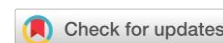


The Relationship between Dietary Patterns and Chronic Energy Deficiency Status Based on a Questionnaire in Pregnant Women in Muara Nibung

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ABSTRACT

Background: Dietary patterns are associated with nutritional status during pregnancy. This study examined the association between dietary patterns and questionnaire-based chronic energy deficiency (CED) status among pregnant women in Muara Nibung, Central Tapanuli, Indonesia.

Methods: A cross-sectional study was conducted in March 2025 among 60 pregnant women recruited through total sampling. Data were collected using questionnaires. Dietary patterns were categorized as good or poor, and CED status was recorded as yes or no. Pearson's chi-square test was used to assess the association. The crude prevalence ratio (PR) and its 95% confidence interval (CI) were calculated from the contingency table.

Results: Twenty-five participants (41.7%) had questionnaire-based CED status. The proportion was 60.0% (18/30) among women with poor dietary patterns and 23.3% (7/30) among women with good dietary patterns. Dietary patterns were associated with CED status ($\chi^2 = 8.30$; $p = .004$), with a crude PR of 2.57 (95% CI 1.26–5.24).

Conclusion: Poor dietary patterns were associated with a higher proportion of questionnaire-based CED status. Interpretation is limited by the cross-sectional design, questionnaire-based outcome assessment, and the absence of adjustment for confounding. Objective nutritional assessment is needed to confirm these findings.

BACKGROUND

Adequate nutrition during pregnancy is necessary to support maternal physiological changes and fetal growth. Energy and nutrient needs increase during pregnancy, making assessment of nutritional intake and status a crucial part of maternal care (Kominiarek & Rajan, 2016). Maternal malnutrition is associated with fetal growth retardation and adverse child health outcomes, so prevention should begin before and during pregnancy (Black et al., 2013).

In Indonesian studies, the risk of chronic energy deficiency (CED) in pregnant women is often identified using a mid-upper arm circumference (MUAC) of less than 23.5 cm (Angkasa et al., 2024; Rachmi et al., 2024). This anthropometric indicator needs to be distinguished from CED status obtained through questionnaire responses. Differences in the method of determining nutritional status can affect respondent classification and the comparability of results between studies.

Dietary patterns encompass several consumption aspects that need to be defined according to research instruments. Dietary diversity is one aspect of diet quality, but it does not directly indicate energy adequacy. The Minimum Dietary Diversity Guidelines for Women describe dietary diversity as an indirect indicator of micronutrient adequacy at the population level (Food and Agriculture Organization of the United Nations [FAO], 2021). Therefore, categorizing a diet as good or poor cannot be equated with the amount of energy or protein consumed without appropriate intake measurements.

Research evidence suggests that maternal nutritional status is influenced by various factors. A study in Banyumas found associations between CED and protein intake, maternal age, education, pregnancy spacing, and frequency of antenatal care (Wati et al., 2024). A study in East Nusa Tenggara also demonstrated associations between CED and maternal characteristics and access to care, with parity being a significant factor in multivariate analysis (Rachmi et al., 2024). These findings support the need to consider the maternal context and care when assessing the relationship between diet and nutritional status.

In addition to individual factors, food availability, consumption practices, and access to services can shape maternal diet quality. UNICEF's conceptual framework positions diet and caregiving as direct determinants of nutrition, influenced by food, practices, services, and resources (United Nations Children's Fund [UNICEF], 2021). A meta-analysis in Ethiopia showed that low dietary diversity and household food insecurity were associated with undernutrition during pregnancy (Zewude et al., 2024). However, the magnitude of the associations from this context cannot be directly applied to the Indonesian population.

A preliminary survey in Muara Nibung Village indicated that pregnant women still experience chronic energy deficiency syndrome (CED). Information on the relationship between dietary patterns and CED status among pregnant women accessing services in this area is needed as a basis for further assessment. This study aimed to analyze the relationship between dietary patterns and CED status based on a questionnaire conducted among pregnant women in Muara Nibung Village, Central Tapanuli Regency.

