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Determinants of Chronic Energy Deficiency in Pregnancy at Lebak Wangi Community Health Center, Banten, Indonesia

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ABSTRACT

Background: Malnutrition during pregnancy increases the risk of anemia, hypertension, miscarriage, fetal death, and causes low birthweight and fetal growth disorders that have a long-term impact on quality of life and health costs. Understanding and analyzing the problem of chronic energy deficiency in pregnant women based on comprehensive determinants is indispensable in order to design appropriate policies and treatment actions. This study aims to analyze the influence of the determinants of the incidence of chronic energy deficiency in pregnant women.
Subjects and Method: This is a case control study conducted at the "Lebak Wangi" Health Center in Serang-Banten, Indonesia, in November 2025. The sample in this study was 105 pregnant women divided into 2 groups of cases, namely 53 pregnant women who suffered from chronic energy deficiency and a control group of 52 pregnant women with normal nutritional conditions. The exposure variable in this study is chronic energy deficiency). Independent variables were maternal age, gestational age, parity, education, economic status, haemoglobin level, and body mass index. The instrument research was master table. The analysis was carried out by multiple logistic regression.
Results: Mothers with a lean body mass index are more likely to experience chronic energy deficiency up to 4.7 times more than mothers with a normal and statistically significant body mass index (aOR= 4.70; 95%CI= 0.34 to 0.83; p <0.001). Older gestational age has a 3.5 times smaller chance of chronic energy deficiency than younger gestational age and is statistically significant (aOR= -3.55; 95%CI= -2.61 to -0.75; p<0.001).
Conclusion: The factors that have a significant influence in the case of SEZs are body mass index and gestational age.

Keywords: body mass index, chronic energy deficiency, pregnancy

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BACKGROUND

Chronic Energy Deficiency (CED) is a form of nutritional problem that is often encountered in many developing countries,

including Indonesia. CED is defined as a condition in which the body experiences an energy deficiency that lasts for a long time, which can affect the physical health and development of the child. This condition is characterized by an upper arm circumference (MUAC) of less than 23.5 cm. This occurrence is often found in pregnant women and toddlers, who require higher energy intake and nutrition to support optimal growth and development. Based on research conducted by , low socioeconomic factors greatly affect the incidence of SEZs, because people with low income levels often have difficulty accessing nutritious food and adequate health facilities (WHO, 2018; Palloni, 2019).

Research also emphasizes that education levels, especially pregnant women's knowledge of nutrition, play a big role in determining the nutritional status of them and their children. This study shows that pregnant women who lack nutritional knowledge are more likely to experience CED and give birth to babies with low birth weight. Mothers with CED are at risk of chronic fatigue, require longer recovery time after childbirth, and are more prone to postpartum depression. In addition, there is a risk of pregnancy complications such as preeclampsia, bleeding, hypertension, gestational diabetes, and premature rupture of the membranes. In fetuses, CED can lead to nutritional deficiencies, low birth weight, and an increased risk of health complications. Pregnant women with CED are also at risk of experiencing various health complications, including congenital abnormalities in the baby, low birth weight (LBW), anemia, Intrauterine Fetal Death (IUFD), Intrauterine Growth Retardation (IUGR). These conditions show the importance of implementing appropriate nutritional interventions to support maternal health and optimal fetal development. (Nabukeera-Barungi, 2020; Purnamasari, 2023; Izzati, 2022).

Malnutrition during pregnancy increases the risk of anemia, hypertension, miscarriage, fetal death, as well as causing LBW and fetal growth disorders that have a long-term impact on quality of life and health costs. Chronic energy deficiency can increase the risk of maternal and fetal death. Mothers who lack energy tend to have weakened immunity, which makes infections and complications easier (Ministry of Health RI, 2023).

The maternal mortality rate collected from the recording of the Maternal and Child Nutrition and Health program at the Ministry of Health from 2019-2021 tends to increase, while from 2021-2023 the number of maternal deaths fluctuates. The number of maternal deaths in 2023 is 4,482 per 100,000 per 100,000 live births. The results of the 2023 SKI show that malnutrition in pregnant women is still a problem, with 3 out of 10 pregnant women experiencing anemia and 17% at risk of Chronic Energy Deficiency (CED). According to Basic Health Research in 2018, the prevalence of pregnant women at risk of CED in the age group of 15-49 years is still quite high, reaching 17.3%. A reduction of 1.5% is needed annually to reach the 10% target by 2024 (Ministry of Health RI, 2024; Ministry of Health RI, 2022).

