



## ANALYSIS OF RISK FACTORS FOR CHRONIC ENERGY DEFICIENCY IN PREGNANT WOMEN

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### ABSTRACT

Chronic energy deficiency is a nutritional problem that is still commonly experienced by pregnant women in developing countries. This condition occurs when energy and protein intake is not met over a long period of time. CED is usually identified through upper arm circumference (UAC) measurements, where a value of <23.5 cm or in the red area of the UAC tape indicates risk. This study aims to identify risk factors associated with the occurrence of CED in pregnant women. The method used is quantitative with a cross-sectional design. The study population consists of all pregnant women who underwent examinations at the Gambirsari Surakarta Community Health Center in August 2025, with a sample of 88 respondents determined through consecutive sampling. Data were obtained through questionnaires and interviews, with the validity of the knowledge questionnaire ranging from 0.341 to 0.664, thus declared valid ( $r \geq 0.30$ ) and reliability tested with a Cronbach's Alpha value of 0.885, indicating excellent reliability. In contrast, the GPAQ instrument had substantial reliability (Kappa 0.67–0.73) and acceptable criterion-related validity against accelerometer ( $r = 0.48$ ). Based on the results, the majority of participants did not experience CED (61.4%), were aged 20–35 years (83%), had a parity of <2 (94.3%), were economically well-off (60.2%), had good knowledge (59.1%), and engaged in light physical activity (43.2%). The chi-square analysis drew a significant relationship among age and CED ( $p=0.001$ ), parity ( $p=0.05$ ), economic status ( $p=0.001$ ), knowledge ( $p=0.001$ ), and physical activity ( $p=0.001$ ). The multivariate test results confirmed that knowledge ( $p=0.002$ , OR=1.066) and physical activity ( $p=0.005$ , OR=1.226) were the dominant factors. There was a significant relationship among age, parity, economic status, knowledge, and physical activity by CED in pregnant women. Multivariate analysis confirmed that knowledge and physical activity were the dominant factors influencing the incidence of CED.

Keywords: chronic energy deficiency; pregnant women; risk factors

### How to cite (in APA style)

Marshanda, L., & Sulastri, S. (2026). Analysis of Risk Factors for Chronic Energy Deficiency in Pregnant Women. *Indonesian Journal of Global Health Research*, 8(3), 1399–1406. <https://doi.org/10.37287/ijghr.v8i3.1215>.

### INTRODUCTION

Chronic energy deficiency (CED) is one of the world's health problems, especially in enhancing nations. Chronic energy deficiency (CED) in pregnant women is a condition in that the mother experiences long-term nutritional deficiency, comprising insufficient energy and protein intake, and is characterized by an upper arm circumference of less than 23.5 cm or a measurement that draws a red on the UAC tape (Nadrah et al., 2024). Pregnant women suffering chronic energy deficiency (CED) and anemia are at risk of various serious complications, comprising difficult and prolonged labor, premature birth, and the risk of providing birth to a low birth weight (LBW) baby (Aisyah et al., 2023). The World Health Organization (WHO) recorded that the prevalence of Chronic Energy Deficiency (CED) increased to 35% in 2020. In addition, the WHO notes that up to 40% of maternal deaths in enhancing nations are related to chronic energy deficiency (CED), reflecting its significant impact on the health of pregnant women (Sukmawati et al., 2023). In Asia, the prevalence of CED ranges by 15–47%, by Indonesia ranking fourth at 35.5%, drawing that CEE remains a serious challenge, especially in nations by more vulnerable socioeconomic conditions (Retni et al., 2021).

