

Literature Review: The Effect of Nutritional Patterns on the Incidence of Chronic Energy Deficiency (CED) in Pregnant Women

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Article Info	Abstract
Article History Submitted, 2026-05-01 Accepted, 2026-05-19 Published, 2026-06-30	Chronic Energy Deficiency (CED) in pregnant women remains a significant public health problem and contributes to an increased risk of pregnancy complications, such as anemia, preterm birth, and low birth weight infants. This condition is generally caused by a long-term imbalance between energy intake and the body's requirements. One of the main factors presumed to influence the occurrence of CED is maternal nutritional patterns during pregnancy, including the adequacy of energy, protein, and essential micronutrient intake. The purpose of this literature review is to analyze the influence of nutritional patterns on the incidence of CED in pregnant women based on recent research findings. The method used is a literature review of various databases, including Google Scholar, PubMed, and ScienceDirect, with a publication range from 2016 to 2025. The inclusion criteria in this study were original research articles, using quantitative or mixed-method designs, discussing the relationship between nutritional patterns and CED in pregnant women, and available in full text. The exclusion criteria included articles not relevant to the topic, review articles, and studies with incomplete data. Based on the selection process, 14 articles met the criteria for analysis. The results of the review indicate that 10 out of 14 articles reported a significant relationship between nutritional patterns and the incidence of CED in pregnant women. Poor nutritional patterns, particularly low intake of energy, protein, iron, and micronutrients such as folic acid and vitamins, were shown to increase the risk of CED. Meanwhile, the remaining four articles reported non-significant findings, suggesting variations influenced by differences in research methods, respondent characteristics, and other contextual factors. In addition to nutritional patterns, several other factors were found to influence the occurrence of CED, including socioeconomic status, level of education, nutritional knowledge, and access to food and healthcare services. In conclusion, nutritional patterns play an important role in influencing the incidence of CED in pregnant women. However, CED is not influenced by a single factor but is the result of interactions among multiple related factors. Therefore, comprehensive efforts are needed, including improving nutrition education, enhancing access to nutritious food, and strengthening healthcare services to prevent CED in pregnant women
Keywords: Nutritional patterns, chronic energy deficiency, pregnant women	

Introduction

The problem of malnutrition among pregnant women remains a public health challenge both globally and nationally. Many countries, especially developing countries, continue to face issues in meeting optimal nutritional needs among vulnerable groups, including pregnant women. In Indonesia, nutritional problems among pregnant women, such as Chronic Energy Deficiency (CED), are still prevalent and remain a concern in efforts to improve maternal and

child health. Pregnant women are a vulnerable group to nutritional problems due to increased energy and nutrient requirements to support fetal growth and development. If these needs are not adequately met, it can have serious consequences for both the mother and the fetus (Kadmaerubun, 2023; Nurfajriani, 2025). (Kadmaerubun et al., 2023)

Chronic Energy Deficiency (CED) in pregnant women occurs due to an imbalance between energy intake and the body's needs over a long period, leading to decreased energy reserves. This condition is generally identified through the measurement of Mid-Upper Arm Circumference (MUAC), which falls below the standard as an indicator of maternal nutritional status. The impact of CED is not only experienced by the mother but also affects fetal growth and development. Pregnant women with CED have a higher risk of anemia, fatigue, pregnancy complications, preterm delivery, and low birth weight (LBW). In the long term, this condition may also reduce the quality of human resources due to impaired child growth and development (Muryani, 2021; Musaddik, 2022). (Indonesia, 2021) (Mahendika et al., 2023)

One of the main factors contributing to the incidence of CED is the nutritional pattern of pregnant women. Inadequate nutritional patterns, both in terms of quality and quantity—such as low intake of energy, protein, vitamins, and minerals—can lead to insufficient nutrient intake during pregnancy. In addition, irregular eating habits, low meal frequency, and food taboos may further worsen the nutritional status of pregnant women. A proper nutritional pattern should include the consumption of a diverse and balanced diet to meet the increased energy requirements during pregnancy (Aryanti, 2023; Sulistianingsih, 2024). (Artikel, 2023) (Kelompok et al., n.d.)

