISSN: 2614-3488 (print); 2614-3496 (online) Vol.9 No.3. April 2026. Page.688-696

Multilevel Analysis of Socioeconomic and Cultural Factors on Chronic Energy Deficiency among Pregnant Women in Madura

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ABSTRACT

Background: Chronic Energy Deficiency (CED) is one of the health problems that often occurs in pregnant women in various countries, especially in regions with low economic levels and vulnerable communities.

Purpose: The purpose of this study is to examine the influence of socioeconomic and cultural contextual factors on the occurrence of CED in pregnant women.

Methods: The research design is explanatory research with a cross-sectional approach. The research sample consists of 200 pregnant women with CED and 200 pregnant women without CED in Madura. The dependent variable in this study is the incidence of CED, while the independent variables are regional conditions, access to health services, parity, food availability, and CED preventive behavior. Data analysis in the study is univariate and linear regression with a multilevel approach using SPSS 23. The research ethics certificate 001867/EC/KEPK/I/II/2024.

Results: Level 1 is rural and urban areas, access to health services, parity, food availability, and preventive behavior for CED. Level 2 is the subdistrict level. Subdistrict conditions have a contextual influence on the variation in the occurrence of CED in pregnant women, namely significant values in rural and urban areas (p=0.009), significant values in access to health services (p=0.013), significant values for parity (p=0.022), significant values for food availability (p=0.049), and significant values for CED preventive behavior (p=0.029).

Conclusion: The highest prevalence of CED was found in coastal areas, followed by villages, and the lowest in cities. Women with low parity (primiparas) are not entirely free from the risk of CED. Conversely, pregnant women in urban areas tend to have better access to health facilities, nutritional information, and a variety of foods, resulting in a relatively lower risk of CED.

Keywords: CED, Cultural Contextual Factors, Pregnant Women, Socioeconomic

Received January 10, 2025; Revised February 12, 2025; Accepted March 3, 2026
DOI: https://doi.org/10.30994/jnp.v9i3.952

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.9 No.3. April 2026. Page.688-696

BACKGROUND

Chronic Energy Deficiency (CED) in pregnant women is influenced by complex interactions between psychological and socio-structural factors, including resource allocation within the household, reinforcement, observational learning, self-efficacy, perceived barriers, perceived benefits, perceived threats, outcome expectations, socio-demographic conditions, social capital, food taboos, gender roles, food availability, perceived vulnerability, perceived severity, and cues to action (Zerfu and Biadgilign, 2018). Chronic Energy Deficiency (CED) in pregnant women can have serious consequences for the health of both the mother and her fetus. Chronic Energy Deficiency (CED) is a condition caused by an imbalance in nutritional intake between energy and protein, resulting in the body not getting the nutrients it needs (Gelebo et al., 2021).

The World Health Organization (WHO) states that the country with the highest rate of Chronic Energy Deficiency (CED) is Bangladesh, with a CED incidence of 47%, while Indonesia ranks fourth after India, with a CED incidence of 40% (World Health Organization, 2023). The percentage of CEN cases among pregnant women in 2023 in each subdistrict of Sumenep Regency was highest in Gapura Subdistrict (20.25%) and lowest in Gili Genting Subdistrict (2.67%). The incidence of Chronic Energy Deficiency (CED) among pregnant women based on coastal, inland, and marine areas indicates that the health and nutritional status of pregnant women in a geographical context has different predisposing factors.

A prevention approach based on health promotion theory, as developed by Nola Pender, is highly effective in improving pregnant women's understanding of healthy behaviors and reducing the risk of Chronic Energy Deficiency (CED). These interventions need to consider socio-contextual factors, such as eating habits, gender roles, and social support, and use multilevel analysis models to strengthen the prevention of Chronic Energy Deficiency (CED) in various regions and socioeconomic conditions. The complex interaction between psychological and socio-structural factors can significantly influence preventive behaviors and the incidence of chronic energy deficiency in pregnant women. Understanding the interrelatedness of these factors is essential for designing effective interventions to improve maternal nutrition and reduce the burden of chronic energy deficiency during pregnancy. Careful consideration of broader socio-contextual factors, as well as cultural contexts and the influence of key decision-makers in the household, is necessary to address critical gaps and promote positive behavioral change (Jhaveri et al., 2023). Preconception counseling and antenatal services can be important entry points for educating pregnant women, improving nutritional knowledge, and fostering positive attitudes toward recommended practices (Zerfu and Biadgilign, 2018).