Based on data by the Indonesian Health Risk Assessment, it is known that the prevalence of Chronic Energy Deficiency (CED) among pregnant women reached 17.3% nationally (Riskesdas, 2019). Meanwhile, in Central Java Province, the figure was greater, at 20.2%. Meanwhile, in

Surakarta City in 2023, 481 pregnant women were recorded as having CED out of a total of 10,479 pregnant women targeted, by the highest prevalence in Banjarsari District (Dinas Kesehatan Surakarta, 2022). Lack of nutritional knowledge is one of the factors giving to the incidence of CED. Low knowledge can cause mothers to have difficulty choosing the right nutrients to meet their increased nutritional needs during pregnancy (Diningsih, 2021). Good nutritional understanding is important for maintaining the health of mothers and supporting fetal growth and development (Rusmita et al., 2022). In addition, family economic conditions also have an influence, where limited income restricts the ability to obtain the nutritious food needed by pregnant women (Pertiwi et al., 2022).

Other factors that contribute to the risk of CED are the mother's reproductive age, that is <20 years or >35 years (Deeksha Pandey, 2024). Inadequate nutritional intake, comorbidities, low educational attainment, lack of women's empowerment, minimal spousal support, and closely spaced pregnancies (<2 years) are also causes of CED (Rosita et al., 2022). Given the complexity of the causative factors and the still high prevalence of CED, this study aims to analyze the risk factors associated by the occurrence of CED in pregnant women in the working area of the Gambirsari Surakarta Community Health Center.

## METHOD

A quantitative cross sectional research design method was used to explore the relationship among factors contributing to CED in pregnant women. Consecutive sampling was utilized in this research, with a sample of 88 responders. The ones who included in this study was the pregnant women at the Gambirsari Gealthing Post, Surakarta – Indonesia in their first, second and third trimester of pregnancy. This study population was all pregnant women who conducted pregnancy test checkups at the Gambirsari Community Health Center in Surakarta, August 2025. Original specimens were collected through pregnant women questionnaires and interviews. The research instruments used were observation sheets and questionnaires. Observation sheets were used to record demographic data on respondents, including age, parity, economic status, and the UAC measurement results. Questionnaires were used to assess pregnant women's knowledge of chronic energy deficiency (CED) and physical activity, which was measured using the Global Physical Activity Questionnaire (GPAQ) Score. Univariate and bivariate analysis was performed, chi-square test was applied for the bivariate. The values of the validity test questionnaire were between 0.341 to 0.664 which was accounted for valid ( $r \geq 0.30$ ) and Cronbach's Alpha value in reliability test was 0.885, showing an excellent reliability. In contrast, the GPAQ instrument had good reliability (Kappa = 0.67–0.73) and fair validity by accelerometer criteria ( $r > 0.48$ ).

## RESULT

Table 1.  
Description of Respondent Characteristics

Variable	f	%
Age		
20-35 years	73	83
<20 years old and >35 years old	15	17
Economic Conditions		
Low <2,200,000	35	39.8
High >2,200,000	53	60.2
Occupation		
Civil Servant	3	3.4
Labor	3	3.4
Housewives	44	50
Private sector employee	27	30.7
Health workers	2	2.3
Self-employed	9	10.2

Based on the data in table 1, most pregnant women were aged 20–35 years, namely 73 people (83%). In terms of economic status, the majority of participants were in the high economic category, namely 53 people (60.2%), while those in the low economic category numbered 35 people (38.9%). Meanwhile, characteristics based on occupation show that most participants are housewives, namely 44 people (50%) of the total 88 participants.

Table 2.

Frequency Distribution of Chronic Energy Deficiency, Age, Parity, Economic Status, knowledge, and Physical Activity

Research Variables	f	%
Incidence of chronic energy deficiency (CED)		
CED	34	38.6
Non CED	54	61.4
Age		
20-35 years	73	83
<20 years old and >35 years old	15	17
Parity		
< 2	83	94.3
> 2	5	5.7
Economic conditions		
Low <2.200,000	35	39.8
High >2.200,000	53	60.2
Knowledge		
Insufficient <56%	11	12.5
Adequate 56%-75%	25	28.4
Good 76%-100%	52	59.1
Physical Activity		
Weight > 3000 MET	36	40.9
Moderate 600 MET-3000 MET	14	15.9
Light <600 MET	38	43.2

The results of the study in table 2 show that the majority of participants did not experience chronic energy deficiency, by 54 participants (61.4%). Based on age, most participants were in the 20–35 age range, namely 73 participants (83%). In terms of parity, almost all participants had a parity of <2, namely 83 people (94.3%). In terms of economic status, the majority of participants were in the high economic category, namely 53 people (60.2%). Based on knowledge, the majority of participants had a good level of knowledge, namely 52 participants (59.1%). Based on physical activity, 38 participants (43.2%) had light physical activity.