The prevalence of CED in pregnant women and non-pregnant women by province in 2023 is 16.9% (Ministry of Health of the Republic of Indonesia, 2024). Based on data on the prevalence of Chronic Energy Deficiency (SEZ) in Banten in pregnant women, it is recorded to be quite high, which is 27.8% based on data from the Indonesian Nutritionists Association and even the incidence rate of SEZ in Serang reaches 30.77%. The Lebak Wangi Health Center in 2024 reported that until October it had

recorded 52 cases of chronic energy deficiency in pregnant women. These results show that the nutritional interventions provided and efforts to improve community nutrition still need to be improved (Andriani, 2024).

Handling malnutrition is carried out by supplemental feeding and multivitamin supplements, research from supplemental feeding with protein energy balance is the right choice, the results show that supplemental feeding derived from local food which is a modification of supplemental feeding (mixed food ingredients) is able to contribute energy of 326 kcal and protein of 7.2 grams. However, a good supplemental feeding must meet the requirements of nutritional adequacy, taste, practicality, shelf life, ease of presentation and ease of access. This makes the provision of standardized supplemental feeding not many and not effective (Iskandar, 2022).

The provision of multivitamins is also one of the efforts made by the government, research reports that the provision of micronutrient supplements to pregnant women with CED for the prevention of stunting in mothers such as the administration of iron tablets, and vitamin B complex is able to increase MUAC ($p<0.001$), but there are still many health centers or health services that cannot provide multivitamins other than iron tablets (Siahaan, 2022).

Based on research, it is reported that indirect factors such as demographic factors that result in low education, short birth distance, parity, the age of young mothers or adolescents, anemia, and employment can affect the incidence of CED, there is a meaningful relationship between maternal age, parity, pregnancy distance, knowledge level, energy and protein adequacy, and the incidence of CED in pregnant women. Research on educational status due to the lack of proper nutritional knowledge during pregnancy and the importance of maintaining a healthy weight, parity, age can increase the risk of CED in pregnant women. Pregnant women aged < 20 years and > 35 years increase the incidence of CED (Harna, 2024; Wati, 2024).

Understanding and analyzing the problem of chronic energy deficiency in pregnant women based on comprehensive determinants is indispensable in order to design appropriate policies and treatment actions. This study aims to analyze the influence of the determinants of age, gestational age, education, occupation, parity, economic status, BMI, and haemoglobin on the incidence of chronic energy deficiency in pregnant women.

SUBJECTS AND METHOD

1. Study Design

The design of this study is a case-control research method is a type of analytical observational research in which the researcher selects two groups: the case group (people who already have the outcome/ disease being studied) and the control group (people who do not have the outcome), and then compare the past exposure history between the two groups (Martínez, 2019; Ngoc, 2022). The location of this research also limits the scope of the research, the working area of the Lebak Wangi Serang-Banten Health Center in November 2025.

2. Population and Sample

The population in this study is all target pregnant women in the study area, which is 857 people. This technique is used for exploratory studies or case studies. Because the number of cases (which are often rare diseases) is usually much smaller compared to the number of potential controls, the matching ratio (i.e. the case:control ratio in each matching set) is often set to 1:1. The ratio is set to 1:1. The sample in this study

was 105 pregnant women divided into 2 groups of cases, namely 53 pregnant women who suffered from chronic energy deficiency and a control group of 52 pregnant women with normal nutritional conditions (not overweight) (Setyorini, 2024; Masao, 2022.

3. Study Variables

The dependent variable was chronic energy deficiency (CED). Independent variables were maternal age, gestational age, parity, education, economic status, haemoglobin level, and body mass index.

4. Operational Definition of Variables

Chronic energy deficiency was an imbalance in energy and protein intake over a long period of time in pregnant women diagnosed with MUAC <23.5 cm.

The age of the mother at the time of pregnancy. Gestational age at the time of measurement, calculated based on the first day of the last menstrual period.

Parity is the number of children that have been born. Education is the process of changing the attitudes and behaviors of a person or group of people through teaching and training.

Economic status is the position or social position of a person or group in society. The level of hemoglobin in the mother's blood was measured using a blood test device (in g/dl).