METHOD

Research design and participants

This study used a cross-sectional analytical observational design and was conducted in Muara Nibung Village, Central Tapanuli Regency, in March 2025. The accessible population consisted of 60 pregnant women seeking treatment in the study area. All members of the accessible population were recruited using total sampling, resulting in a reported sample size of 60 respondents.

Inclusion criteria included pregnant women residing in Muara Nibung Village and willing to participate. Pregnant women who could not be interviewed due to illness were excluded from the study. Respondents who withdrew their consent during the study were excluded. Willingness to participate was a prerequisite for respondent involvement.

Variables and data collection

The exposure variable was dietary patterns categorized as good or poor. The outcome variable was CED status, recorded as yes or no based on a questionnaire. Reported respondent characteristics included age and education level. Data were collected through a questionnaire; CED status in this study was information obtained from the questionnaire and was not treated as a direct MUAC measurement by the researchers.

Statistical analysis

The research data was processed using SPSS. Descriptive analysis presented the frequency and percentage of each category. Bivariate analysis used a two-sided Pearson Chi-square test at a significance level of 0.05. In the 2×2 table, all expected frequencies met the test requirements, namely 12.5 and 17.5 in each row. The crude RP was calculated as the ratio of the proportion of CED status in the poor diet group to the good diet group. The 95% CI was calculated using a logarithmic approach. This analysis did not control for confounding variables.

RESULTS

Of the 60 respondents, the majority were aged 20–35 years (80.0%) and had secondary education (63.3%). Each dietary pattern category included 30 respondents (50.0%). A total of 25 respondents (41.7%) had CED status based on the questionnaire (Table 1).

Table 1. Respondent characteristics and distribution of research variables (N = 60)

Variables and Categories	n	%
Age less than 20 years	4	6.7
Age 20–35 years	48	80.0

Variables and Categories	n	%
Age over 35 years	8	13.3
Basic education	12	20.0
Secondary education	38	63.3
Higher education	10	16.7
Poor diet	30	50.0
Good diet	30	50.0
CED status based on questionnaire — Yes	25	41.7
CED status based on questionnaire — No	35	58.3

Note: Percentages are calculated across all respondents. CED = chronic energy deficiency. The proportion of CED status was 60.0% in the poor diet group and 23.3% in the good diet group. The Pearson Chi-square test showed a relationship between diet and CED status ($\chi^2 = 8.30$; $df = 1$; $p = 0.004$). The crude RP of 2.57 (95% CI 1.26–5.24) indicated that the proportion of CED status in the poor diet group was 2.57 times the proportion in the good diet group (Table 2).

Table 2. Relationship between dietary patterns and CED status based on the questionnaire (N = 60)

Dietary habit	CED yes n (%)	CED not n (%)	Total n	Rough RP (IK 95%)	p
Not good	18 (60.0)	12 (40.0)	30	2.57 (1.26–5.24)	0.004
Good	7 (23.3)	23 (76.7)	30	1.00 (reference)	—
Total	25 (41.7)	35 (58.3)	60	—	—

Note. Percentages are calculated per row. p is from a two-sided Pearson Chi-square test without continuity correction. RP = prevalence ratio; CI = confidence interval. RP and CI are calculated from the frequencies in the table.

DISCUSSION

This study demonstrates the relationship between dietary patterns and CED status based on a questionnaire among pregnant women. The proportion of CED status was higher in the poor dietary pattern group, with a crude RP of 2.57. These results reflect differences in proportions across observation time. Because exposures and outcomes were assessed in a cross-sectional design, these results do not establish a chronological sequence or prove that poor dietary patterns cause CED.

The direction of this association aligns with the results of a meta-analysis by Zewude et al. (2024), which found a link between low dietary diversity and malnutrition in pregnant women. However, the dietary patterns in this study cannot be considered identical to the dietary diversity scores in that study. The similarity in the direction of the association must be interpreted in conjunction with differences in instruments, outcome criteria, and population characteristics. Comparisons of effect sizes also require consideration of the fact that this study used crude odds ratios, while some literature reports adjusted odds ratios.