Table 3.

Relationship among age and chronic energy deficiency in pregnant women

Research Variables	KEK		Non-CED		Total		P-Value
	f	%	f	%	f	%	
Age							
<20 and >35 years	15	100	0	0	15	100	
20 - 35 years	19	21.6	54	61.4	73	100	0.001
Parity							
>2	4	80	1	20	5	100	
<2	30	36.1	53	63.9	83	100	0.050
Economic Conditions							
Low	23	65.7	12	34.3	35	100	
High	11	20.8	42	79.2	53	100	0.001
Knowledge							
Insufficient	8	72.7	3	27.3	11	100	
Sufficient	16	64	9	36	25	100	0.001
Good	10	19.2	42	80.8	52	100	
Physical Activity							
Weight	23	63.9	13	36.1	36	100	
Moderate	6	42.9	8	57.1	14	100	0.001
Light	5	13.1	33	86.9	38	100	

The results of the study in table 3, drew a relationship among age and CED ( $p=0.001$ ), parity ( $p=0.05$ ), economic status ( $p=0.001$ ), knowledge ( $p=0.001$ ), and physical activity ( $p=0.001$ ).

Table 4.

Binary logistic regression to determine the most dominant independent variables associated by CED in pregnant women.

Variable	B	Sig. ( <i>p</i> -value)	Exp(B) (OR)
Age	0.097	0.170	1.102
Parity	-0.205	0.608	0.815
Economic status	0.001	0.396	1.001
Knowledge	0.064	0.002	1.066
Physical activity	0.001	0.001	1.000
Constant	-7.545	0.001	0.001

The five independent variables analyzed (age, parity, economic status, knowledge, and physical activity), only the variables of knowledge ( $p=0.002$ , OR=1.066) and physical activity ( $p=0.005$ , OR=1.226) were significantly associated by the occurrence of CED.

## DISCUSSION

The results of the analysis in Table 3 show that the majority of participants were in the 20–35 age group, namely 73 people (83%), that is the reproductive age range and is considered the safest for pregnancy. Meanwhile, the number of participants aged <20 years and >35 years was relatively smaller, namely 15 people (17%). The statistical test results obtained a significance value of  $p=0.001 < \alpha (0.05)$ , that indicates a significant relationship among the age variable and the incidence of chronic energy deficiency (CED) in pregnant women at the Gambirsari Community Health Center in Surakarta. The results of this study are in line by the findings of (Aprianti et al., 2021), that drew a significance value of  $p=0.001$ , so it can be concluded that there is a relationship among age and the incidence of CED in pregnant women in the Suela Community Health Center Working Area in 2020. Similarly, research conducted by (Fitri et al., 2022) reported a significant relationship among age and the incidence of chronic energy deficiency (CED), by a  $p$ -value of 0.027. Pregnant women aged <20 years and >35 years have a greater risk of experiencing chronic energy deficiency (CED) compared to pregnant women of reproductive age (20–35 years) (Utami et al., 2023). Therefore, mothers aged <20 and >35 years need more attention in efforts to prevent chronic energy deficiency (CED). This indicates that age plays an important role as a factor that influences the risk of chronic energy deficiency (CED). However, this study also found that there were pregnant women in the high-risk age group who did not experience chronic energy deficiency (CED). This suggests that, in addition to age, other factors also play a role in determining the nutritional status of pregnant women such as parity, economic conditions, knowledge, and physical activity. Therefore, it can be concluded that age is one of the factors associated by the occurrence of chronic energy deficiency (CED) in pregnant women.