Besides nutritional patterns, several other factors also influence the incidence of CED, including education level, socioeconomic status, nutritional knowledge, family support, and maternal health conditions. Mothers with lower levels of education and nutritional knowledge tend to have limitations in selecting nutritious foods. Furthermore, economic factors and the presence of infectious diseases or conditions such as hyperemesis gravidarum may also affect nutrient intake and absorption (Mariyatun, 2023; Munica, 2025). (Oktober et al., 2023)

Previous studies have shown that the relationship between nutritional patterns and the incidence of CED in pregnant women has yielded varying results. Some studies indicate a significant relationship between dietary patterns and CED, while others show inconsistent findings due to the influence of confounding variables (Aeni, 2024; Kadmaerubun, 2023). (Larassetya et al., 2024) (Kadmaerubun et al., 2023) Moreover, these studies are generally conducted partially and have not been comprehensively synthesized into a unified analysis. Therefore, a more systematic analysis through a literature review approach is needed to integrate existing research findings and provide a deeper understanding of the relationship between nutritional patterns and the incidence of CED in pregnant women.

Based on the above explanation, the objective of this study is to analyze the effect of nutritional patterns on the incidence of Chronic Energy Deficiency (CED) in pregnant women based on published research findings.

Methods

This study uses a literature review design to analyze the effect of nutritional patterns on the incidence of Chronic Energy Deficiency (CED) in pregnant women. Data sources were obtained through searches of various scientific databases, including Google Scholar, PubMed, and Garuda, as well as relevant national and international journals. The articles included in this review were scientific publications published between 2016 and 2025. The article search process was conducted using several keywords adjusted to the research topic, namely: “nutritional patterns of pregnant women,” “dietary patterns of pregnant women,” “chronic energy deficiency,” “CED in pregnant women,” “maternal nutrition,” “chronic energy deficiency,” and “pregnant women nutrition.” These keywords were combined using Boolean operators such as AND and OR to obtain more specific and relevant search results.

Article selection was carried out based on inclusion criteria, namely: (1) research articles discussing nutritional patterns in pregnant women, (2) articles examining the relationship between nutritional patterns and the incidence of CED, (3) articles available in full-text format, and (4) articles published between 2016–2025. Meanwhile, the exclusion criteria included: (1) articles not relevant to the research topic, (2) articles without clear research data, and (3) duplicate articles. The article selection process was conducted through several stages: identification, screening, and eligibility. Based on the initial search results, approximately 120 articles were obtained from various databases. After removing duplicate articles, 95 articles remained. Further screening based on titles and abstracts resulted in 45 relevant articles. The next stage was full-text review, which yielded 16 articles that met the inclusion criteria and were deemed suitable for further analysis in this study.