In the Indonesian context, Wati et al. (2024) reported an association between low protein intake and CED after considering several maternal characteristics. These results justify a more detailed assessment of nutritional intake in further research. This study only provided dietary categories and therefore cannot determine whether differences in CED status are specifically related to energy, protein, or specific micronutrient deficiencies.

Other evidence suggests that the association between diet and CED is not always statistically significant. Angkasa et al. (2024), in a study of 178 pregnant women in rural Indonesia, reported that the association between low dietary diversity and CED did not reach statistical significance, while parity was a significant factor in further analysis. These differences in results highlight the importance of dietary measurement, CED assessment method, sample composition, and control for confounders. Therefore, these local findings need to be confirmed through studies with more standardized measurements.

Physiologically, increased nutritional needs during pregnancy can increase vulnerability if consumption is inadequate. Adequate energy and nutrients are needed to support maternal body changes and fetal growth (Kominiarek & Rajan, 2016). While this explanation is plausible in a biological context, this study did not measure energy intake, body composition, or changes in nutrient reserves. Specific metabolic mechanisms cannot be inferred from the available questionnaire categories.

Dietary quality also does not stand alone. The UNICEF (2021) framework highlights the role of food, consumption practices, and services in supporting maternal nutrition. Research by Rachmi et al. (2024) shows that reproductive characteristics and access to services need to be considered in assessing SEZs. Education, income, gestational age, parity, infections, and access to services can be confounders that need to be measured. This study does not provide an analysis that allows for the separation of dietary patterns from these factors.

The consequences of maternal nutrition need to be carefully explained. Tareke et al.'s (2024) meta-analysis found an association between inadequate dietary diversity and low birth weight and small-for-gestational-age infants, but no significant association with preterm birth. This evidence supports attention to diet quality during pregnancy without generalizing all pregnancy outcomes. This study did not collect delivery or infant health outcomes and therefore could not assess the clinical consequences of CED status on the respondents.

The study findings can be used to prioritize further nutritional assessments in pregnant women with poor diets. WHO guidelines recommend counseling on healthy eating patterns during antenatal care and, in undernourished populations, balanced energy and protein supplementation as indicated (World Health Organization [WHO], 2016). Implementation of these services should take into account individual assessments, maternal needs, and local food availability. The effectiveness of the interventions was not tested in this study.

Research limitations

This study has several limitations. First, the cross-sectional design limits causal inference and the possibility of bidirectional relationships. Second, CED status was obtained through a questionnaire, making it susceptible to misclassification; the results are not equivalent to determining CED risk through MUAC measurements. Third, the basis for scoring and dietary category boundaries need to be clarified to assess the validity of the measurements. Fourth, the analysis yielded only crude associations without controlling for confounders. Fifth, the total sampling of 60 pregnant women accessing services in one area does not guarantee representation of all pregnant women in Central Tapanuli Regency. The relatively wide CI also limits the accuracy of the estimates.

Further research should incorporate anthropometric measurements, consumption assessments using appropriate instruments, and measures of confounding factors. Dietary diversity can be assessed using FAO (2021) guidelines, but these assessments need to be supplemented if the study's objective is to measure energy sufficiency. Complete reporting of variable definitions, recruitment processes, biases, and analyses is necessary to enable readers to assess the quality of observational studies (von Elm et al., 2007).

CONCLUSION

There was a relationship between dietary patterns and CED status based on a questionnaire among pregnant women in Muara Nibung Village, Central Tapanuli Regency ($p = 0.004$). The proportion of CED status in the poor dietary pattern group was 60.0%, compared to 23.3% in the good dietary pattern group, with a crude RP of 2.57 (95% CI 1.26–5.24). These results support the need for further nutritional assessment but do not prove a causal relationship. Confirmation using anthropometric measurements and analyses that consider confounders is needed.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest in this research.

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