Multilevel analysis of Chronic Energy Deficiency (CED) prevention in pregnant women, based on health promotion theory, involves steps to understand, analyze, and address the problem of Chronic Energy Deficiency (CED). This process includes analysis of epidemiological data, scientific literature, and related information, as well as selection of the appropriate theory as the basis for an effective intervention model (Harlan, 2016). Health promotion theory provides a framework for understanding health behavior and motivating behavioral change. In this context, the theories used are the Epidemiological Triad, Social Cognitive Theory (SCT), and Health Belief Model (HBM) to analyze and change health behavior (Tonkaboni et al., 2021).

The results of multilevel analysis should be disseminated to stakeholders, health professionals, and the wider community to increase understanding of the prevention of Chronic Energy Deficiency (CED) in pregnant women. Research findings on the prevention of Chronic Energy Deficiency (CED) based on health promotion theory are a complex process and require

collaboration between researchers, health practitioners, and communities to ensure success and a significant impact in preventing this nutritional problem in pregnant women.

OBJECTIVE

The purpose of this study was to analyze the influence of socioeconomic and contextual factors on CED incidence among pregnant women using a multilevel approach

METHODS

The research design is explanatory research with a cross-sectional approach, which is a research design where research variables are studied and then measured at the same time. The research location is in Sumenep Regency. The research proposal was conducted in October 2024. The research population consists of all pregnant women in Sumenep Regency, totaling 14,104 respondents. The research sample consists of 200 pregnant women with CED and 200 pregnant women without CED, using proportional random sampling as the probability sampling technique. The research variables consisted of independent variables, namely region (rural and urban), access to health services, parity, and food availability, while the dependent variable was CME preventive behavior. Level 1 of the research was rural and urban areas, access to health services (m), parity, food availability, and Chronic Energy Deficiency (CME) preventive behavior. Level 2 is the sub-district area. The measurement tool used is a questionnaire that has been tested for validity and reliability. The questionnaire validity test results show that each question has a value of ≥ 0.20 and a Cronbach's alpha value of 0.881, which means that the questionnaire is valid and reliable. The questionnaire was given to respondents with the help of enumerators. The research analysis was univariate, bivariate, and linear regression with a multilevel approach using SPSS 23. The research ethics certificate was issued by STRADA University Indonesia Number: 001867/EC/KEPK/I/II/2024.

RESULTS

The results of the study of 400 respondents, divided into 200 pregnant women with Chronic Energy Deficiency (CED) and 200 pregnant women without Chronic Energy Deficiency (CED), are described in the results below. The characteristics of the study respondents describe their age, highest level of education, socioeconomic status, parity, pregnancy spacing, access to health services, and area of residence, as follows:

Table 1. Characteristics of pregnant women (n=400)

Respondent characteristics	Category	Group			
		Pregnant women with CED		Pregnant women do not have CED	
		n	%	n	%
Age	< 20 years	21	10.50	3	1.50
	20-35 years	168	84.00	177	88.50
	> 35 years	11	5.50	20	10.00
Education	No school	30	15.00	32	16.00
	Elementary School	38	19.00	38	19.00
	Junior High School	106	53.00	74	37.00
	Senior High School	25	12.50	56	28.00
	Higher education	1	0.50	0	0.00
Social status	Doesn't work	179	89.50	151	75.50
	Work	21	10.50	49	24.50
Economy	< Minimum Wage	163	81.50	133	66.50
	≥ Minimum Wage	37	18.50	67	33.50