The article selection process can be illustrated as follows (flow diagram/PRISMA

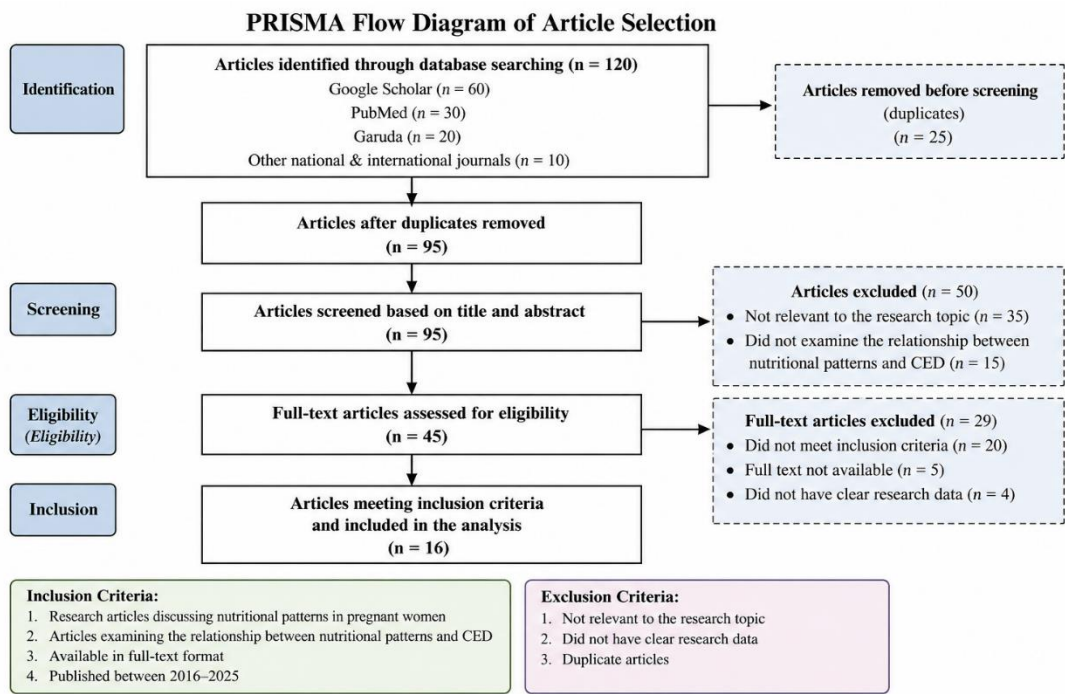


Figure 1. Fw Diagram/PRISMA

This figure illustrates the PRISMA flow process used in selecting articles for the study. A total of 120 articles were identified from several databases, including Google Scholar, PubMed, Garuda, and other international journals. After duplicate articles were removed, 95 articles remained for screening based on titles and abstracts. Subsequently, 45 full-text articles were assessed for eligibility, and 16 articles met the inclusion criteria and were included in the final analysis. The diagram also presents the reasons for article exclusion and the inclusion and exclusion criteria applied throughout the selection process.

Data analysis was conducted qualitatively using a narrative approach, by comparing research findings across articles, identifying patterns of relationships between nutritional patterns and the incidence of Chronic Energy Deficiency (CED) in pregnant women, and examining other contributing factors associated with this condition. In addition, the analysis was also directed at identifying research gaps within the existing literature as a basis for future research development.

Results and Discussion

Database searches were conducted using the keywords “nutritional patterns,” “dietary patterns,” “chronic energy deficiency (CED),” and “pregnant women.” Based on the search results through Google Scholar and various national scientific journals, a number of articles meeting the inclusion criteria were obtained. A summary of the research findings is presented in the following table:

Table 1. Results of Journal Analysis

No	Research	Method	Results
1.	Hubungan Status Sosial Ekonomi dan Pola Makan dengan Kejadian KEK pada Ibu Hamil, Musaddik, Linda Ayu Rizka Putri, Habib Ihsan , Jurnal Gizi Ilmiah (JGI) (Vol. 9, No. 2, 2022) (Gizi et al., 2022)	Analytical survey with a cross-sectional approach, sample of 35 pregnant women (total sampling), analyzed using the Chi-Square test	There is a significant relationship between socioeconomic status and dietary patterns and the incidence of Chronic Energy Deficiency (CED) in pregnant women ($p < 0.05$).
2.	Hubungan Pola Makan dengan Kejadian KEK pada Ibu Hamil, Wiwin Nur Aeni, Eleni Kenanga Purbasary, Puput Rahayu Bima Nursing Journal (Vol. 5, No. 1, 2024) (Sulistianingsih, 2024)	Quantitative descriptive-analytic study with a cross-sectional design, a sample of 202 respondents selected using accidental sampling, analyzed using the Chi-Square test.	A relationship was found between dietary patterns and the incidence of Chronic Energy Deficiency (CED) in pregnant women in the study area.
3.	Pola Makan Ibu Hamil Trimester I dan Kejadian KEK, Emi Tri Sulistianingsih, Tutik	Quantitative study with correlational analysis using a cross-	The results indicate a relationship between dietary patterns of first-trimester pregnant women and the

