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The effect of nutrition education on weight gain in pregnant women with chronic energy deficiency (CED)

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Abstract

Background: Chronic Energy Deficiency (CED) in pregnant women remains a public health problem in Indonesia and contributes to an increased risk of pregnancy complications, low birth weight, stunting, and maternal and perinatal mortality. One effort to improve the nutritional status of pregnant women with CED is through structured and ongoing nutrition education.

Purpose: This study aims to determine the effect of nutritional education on weight gain in pregnant women with Chronic Energy Deficiency (CED).

Method: This study used a pre-experimental design with a one-group pretest–posttest approach. The study was conducted at the Helen Tarigan Clinic from March to May 2025. A sample of 25 pregnant women with special needs was selected using a total sampling technique. The intervention, in the form of nutritional education, was provided in a structured manner through counseling and educational media. Weight data were measured before and after education, then analyzed using a paired t-test with a significance level of $p < 0.05$.

Results: The average weight of pregnant women before nutrition education was 45.2 ± 2.8 kg and increased to 47.1 ± 2.7 kg after education. There was a difference in weight gain of 1.9 kg. The statistical test results showed a p-value of 0.001, indicating a significant effect of nutrition education on weight gain in pregnant women with CED.

Conclusion: Nutrition education has a significant impact on weight gain in pregnant women with Chronic Energy Deficiency, so it is important to implement it as part of antenatal care.

Keywords: Nutrition Education; Pregnant Women with CED; Weight Gain.

INTRODUCTION

Maternal and fetal health is a crucial foundation for the quality of human resources for the next generation. Maternal nutritional status during pregnancy significantly determines fetal growth and development, including birth weight, the risk of prematurity, and the child's long-term metabolic program (Kukreja, Kaur, & Taneja, 2015). Chronic maternal undernutrition and malnutrition increase the incidence of low birth weight, small for gestational age, prematurity, and perinatal morbidity and mortality (González-Fernández, Muralidharan, Neves, & Bhutta, 2024). Furthermore, both underweight and overweight (low BMI or obesity) are associated with serious maternal complications, such

as anemia, preeclampsia, hemorrhage, infection, operative delivery, and maternal death (Figa, Temesgen, Mahamed, & Bekele, 2024). The high burden of micronutrient deficiencies (e.g., iron deficiency anemia, vitamin D, calcium, and folate deficiencies) in low- and middle-income countries exacerbates these risks and contributes to an intergenerational cycle of malnutrition and chronic disease susceptibility (Marphatia, Wells, Reid, Bhalerao, & Yajnik, 2025).

Chronic Energy Deficiency (CED) is one of the most common nutritional problems encountered in pregnant women and remains a serious challenge in various regions of Indonesia. CED in pregnant

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women is a condition of prolonged calorie and protein malnutrition, resulting in the mother not having sufficient energy reserves to meet the needs of herself and her fetus (Wayanti, Anisak, & Irawati, 2025). In primary health care, CED is generally identified through measuring the Mid-Upper Arm Circumference (MUAC); a MUAC of less than 23.5 cm is used as the risk limit for CED in women of childbearing age and pregnant women, and is associated with the possibility of giving birth to a low birth weight baby (Wiji, Sary, Yuningsih, & Heriyeni, 2022). This inadequate nutritional condition risks causing suboptimal maternal weight gain during pregnancy, increases complications during pregnancy and childbirth, and negatively impacts fetal growth and development, including an increased risk of low birth weight (LBW), stunting, and perinatal death (Sobbay, Kanan, Lanyumba, Sattu, Balebu, Ekaputri, & Handayani, 2025).