Respondent characteristics	Category	Group			
		Pregnant women with CED		Pregnant women do not have CED	
		n	%	n	%
Parity	Primipara	155	77.50	126	63.00
	Multipara	45	22.50	74	37.00
	Grandemultipara	0	0.00	0	0.00
Pregnancy spacing	< 2 years	16	8.00	16	8.00
	≥ 2 years	79	39.50	104	52.00
Access to health services	Near (≤ 2000 meters)	86	43.00	124	62.00
	Medium (2001-3000 meters)	35	17.50	30	15.00
	Far (> 3000 meters)	79	39.50	46	23.00
Area	Rural	155	77.50	141	70.50
	Urban	45	22.50	59	29.50

Source: Primary Data, 2025

Table 1 shows that the respondents in this study were divided into two groups: pregnant women with chronic energy deficiency (CED) and pregnant women without chronic energy deficiency (CED). In the group of pregnant women with Chronic Energy Deficiency (CED), most of the mothers were aged 20-35 years, namely 168 respondents (84.00%), had a junior high school education, namely 106 respondents (53.00%), were unemployed (179 respondents, 89.50%), had an income below the minimum wage (163 respondents, 81.50%), were primiparous (155 respondents, 77.50%), with a pregnancy interval of ≥ 2 years, 79 respondents (39.50%), close to health services (≤ 2000 meters), 86 respondents (43.00%), and based on area, mostly rural, 155 respondents (77.50%).

In the group of pregnant women without Chronic Energy Deficiency (CED), most of the mothers were aged 20-35 years, namely 177 respondents (88.50%), had a junior high school education, namely 74 respondents (37.00%), were unemployed, 151 respondents (75.50%), had an income below the minimum wage, 133 respondents (66.50%), were in the primipara parity category, 126 respondents (63.00%), had a pregnancy interval of ≥ 2 years, 104 respondents (52.00%), were close to health services (≤ 2000 meters), 124 respondents (62.00%), and were mostly from rural areas, 141 respondents (70.50%).

Table 2. Characteristics of research variables in pregnant women (n=400)

Variables	N	Mean	Elementary School	Min	Max
LiLA (cm)	400	23.16	1.28	21	36.6
CED preventive behavior	400	19.04	4.27	7	29
Access to health services (m)	400	3,688	4,919	0	40,000
Food availability	400	28.27	4.93	0	35

Source: Primary Data, 20 25

Table 2 shows the breakdown of the mean, SD, min, and max values of the variables LiLA (Upper Arm Circumference), preventive behavior against Chronic Energy Deficiency (CED), access to health services, and food availability.

Multivariate effects explain the influence of more than one independent variable, namely socioeconomic and cultural contextual factors of the community, on preventive behavior against Chronic Energy Deficiency (CED) and the incidence of Chronic Energy Deficiency (CED). The method used is linear regression with a multilevel approach using the STATA program.

Table 3. Results of Linear Regression Analysis with a Multilevel Approach

Independent Variables	Coef.	CI(95%)		p
		Limit Lower	Limit On	
Fixed Effect				
Rural and Urban	0.45	0.11	0.78	0.009
Access to health services (m)	-0.01	-0.01	-6.97	0.013
Parity	0.12	0.02	0.22	0.022
Food availability	0.02	0.01	0.05	0.049
CED preventive behavior	0.03	0.01	0.06	0.029
Random Effect				
Subdistrict Area				
Estimate: 0.06				

Source: Primary Data, 2025

Table 3 shows that level 1, namely rural and urban areas, access to health services (m), parity, food availability, and preventive behavior against Chronic Energy Deficiency (CED). Level 2 is the subdistrict area. Subdistrict conditions have a contextual influence on the variation in the occurrence of CEE in pregnant women, namely significant values in rural and urban areas (p=0.009), significant values in access to health services (m) (p=0.013), significant values for parity (p=0.022), significant values for food availability (p=0.049), and significant values for preventive behavior against Chronic Energy Deficiency (CED) (p=0.029).

DISCUSSION

The results of the multilevel linear regression analysis used in this study show that several contextual factors are significantly associated with the occurrence of Chronic Energy Deficiency (CED) in pregnant women in Madura. Among the socioeconomic and cultural variables analyzed, several showed a statistically significant relationship with CEE preventive behavior and the incidence of CEE, namely: rural and urban areas, access to health services (meter), parity, and food availability.