Statistical analysis results show that there is a relationship among parity and the incidence of Chronic Energy Deficiency (CED), by a significance value of  $p=0.05$ . These findings indicate a relationship among parity and CED, even though the relationship is right at the significance threshold. The results of this study are in line by the study (Faozi, 2022) that reported a significant relationship among parity and CED by  $p=0.01$ . The study mentioned that high parity ( $\geq 5$ ) or grandemultipara is a risk factor for pregnancy that can increase the possibility of CED due to repeated physiological stress on the mother's body. Similarly, a study (Sihite, 2022) at the Aek Parombunan Community Health Center in Sibolga City found a significant relationship by a  $p$ -value of 0.033, reinforcing that parity is one of the factors associated by the incidence of CED in pregnant women. This study draws that pregnant women by parity >2 have a greater proportion of CED occurrence (80%) compared to pregnant women by low parity (<2), that is only 36%. This finding illustrates that an increase in parity is associated by a greater risk of CED. This condition can occur because the nutritional needs of pregnant women increase by more frequent pregnancies, while the body's energy and nutrient reserves are not fully recovered, making women by high parity more

vulnerable to chronic energy deficiency (Auranissa et al., 2024). Meanwhile, in mothers by low parity or primiparas and nuliparas, the risk of CED can also occur, especially if the pregnancy occurs at an age that is not inside of the healthy reproductive range. Thus, it can be concluded that the greater the parity, the greater the risk of pregnant women experiencing CED due to increased nutritional needs that cannot be fully met. This condition indicates that the parity factor needs to be considered in efforts to prevent CED, by providing nutritional counseling and more intensive health status monitoring for groups of mothers by high-risk parity.

Based on the results of the study, the test results among economic conditions and the incidence of chronic energy deficiency drew a significant relationship, by a significance level of  $p=0.001 < \alpha$  (0.05). These results indicate that socioeconomic factors play an important role in determining nutritional status, particularly the incidence of chronic energy deficiency. This study draws that pregnant women by low economic status have a much greater proportion of CED (65.7%) compared to pregnant women by high economic status, that is only 20.8%. This indicates that economic status plays an important role in determining the nutritional status of pregnant women. The results of this study are in line by a study conducted by (Titiningsih et al., 2023), that drew a significance value of  $p=0.001$ , drawing that there is a relationship among economic status and the incidence of chronic energy deficiency in pregnant women. Similarly, research conducted by (Harismawati, Retni, 2019) found a significance value of  $p=0.02 < \alpha$  (0.05), proving that there is a significant relationship among economic status and the incidence of chronic energy deficiency (CED) in pregnant women in the Limboto Community Health Center working area. Low income can limit a family's access to nutritionally balanced food, resulting in suboptimal energy and nutrient intake for pregnant women (Istiqomah & Farhat, 2025). Conversely, high income can indeed increase purchasing power for healthier foods, but it does not always guarantee that nutritional needs are met, because food choices are also influenced by the level of knowledge and awareness of the importance of balanced nutrition. Even in pregnant women by good economic conditions, inappropriate consumption patterns can still be found, such as a tendency to choose low-nutrient foods, irregular eating schedules, or unhealthy eating habits. These conditions ultimately increase the risk of CED. However, having a good economic status still provides a greater opportunity for a family to improve the quality of the food they consume.