Globally, maternal malnutrition, including chronic energy deficiency (CED), remains a serious public health problem, particularly in developing countries. The WHO reports that in various developing countries, the prevalence of chronic energy deficiency in women, including pregnant women, ranges from 15–47%, with a high burden in South and Southeast Asia, such as India, Nepal, Bangladesh, Thailand, Sri Lanka, Myanmar, and Indonesia (Khamdiyah, Hidayati, Lanita, Ibnu, & Perdana, 2025). In Indonesia itself, CED in pregnant women is categorized as a public health problem with a national prevalence of around 17–20% and even higher in some rural areas (Silfia, Maineny, & Yustika, 2022).

In Indonesia, the problem of Chronic Energy Deficiency (CED) in pregnant women remains a major focus in efforts to improve maternal nutrition and health, as it contributes to the high risk of pregnancy complications and the quality of fetal growth and development (Silfia et al., 2022). Data from the 2018 Basic Health Research (Riskesdas) shows that the prevalence of pregnant women at risk of CED nationally remains quite high, at around 17.3%, categorizing it as a public health problem that requires serious attention (Masrikhiyah, Wahyani, Rahmawati, Balfas, & Fajarini, 2022). In some provinces, this figure is even higher, such as in Aceh (24.2%), and several regions in Kalimantan, Riau, and Lampung, which reported a proportion of

pregnant women at risk of CED above the national figure (Sephia, Astuti, & Hervidea, 2024).

The impact of Chronic Energy Deficiency (CED) on pregnant women is extensive, affecting both maternal and fetal health. CED increases the risk of anemia, bleeding, infection, and decreased muscle strength essential for labor, which can lead to prolonged labor, miscarriage, and even maternal death. From a fetal perspective, CED contributes to low birth weight (LBW), intrauterine growth restriction, prematurity, congenital defects, neonatal death, and is a significant risk factor for stunting and impaired physical and cognitive growth in children later in life (Agusmarinda, Ananti, & Purnamasari, 2025). Several studies have also shown that CED and anemia during pregnancy significantly increase the risk of LBW, which is then associated with impaired growth and development and the severity of stunting in toddlers (Azzahra, Shahib, & Kurniasari, 2025).

One strategy that can be implemented to address chronic energy deficiency syndrome (CED) in pregnant women is through structured and continuous nutrition education. Nutrition education and counseling have been shown to improve the knowledge, attitudes, and behaviors of pregnant women with CED regarding the importance of balanced nutrition during pregnancy, as demonstrated by improved pretest–posttest scores following lecture and question-and-answer interventions (Hapsari, Rozi, Asyifa, Putranegara, & Balqis, 2022). Providing education on pregnancy nutritional needs, anemia prevention, and examples of nutritious menus (through leaflets, booklets, posters, videos, or menu demonstrations) improves mothers' understanding and skills in meeting energy and nutrient needs during pregnancy (Dansis, Illau, Sarni, Bate, Ngamul, Dahung, & Manggul, 2025).

Various studies have shown that nutrition education contributes positively to increasing knowledge, attitudes, and consumption behavior, thus impacting nutritional intake in pregnant women and other vulnerable groups. Education provided in a structured and continuous manner through lectures, discussions, leaflets, booklets, and menu demonstrations has been shown to improve participants' understanding of nutritional needs during pregnancy, the prevention of chronic energy

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deficiency syndrome (CED), anemia, and stunting, which is then reflected in more nutritionally balanced food choices and adherence to recommended food and supplement consumption (Hadi, Primasari, & Hakim, 2023). Interventions that combine nutrition education with practical support, such as providing supplementary foods made from local ingredients and practicing nutritious menu preparation, can even improve objective nutritional status such as weight gain, mid-upper arm circumference, and toddler weight (Tendean, Ering, & Makasudede, 2025).

Weight gain during pregnancy is an important indicator of maternal nutritional status and health, as it is related to adequate energy and nutrient intake that supports fetal growth and reduces the risk of low birth weight (LBW) and pregnancy complications (Siregar & Sukartini, 2022). Pregnant women with Chronic Energy Deficiency (CED) tend to experience lower-than-recommended weight gain due to insufficient energy and protein reserves, thereby increasing the risk of giving birth to babies with LBW, IUGR, and stunting. This condition requires appropriate and sustainable nutritional interventions, such as weight monitoring, dietary improvements, supplementary feeding, and the involvement of cadres and health workers in intensive support (Hodikoh, Surtiati, Yumi, & Meirina, 2025).