At level 1 analysis, the comparison between rural and urban areas shows significant differences in several aspects related to maternal health, namely access to health services, parity, food availability, and preventive behavior. Maternal and Child Health Chronic Energy Deficiency (CED). The results of the multivariate analysis show that the p-value for this comparison is 0.009. This low p-value indicates that the differences found between the two areas are not coincidental, but rather reflect a consistent and significant pattern.

These differences show that environmental factors, such as access to health services and food availability, have a significant impact on the health of pregnant women. In urban areas, pregnant women may have better access to health services, such as prenatal checkups, medical facilities, and health information, compared to pregnant women in rural areas. In addition, the availability of nutritious food also tends to be better in urban areas, which can

contribute to the health of mothers and fetuses (Idris et al., 2025).

Thus, these results emphasize the importance of considering the geographical context in efforts to improve maternal health. These significant differences indicate that health interventions must be tailored to local conditions, both in rural and urban areas, in order to address the challenges faced by pregnant women in each region. This also underscores the need for greater attention to rural areas, where access to health services and food resources may be more limited, thereby increasing the risk of Chronic Energy Deficiency (CED) in pregnant women (Renjani & Misra, 2017). Most of the population in Madura lives in rural areas with limited access to health services and information, where dietary restrictions may be more common. Thus, pregnant women will be more influenced by these cultural norms than by updated medical knowledge about balanced nutrition. Food taboos in Madura often involve prohibitions on consuming nutritious foods that are essential during pregnancy, such as fish, meat, and eggs (Noviyanti et al., 2022). These foods are important for reducing the risk of malnutrition, especially for preventing Chronic Energy Deficiency (CED). Cultural practices such as these can play a major role in lower preventive behavior and increase the risk of Chronic Energy Deficiency (CED) in pregnant women (Rachmi et al., 2024).

In addition to rural-urban areas, Madura's geographical conditions can also be viewed from the perspective of inland and coastal areas. Coastal areas, where most of the population works as fishermen, actually have the potential for highly nutritious food sources such as fish and other marine products. However, cultural practices that prohibit pregnant women from eating often forbid the consumption of fish, meat, or eggs, so that the abundant nutritional potential of the coast is not optimally utilized. On the other hand, inland areas far from the coast tend to be more dependent on agricultural products and the availability of seasonal foods. This leads to differences in consumption patterns and nutritional risks for pregnant women. Mothers in coastal areas may face cultural challenges, while mothers in inland areas face limitations in the availability of diverse nutritious foods. Both conditions can contribute to an increased risk of Chronic Energy Deficiency (CED) if not balanced with proper nutrition education (Rachmi et al., 2024).

Parity is one of the key determinants of nutritional status in pregnant women, particularly regarding the incidence of Chronic Energy Deficiency (CED). Biologically, women with high parity (multiparous or grand multiparous) tend to have a higher risk of developing CED compared to primiparous women. This is due to the repeated depletion of energy and nutrient reserves resulting from previous pregnancies and childbirths. If not balanced by adequate nutritional recovery between pregnancies, the condition of chronic energy deficiency will worsen. Additionally, short pregnancy intervals in women with high parity further exacerbate this condition because the body has not had sufficient time to replenish nutrients. From a social and cultural perspective in Madura, high parity is often linked to cultural values that view having many children as a symbol of family blessing or strength. This situation can increase women’s reproductive burden without corresponding improvements in access to adequate nutritional intake. In households with limited resources, mothers with many children tend to prioritize the needs of other family members over their own, resulting in suboptimal energy and protein intake for pregnant women. This aligns with a multilevel approach, in which individual factors (parity), household factors (food allocation), and cultural factors (fertility norms) interact to influence the occurrence of CED.

Nutrient deficiencies, supported by environmental and human factors, are the result of Chronic Energy Deficiency (CED), whereby the body's nutrient reserves are used to meet its needs. If this condition persists for a long time, the nutrient reserves will be depleted and tissue wasting will eventually occur (Humphries et al., 2021). The factors that cause Chronic Energy Deficiency (CED) in pregnant women are influenced by direct and indirect factors. Direct

factors include infectious diseases and food intake, while indirect factors include family food supplies, education, maternal knowledge, family income, and health services (Hardinsyah and Supariasa, 2016).