Statistical analysis draws that there is a relationship among knowledge and chronic energy deficiency (CED), by a significance of  $p=0.001 < \alpha$  (0.05). The results of the study show that the lower the level of knowledge of pregnant women, the greater the risk of CED. The highest proportion of CED was found in the group of mothers by low knowledge (72.7%), followed by the group by adequate knowledge (64%), while in the group by good knowledge, the CED rate was much lower at only 19.2%. This indicates that knowledge is an important factor that influences the behavior of pregnant women in maintaining nutritional intake during pregnancy. This study is in line by research conducted by (Mandella et al., 2023), that draws a significance value of  $p=0.008 < \alpha$  (0.05), meaning that there is a significant relationship among the knowledge variable and the incidence of CED in the working area of the Seginim Community Health Center, South Bengkulu Regency, in 2020. Similarly, research conducted by (Fatmawati et al., 2023) found a significance value of  $p = 0.001$ , that means that there is a relationship among pregnant women's knowledge and the incidence of chronic energy deficiency. The analysis also yielded an OR value of 14.000, that means that the knowledge factor has a 14 times greater chance of recurrence in relation to the occurrence of CED in pregnant women. Knowledge plays an important role in determining a decision. Individuals by a good understanding of something tend to be able to make more appropriate decisions than those by limited knowledge. Based on the researcher's assumption, the level of nutritional knowledge greatly influences the occurrence of CED in pregnant women. Lack of information about nutritional needs during pregnancy can lead to unhealthy food choices that do not meet nutritional requirements. This condition is exacerbated by a low understanding of energy requirements, the role of protein, and the importance of a balanced diet, thereby increasing the risk

of chronic energy deficiency (Mulyani et al., 2024). Thus, good knowledge among pregnant women contributes to preventing the risk of CED.

Based on physical activity, 36 participants (40.9%) performed heavy physical activity by a MET score  $>3000$ , 14 participants (15.9%) had moderate physical activity by a MET score of 600–3000, and 38 participants (43.2%) were classified as having light physical activity by a MET score  $<600$ . Statistical tests drew a significant relationship among physical activity and the incidence of chronic energy deficiency (CED) in pregnant women, by  $p=0.001$   $\alpha < (0.05)$ . These findings indicate that the more strenuous the physical activity performed by pregnant women, the greater their risk of experiencing CED. The highest proportion of CED was found in the heavy physical activity group (63.9%), followed by moderate physical activity (42.9%), while in light physical activity, the CED rate was much lower at only 13.1%. This indicates that excessive physical activity during pregnancy can increase energy requirements, so that if not balanced by adequate nutritional intake, it will cause chronic energy deficiency. This study is in contrast to the study conducted by (Rangkuti, 2023), that drew a significance of  $p=1.00 > \alpha (0.05)$ , meaning that there was no significant relationship among physical activity and the incidence of chronic energy deficiency (CED) in pregnant women. Similarly, research conducted by (Sulistyaningsih et al., 2023) a significance value of  $p = 0.73 > \alpha (0.05)$  drew no effect among physical activity and the incidence of chronic energy deficiency in pregnant women at the Masohi Community Health Center, Masohi District, Central Maluku Regency in 2022.

The results of the analysis in table 4, Knowledge and physical activity were the most dominant factors for CED after controlling for other variables. This means that the lower the level of knowledge and the heavier the physical activity, the greater the risk of pregnant women experiencing CED. Meanwhile, the variables of age, parity, and economic status did not show a significant relationship ( $p>0.05$ ). The logistic regression model used had a predictive ability of 77.3%, by a Nagelkerke R Square value of 0.492.

Bivariate analysis results show a significant relationship among age, parity, and economic status variables, but after multivariate analysis, these variables are no longer significant. This condition indicates the presence of interaction and confounding effects, where the influence of age and economic status is largely influenced by the level of knowledge and physical activity. (Wati et al., 2024) reported similar findings, namely that after controlling for nutritional factors and activity, the influence of age and income on CED weakened.

## **CONCLUSION**

This study draws that there is a significant relationship among age, parity, economic status, level of knowledge, and physical activity by the incidence of Chronic Energy Deficiency (CED) in pregnant women. Pregnant women aged  $<20$  years and  $>35$  years, by high parity, low economic status, low knowledge, and heavy physical activity had a greater proportion of CED compared to other groups. This confirms that biological, socioeconomic, cognitive, and lifestyle factors play an important role in influencing the nutritional status of pregnant women. Therefore, CED prevention efforts should focus on improving nutrition education and monitoring by health workers, accompanied by government support in providing nutritious food and empowering families economically.

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