RESEARCH METHOD

This study is a quantitative study with a pre-experimental design using a one-group pretest-posttest design. The study was conducted at the Helen Tarigan Clinic in 2025 for three months, namely from March to May 2025. The three-month time span was chosen based on the theory that weight gain in

pregnant women, especially in the second and third trimesters, can be optimally observed within a period of 8–12 weeks, where clinically meaningful weight gain generally occurs gradually and consistently after nutritional intervention is given.

The population in this study were all pregnant women who experienced Chronic Energy Deficiency (CED) and underwent pregnancy check-ups at the Helen Tarigan Clinic during the study period. The sampling technique used total sampling, so that all CED pregnant women who met the inclusion and exclusion criteria were selected as respondents, with a total sample of 25 people. Inclusion criteria in this study included pregnant women with a MUAC <23.5 cm, a second or third trimester of pregnancy, willingness to be respondents, and able to participate in the entire series of nutrition education. Meanwhile, exclusion criteria were pregnant women with comorbidities such as gestational diabetes, chronic hypertension, or other pregnancy complications that could affect body weight, as well as pregnant women who did not complete the entire series of studies.

Data collection was conducted by measuring body weight before and after nutrition education using calibrated standard scales. The intervention, in the form of nutrition education, was delivered in a structured manner through face-to-face counseling and educational media regarding the nutritional needs of pregnant women, a balanced diet, and the selection of nutritious foods during pregnancy. The data obtained were analyzed using a paired t-test to determine the difference in average body weight before and after nutrition education, with a statistical significance level set at $p < 0.05$.

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RESEARCH RESULTS

Table 1. Frequency Distribution of Respondents (N=25)

Variable	Results
Age (Mean±SD) (Range) (Years)	(27.6±6.28) (18-42)
<20	4/16.0
20-35	18/72.0
>35	3/12.0
Education (n/%)	
Elementary School	5/20.0
Junior High School	8/32.0
Senior High School	9/36.0
Bachelor	3/12.0
Occupation (n/%)	
Housewife	17/68.0
Working	8/32.0
Gestational Age (n/%)	
Second Trimester	11/44.0
Third Trimester	14/56.0
Parity (n/%)	
Primigravida	10/40.0
Multigravida	15/60.0

Table 1 shows that the average age of respondents and standard deviation is (27.6±6.28) with an age range of (18-42). The majority of respondents had a high school education level, namely 9 (36.0%), with the majority unemployed or housewives, namely 17 (68.0%). The majority of respondents were in their third trimester of pregnancy, namely 14 (56.0%), and the majority had multigravida parity, namely 15 (60%).

**Table 2. The Effect of Nutrition Education on Weight Gain in Pregnant Women
with Chronic Energy Deficiency (CED)**

Weight	Mean ± SD (kg)	Mean Difference (kg)	p-value*
Before Education	45.2 ± 2.8	1.9	0.001
After Education	47.1 ± 2.7		

The analysis results showed an increase in the average weight of pregnant women after being given nutrition education. The average weight before education was 45.2 ± 2.8 kg, increasing to 47.1 ± 2.7 kg after the intervention, with a difference in increase of 1.9 kg. Statistical testing using a paired t-test showed a p value = 0.001 (p < 0.05), which indicates that nutrition education has a statistically significant effect on the increase in weight of pregnant women with CED.

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DISCUSSION

The study results showed that the majority of pregnant women with Chronic Energy Deficiency (CED) were aged 20–35 years and were predominantly multigravida. In theory, active reproductive age does not always guarantee good nutritional status if energy and nutrient needs are not adequately met. Multigravida mothers are at higher risk of CED due to reduced energy and protein reserves due to previous pregnancies, especially if the pregnancies were closely spaced and nutritional intake was suboptimal. This condition aligns with the concept of maternal nutrition, which states that energy needs increase with the frequency of pregnancies.