	Ekasari, Iit Ermawati Jurnal Trilogi (Vol. 6, No. 2, 2024) (Sulistianingsih, 2024)	sectional design, analyzed with the Chi-Square test.	incidence of Chronic Energy Deficiency (CED).
4.	Hubungan Pola Makan dan Riwayat Penyakit dengan Kejadian KEK pada Ibu Hamil, Nena Muryani, Eka Afrika, Eka Rahmawati ,Jurnal Ilmiah Universitas Batanghari (Vol. 21, No. 3, 2021) (Riwayat et al., 2022)	Descriptive-analytic study with a cross-sectional approach, involving 56 respondents, using bivariate analysis.	Dietary patterns and disease history are associated with the incidence of Chronic Energy Deficiency (CED) in pregnant women.
5.	Faktor-Faktor yang Berhubungan dengan Kejadian KEK pada Ibu Hamil, Septia Linta Aryanti, Novrida Tambunan ,Dohara Journal (Vol. 4, No. 2, 2023) (Publisher et al., 2023)	Correlational quantitative study with a retrospective approach, involving 45 respondents selected through total sampling, analyzed using the Chi-Square test.	Consumption patterns, infectious diseases, and food taboos are associated with the incidence of Chronic Energy Deficiency (CED).
6.	Faktor yang Berhubungan dengan Kejadian KEK pada Ibu Hamil, Nurfajriani, Akmal Novrian Syahrudin, Rahmawati Azis, Jurnal Kesehatan Ilmiah Indonesia (Vol. 10, No. 1, 2025) (Syahrudin & Azis, n.d.)	Quantitative study with a cross-sectional design, involving a sample of 65 respondents selected through purposive sampling, analyzed using the Chi-Square test.	There is a relationship between knowledge, income, and dietary patterns and the incidence of Chronic Energy Deficiency (CED).
7.	Hubungan Asupan Makronutrien dengan Kejadian KEK pada Ibu Hamil, Ria Munica, Ririn Wahyu Hidayati, Kurnia Mar'atus Solichah, Borneo Nursing Journal (Vol. 7, No. 1, 2025) (Munica & Wahyu, 2025)	Quantitative study using a simple random sampling method.	Energy, protein, carbohydrate, and fat intake are associated with the incidence of Chronic Energy Deficiency (CED) in pregnant women.
8.	Hubungan Pola Makan dan Status Gizi dengan Kejadian KEK pada Ibu Hamil, Hendro Stenly Kadmaerubun, Rahmawati Azis, Jalil Genisa, INHEALTH Journal (Vol. 2, No. 1, 2023) (Kadmaerubun et al., 2023)	Quantitative study using questionnaires and Mid-Upper Arm Circumference (MUAC) measurements in 35 pregnant women.	Dietary patterns and nutrient intake are associated with the incidence of Chronic Energy Deficiency (CED) in pregnant women.
9	Hubungan Pola Nutrisi, Sikap, dan Dukungan Keluarga dengan Kejadian KEK, Mariyatun, Hedy Herdiana, Ageng Septa Rini, SENTRI Journal (Vol. 3, No. 2, 2023) (Oktober et al., 2023)	Quantitative study with a cross-sectional design, involving a sample of 63 respondents, analyzed using the Chi-Square test.	Nutritional patterns, attitudes, and family support are significantly associated with the incidence of Chronic Energy Deficiency (CED).
10	Hubungan Pola Makan dengan Kejadian KEK Berdasarkan LILA, Wiwin Nur Aeni dkk., Bima Nursing Journal (Vol. 5, No. 2, 2024) (Nursing et al., 2024)	Quantitative descriptive-analytic study with a cross-sectional design, involving a sample of 67 pregnant women selected using accidental sampling.	A significant relationship was found between dietary patterns and the incidence of Chronic Energy Deficiency (CED) based on Mid-Upper Arm Circumference (MUAC) measurements.
11	Maternal Dietary Patterns and Birth Outcomes, Zhang et al., Nutrition Journal (Vol. 23, Article No. 101, 2024) (Li et al., 2024)	Prospective cohort study	Maternal dietary patterns during pregnancy are associated with birth outcomes; healthy dietary patterns reduce the risk of low birth weight (LBW).
12	Maternal Nutrition and Birth Outcomes, Abu-Saad & Fraser, (Book Chapter/Review, 2010) (Abu-saad & Fraser, 2010)	Narrative review	Nutrition during pregnancy has a major impact on maternal and fetal health, including the risk of Chronic Energy Deficiency (CED).