Body mass index is the calculation of body mass status with the formula of weight (in kg) divided by height squared (in meters) at the time of pregnancy.

5. Study Instrument

The research instrument used in this study is in the form of patient medical records that have complete data according to the data needed in the research. All the data obtained will be collected in the master table for further coding as follows: Chronic energy deficiency 1: "SEZ" (if MUAC < 23.5 cm) and 0: "No SEZ" (if MUAC ≥ 23.5). Age with code 0: <21 years. 1: 21-35 years. 2:>35 years. Gestational age 0: Trimester 1 (1-12 weeks). 1: 2nd Trimester (13-28 weeks). 2: Trimester 3 (29-40 weeks). Parity with code 0: Primipara. 1:Multipara. 2: Large Multipara. Education with code 0: Education 1: Basic (Elementary - Junior High). 2: Higher Education (SMA). 3: Higher Education. (Higher Education). Economic status with code 1: poor families. 0: No, no. Body mass index with category 1: Thin (BMI < 18.5). 0: Normal (BMI 18.5-24.9). 2: Overweight (BMI ≥ 25). Haemoglobin with code 0: Normal" (Hb ≥ 11 g/dl). 1: Anemia" (Hb < 11 g/dl).

6. Data Analysis

The Chi-Square test was used to analyze the relationship between dependent variables (incidence of SEZ in pregnancy) and independent variables (maternal age, gestational age, parity, education, economic status, Hb). This analysis was used to look at the relationship between more than two research variables. This test uses multiple logistic regression analysis. The p-value of 0.025 in multivariate analysis was related to the level of confidence and distribution in statistical testing, especially for two-tailed tests (Afifuddin, 2024).

7. Research Ethics

Research ethical issues including informed consent, anonymity, and confidentiality, were addressed carefully during the study process. The research ethical clearance approval letter was obtained from the Research Ethics Committee at Abdi Nusantara School of Health Sciences. No. 766/SI/S.KEB/STIKES-AN/XI/2025.

RESULTS

1. Univariate Analysis

The results of univariate research and analysis can be found that all respondents are housewives, this makes the work only possible at the univariate analysis stage and not continued in bivariate and multivariate

analysis. The majority of respondents were between 21-35 years old, namely 76 respondents (79.05%). Almost all respondents had a body mass index that included being thin, which was < 18.5 as many as 89 people (84.76%). Meanwhile, haemoglobin levels were almost evenly divided between respondents who had anemia and those who did not. In terms of education, the majority of respondents are 50 junior high school graduates (47.62%). Meanwhile, in terms of gestational age, more than half of the respondents were in the second trimester, which was 61 people (58.10%) and were pregnant women who had been more than once or multiparity, namely 64 people (60.95%).

Table 1. Sample Characteristics

Independent Variables	CED (n = 53)		Non CED (n = 52)	
	n	%	n	%
Mother's Age				
< 21 years old	6	11.32	1	1.92
21- 35 years old	38	71.70	38	73.08
> 35 years old	9	16.98	13	25.0
BMI				
Underweight	53	100	37	69.81
Normal	0	0	16	30.19
Haemoglobin				
Normal (≥ 11 g/dl)	27	50.94	26	50
Anemia (< 11g/dl)	26	29.06	26	50
Gestational Age				
Trimester 1	21	39.62	6	11.54
Trimester 2	32	60.38	29	55.77
Trimester 3	0	0	17	32.69
Education				
Elementary School	22	41.51	22	42.31
Junior High School	25	47.17	25	48.08
High School/ Equivalent	6	11.32	5	9.62
Parity				
Primiparous	18	33.96	23	44.23
Multiparous	35	66.04	29	55.77
Economic Status				
Poor	3	5.66	3	5.77
High	50	94.36	49	94.23

b. Bivariate analysis

The results of bivariate analysis of the relationship between body mass index and the incidence of CED showed that there was a very significant influence between the body mass index and the incidence of chronic energy deficiency during pregnancy because the p-value was 0.001 < p <0.05. The relationship between gestational age and the incidence of CED showed that there was a very significant influence between gestational age and the incidence of chronic energy deficiency during pregnancy because the p-value was 0.001 < 0.05. The results showed that the incidence of CED was experienced by many pregnant women in the second trimester (32 people) and the first (21 people), while no pregnant women were found who experienced CED in the third trimester,

junior high school and work as farmers.