The majority of respondents had a secondary education. Education plays a crucial role in mothers' ability to understand health and nutrition information, including nutritional needs during pregnancy. According to health behavior theory and the Knowledge, Attitude, and Practice (KAP) framework, as well as the Theory of Planned Behavior, education level influences a person's knowledge and attitudes regarding food choices and the formation of healthy eating intentions and practices (Darabi, Motamed, Hosseini, & Neyshaboury, 2025). Higher education is generally associated with better nutrition knowledge, more positive attitudes toward healthy eating, and better diet quality, while lower education is often associated with limited nutrition knowledge, less positive attitudes, and less healthy eating patterns (Istiqomah & Farhat, 2025).

The results of this study indicate that nutrition education has a positive impact on weight gain in pregnant women with special needs. The average weight gain increased from 45.2 kg to 47.1 kg, with a difference of 1.9 kg and a p-value of 0.001. Physiologically, weight gain during pregnancy reflects the adequacy of energy and nutrient intake needed to support maternal adaptation, maternal tissue growth, the placenta, and fetal development, and is therefore widely used as a simple indicator of maternal nutritional status (Hornig, Lee, & Wang, 2021). This weight gain is strongly influenced by energy and protein consumption, as well as the balance of macro- and micronutrients; adequate energy and protein intake are associated with better gestational weight gain and birth weight, while insufficient intake increases the risk of fetal growth

disorders (Minami, Noguchi, Eitoku, Muchanga, Mitsuda, & Suganuma, 2022).

These findings align with the theory of pregnancy nutrition and health education, which states that nutrition education interventions can increase knowledge, shape attitudes, and ultimately change food consumption behavior in pregnant women (Hapsari et al., 2023). Structured nutrition education, for example through lectures, booklets, audio-visual media, and demonstrations of additional food processing, has been shown to improve mothers' understanding of balanced nutrition, nutritious food choices, and how to prepare meals appropriate to pregnancy needs. This increased knowledge then encourages changes in dietary patterns toward healthier ones, including choosing foods high in protein and micronutrients, increasing meal frequency, and improving the quality of daily menus, which directly contribute to improved nutritional status and weight gain in pregnant women (Ayanti, Hidayat, Saputera, & Muslim, 2025).

The results of this study are supported by previous research stating that nutrition education significantly improves the knowledge and nutritional intake of pregnant women, resulting in better weight gain compared to before the intervention (Hapsari et al., 2023). Another study also reported that a combination of nutrition education and counseling significantly improved the weight and upper arm circumference of pregnant women with chronic energy deficiency (CED). This shows that nutrition education is an effective strategy for improving the nutritional status of pregnant women (Tendean et al., 2025).

The results of this study are consistent with previous findings showing that continuous nutrition education improves pregnant women's compliance with recommendations for nutritious food consumption and pregnancy supplements. This increase in compliance contributes to meeting daily energy requirements, resulting in weight gain (Hadi et al., 2023). Therefore, these results reinforce the evidence that nutrition education plays a crucial role in addressing chronic energy deficiency syndrome (CED) in pregnant women.

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CONCLUSION

Structured and continuous nutrition education has been proven effective in increasing the weight of pregnant women with Chronic Energy Deficiency, as indicated by an average weight gain of 1.9 kg with a p-value of 0.001. Nutrition education plays an important role in improving the knowledge and consumption behavior of pregnant women, thereby supporting improvements in nutritional status during pregnancy. Future researchers are advised to use a research design with a control group, a larger sample size, and consider other variables such as nutrient intake, dietary compliance, and pregnancy outcomes to obtain a more comprehensive picture of the effectiveness of nutrition education in pregnant women with Chronic Energy Deficiency (CED).

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