Nationally, Riskesdas 2018 reported that the prevalence of Chronic Energy Deficiency (CED) risk in pregnant women in Indonesia reached 17.3% (Ministry of Health of the Republic of Indonesia, 2018). This figure confirms that Chronic Energy Deficiency (CED) remains an important public health issue. Several studies in Indonesia also indicate that mothers with parity ≥3 have a higher risk of experiencing Chronic Energy Deficiency (CED) compared to primiparas, especially when accompanied by older reproductive age and short pregnancy intervals (Ni et al., 2023; Puspitasari et al., 2023). This reinforces findings showing an increase in the prevalence of Chronic Energy Deficiency (CED) with an increase in the number of births.

Social cognitive theory is a theory about changes in human behavior. Bandura states in his theory that human behavior is identified as an interaction between human factors (person), behavior, and environment. These three factors continuously influence each other. The interaction between humans and their behavior involves the influence of a person's thoughts and actions. Meanwhile, the interaction between humans and the environment involves human beliefs and cognitive abilities that develop from environmental influences. Finally, the interaction between the environment and human behavior involves the influence of behavior on interrelated aspects of the environment (Bandura, 2012).

The environment refers to factors that influence a person's behavior, including social and physical environments such as family members, friends, and colleagues. The physical environment refers to the size of a room, temperature, or availability of certain foods (Abraham & Sheeran, 2015). The environment and situation form the conceptual framework for understanding behavior. The situation refers to the mental and cognitive picture of the environment that may influence a person's behavior. The environment shapes the model for behavior (Sulaeman, 2022). Bandura says that social cognitive theory is a learning process by translating information about behavior and the environment into symbols to encourage real action.

This difference shows that environmental factors, such as access to health services and food availability, have a significant impact on the health of pregnant women (Musaddik et al., 2022). In urban areas, pregnant women may have better access to health services, such as pregnancy check-ups, medical facilities, and health information, compared to pregnant women in rural areas. In addition, the availability of nutritious food tends to be better in urban areas, which can contribute to the health of mothers and fetuses (Idris et al., 2025). The prevalence of Chronic Energy Deficiency (CED) is highest in coastal areas, followed by villages, and lowest in cities. The high rate of Chronic Energy Deficiency (CED) in villages and coastal areas is influenced by limited access to health services, low education, limited purchasing power for food, and cultural practices that restrict the consumption of animal protein sources (Yunita et al., 2023). Conversely, pregnant women in urban areas tend to have better access to health facilities, nutritional information, and diverse foods, resulting in a relatively lower risk of Chronic Energy Deficiency (CED).

CONCLUSION

Thus, these results emphasize the importance of considering the geographical context in efforts to improve maternal health. These significant differences indicate that health interventions must be tailored to local conditions, both in rural and urban areas, to address the challenges faced by pregnant women in each region. This also underscores the need for greater attention to rural areas, where access to health services and food resources may be more limited, thereby increasing the risk of Chronic Energy Deficiency (CED) in pregnant women. Most of

the population in Madura lives in rural areas with limited access to health services and information, where dietary restrictions may be more common. As a result, pregnant women are more influenced by these cultural norms than by the latest medical knowledge about balanced nutrition. Food restrictions in Madura often involve prohibiting the consumption of nutritious foods that are essential during pregnancy, such as fish, meat, and eggs. These foods are important for reducing the risk of malnutrition, especially for preventing Chronic Energy Deficiency (CED). Cultural practices such as these can play a major role in lower preventive behavior and increase the risk of Chronic Energy Deficiency (CED) in pregnant women.

ACKNOWLEDGMENT

The researchers would like to thank the pregnant women in Madura Regency who were willing to participate in the study. They would also like to thank the Head of the Madura Regency Health Office for granting permission for the study, as well as STRADA University Indonesia for supporting the implementation of the study.

CONFLICTS OF INTEREST

There is no conflict of interest in this study.

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