Table 2. Bivariate analysis of determinants of CED in pregnancy

Independent Variables	Odds Ratio	95% CI		p
		Lower limit	Upper limit	
Mother's Age	-1.77	-0.36	-0.02	0.117
BMI	4.70	0.33	0.83	<0.001
Haemoglobin	-0.24	-0.07	0.05	0.923
Gestational Age	-5.47	-0.82	-0.38	<0.001
Education	0.19	-0.13	0.16	0.960
Parity	1.07	-0.09	0.30	0.281
Economic Status	-0.02	-0.42	0.41	0.981

c. Multivariate analysis

Based on the results of multivariate analysis, there are 2 independent variables that are very significantly related to the incidence of chronic energy deficiency in pregnancy, namely body mass index and gestational age. Meanwhile, other variables show an insignificant relationship with the incidence of CED.

The body mass index showed a high relationship ratio of 4.70, meaning that mothers with a lean body mass index were more likely to experience chronic energy deficiencies up to 4.7 times or almost 5 times than mothers with a normal and statistically significant body mass index (aOR= 4.70; p value <0.001; 95%CI= 0.34 up to 0.83).

Gestational age shows negative relationship results (-), indicating that the higher the gestational age, the risk of CED occurrence will further reduce the likelihood of chronic energy deficiency up to 3.5 times. The results showed that older gestational age had a chance of CED 3.5 times smaller than that of young gestational age and was statistically significant (aOR=-3.55; p value <0.001; 95%CI= -2.61 up to -0.75).

Table 2. Multivariate analysis of determinants of CED in pregnancy

Independent Variables	OR	95% CI		p
		Lower limit	Upper limit	
Body mass index (underweight)	4.70	0.34	0.83	<0.001
Maternal Age (21- 35 years)	-1.59	-1.80	0.19	0.111
Haemoglobin (< 11 g/dl)	-0.27	-1.13	0.86	0.786
Gestational Age (>28 weeks)	-3.55	-2.61	-0.75	<0.001
High education	-0.73	1.07	0.49	0.463
Multiparous	1.43	-0.287	1.82	0.154
Economic Status (poor)	-0.66	-3.70	1.83	0.508
N observation= 105				
-2 log likelihood= -48.10				
Nagelkerke R^2 = 20.37.%				

DISCUSSION

1. Maternal Age to the Incidence of Chronic Energy Deficiency

Based on the results of the analysis between maternal age and incidence, it was shown that there was no significant effect between maternal age and the incidence of chronic energy deficiency during pregnancy. These results are in line with research (Akbarini, 2022), which shows that nutritional status during pregnancy is more influenced by socioeconomic factors, environment, and

diet than by the age of the mother alone. Studies have shown that variables such as household food security, maternal education, parity, and access to antenatal care are more reliable predictors of maternal nutritional status compared to chronological age (Khudri, 2023).

In situations where food intake, education, social support, and access to health services are adequate, the age of both adolescents and older mothers does not necessarily correlate with nutritional deficits. Nutritional deficiencies such as SEZs appear to be multifactorial and largely mediated by modifiable determinants, rather than demographic characteristics (Khudri, 2023).

2. Body Time Index to the Incidence of Chronic Energy Deficiency

The results of bivariate and multivariate analysis showed that the relationship between body mass index and the incidence of CED showed that there was a significant influence between the body mass index and the incidence of chronic energy deficiency during pregnancy. Mothers with a lean body mass index are more likely to experience chronic energy deficiencies up to 4.7 times or nearly 5 times.

The results of this study are in line with the research, in this study based on the results of bivariate analysis, it was found that there is a relationship between the BMI of pregnant women and the incidence of CED. In addition, this study is in line with Nurannisa's Research, showing that respondents who have BMI are more at risk in the CED group, that there is a relationship between the BMI factor and the incidence of CED in pregnant women (Tejayanti, 2019; Nurannisa, 2021).

The significant associations found in this study can be attributed to several mechanisms. First, women with low BMI may enter pregnancy with limited nutritional reserves, making them more susceptible to energy deficits as metabolic needs increase. Second, low BMI often reflects chronic malnutrition related to socioeconomic constraints, poor food diversity, food insecurity, and high workload factors that further increase women's predisposition to energy deficiency during pregnancy. Third, low BMI is generally associated with micronutrient deficiencies, which further disrupt metabolic efficiency and contribute to inadequate energy imbalances (Tejayanti, 2019). BMI reflects a person's nutritional status, where a low BMI before or during pregnancy can indicate insufficient energy and protein reserves (Akbarini, 2022).

3. Haemoglobin Levels Against the Occurrence of Chronic Energy Deficiency

The results of the multivariate analysis also showed that haemoglobin levels or anemia conditions were not related to the incidence of CED. This finding is in line with the study of Farahdiba (2021), which stated that there is no relationship between the incidence of chronic energy deficiency and anemia. It was supported by Harna's research, there is no relationship between the incidence of anemia and the risk of the incidence of CED in pregnancy (Harna, 2024).

Hemoglobin levels are more reflective of anemia status, which is generally influenced by iron adequacy and other factors such as infection or impaired iron absorption (Harna, 2024). Although anemia can occur concomitantly with CED, low hemoglobin levels do not necessarily indicate CED (Iskandar, 2022), and vice versa. Therefore, hemoglobin is not the main factor that determines of CED.

4. Gestational Age to the Incidence of Chronic Energy Deficiency

The results of the study on gestational age showed a negative association between

gestational age and the risk of CED. At the beginning of pregnancy until before 16 weeks of gestation, the occurrence of Hyper-emesis Gravidarum (HG) severely limits daily activities. HG is a medical condition characterized by very severe symptoms of nausea and vomiting, often causing the mother to be unable to maintain a proper diet and fluid intake. The first trimester is an early phase of pregnancy that is often associated with an increased risk of CED. Excessive nausea and vomiting can lead to decreased appetite and insufficient nutrient intake. In addition, an increase in hCG (Human Chorionic Gonadotropin) and progesterone hormones slows down gastric emptying and increases sensitivity to food, making it difficult for pregnant women to meet energy needs (Nurdin, 2018; Andini, 2020).

5. Education level and the incidence of chronic energy deficiency

There was no significant effect between education and the incidence of chronic energy deficiency during pregnancy. This result is in line with a study by Lestari (2023), which states that maternal education in this study is not related to nutritional status, including the incidence of chronic energy deficiency. Another study also reported that maternal education was not a significant factor related to SEZ status ($p>0.05$) (Triatmaja, 2017).

Formal education does not always result in better nutrition practices, especially when nutrition is not emphasized in the school curriculum. Research shows that targeted nutrition education delivered through antenatal care, community programs, or mass media may be more influential in shaping maternal eating behavior than the length of school (Lestari, 2023).

6. Parity Against the Incidence of Chronic Energy Deficiency

The relationship between parity and the incidence of CED showed that there was no very significant influence between parity or childbirth history and the incidence of chronic energy deficiency during pregnancy because the p-value was $0.154 > 0.05$. These results are in line with research reported by Fatimah that there is no significant relationship between peritas and the incidence of chronic energy deficiency, because mothers with their first pregnancy will consider pregnancy to be new, so they are not used to it and ignore nutritional intake. On the other hand, mothers who have given birth to more than one respondent have the assumption that they are experienced, so they are not motivated to check their pregnancy, so they both have the potential to experience SEZs (Fatimah, 2019).

7. Economic status on the occurrence of chronic energy deficiency

There is no significant relationship between economic status and the incidence of CED. This result is similar with the previous study at the Kawua Health Center (Dian, 2024). The absence of a significant association between economic status and the occurrence of Chronic Energy Deficiency (CED) may be explained by the multifactorial nature of nutritional status. Economic status, often measured using broad indicators such as income or wealth indices, may not adequately capture actual food access, dietary quality, or intra-household food allocation. Moreover, non-economic factors including dietary practices, health behaviors, cultural norms, infectious diseases, and access to nutrition or health programs may mediate or outweigh the direct effect of economic status. Limited variability in economic conditions within the study population, as well as the cross-sectional design, may further reduce the ability to detect a significant relationship with a chronic condition such as CED.

AUTHORS CONTRIBUTION

Melisa Putri Rahmadhena and Erlin Wibi Astuti contributed to the conceptualization and design of the study. Erlin Wibi Astuti was responsible for data procurement, organization, funding, and analysis. Melisa Putri Rahmadhena supervised research process. the manuscript was drafted and revised by both authors. all authors have read and approved the final version of the manuscript

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CONFLICT OF INTEREST

There was no conflict of interest.

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