13	Maternal Nutrition Study: Diet Quality and Pregnancy Outcomes, Gernand et al., (Vol. 12, No. 4, 2020) (Siswati et al., 2025)	Studi observasional	The quality of pregnant women's diet is associated with fetal health outcomes.
14	Maternal Energy and Protein Intake during Pregnancy, Ota et al., Cochrane Database of Systematic Reviews (Issue 3, 2019) (Mousa & Naqash, 2019)	Systematic review	Adequate energy and protein intake are important for preventing complications, including Chronic Energy Deficiency (CED).

Based on the review of 14 analyzed journals, it was found that the relationship between nutritional patterns and the incidence of Chronic Energy Deficiency (CED) in pregnant women tends to be consistent, although some variations in findings exist. Most studies indicate a significant relationship between nutritional or dietary patterns and the incidence of CED in pregnant women. Research by Musaddik et al. (2022) showed Chi-square test results with a p-value < 0.05, indicating a relationship between dietary patterns and the incidence of CED. Similar findings were reported by Wiwin Nur Aeni et al. (2024), (Aeni et al., 2024) who stated that dietary patterns have a significant relationship with the incidence of CED among pregnant women in the working area of Losarang Health Center. A study by Sulistianingsih et al. (2024) also demonstrated a relationship between first-trimester maternal dietary patterns and the incidence of CED. In addition, research by Aryanti and Tambunan (2023) found that consumption patterns and food taboos were associated with the incidence of CED ($p < 0.05$). The findings of Nurfajriani et al. (2025) (Nurfajriani et al., 2024) further support these results, showing that dietary patterns, knowledge, and family income have a significant relationship with the incidence of CED.

Other studies also support this relationship, such as research by Muryani et al. (2021), which found that dietary patterns and disease history are associated with the incidence of CED. Furthermore, Kadmaerubun et al. (2023) showed that dietary patterns and nutrient intake are associated with CED status measured using Mid-Upper Arm Circumference (MUAC). Research by Mariyatun et al. (2023) (Health & City, n.d.) also indicated that nutritional patterns, along with attitude and family support factors, are significantly associated with the incidence of CED. A study by Munica et al. (2025) (Munica et al., 2025) demonstrated that energy, protein, carbohydrate, and fat intake are associated with the incidence of CED in pregnant women. Overall, the review findings suggest a strong tendency for a relationship between nutritional patterns and the incidence of CED in pregnant women. However, differences in research methods, sample sizes, and other factors such as socioeconomic status, nutritional knowledge, and maternal health conditions contribute to variations in findings across studies.

The results of this literature review indicate that nutritional patterns play an important role in the incidence of Chronic Energy Deficiency (CED) in pregnant women, although some studies show varying results. Most studies demonstrate a significant relationship between dietary patterns and the incidence of CED, particularly among pregnant women with inadequate energy and nutrient intake. However, some studies indicate that other factors also influence the outcome, making the relationship not always statistically dominant. Nutritional patterns are a key factor in meeting nutritional needs during pregnancy. Pregnant women require increased intake of energy, protein, vitamins, and minerals to support fetal growth and maintain maternal health. An imbalance between nutrient intake and requirements over a prolonged period can lead to energy deficiency, resulting in CED. According to maternal nutrition concepts, inadequate energy and protein intake can inhibit maternal and fetal tissue growth and increase the risk of complications such as anemia and low birth weight (Sulistianingsih et al., 2024).

These findings are consistent with the study by Aryanti and Tambunan (2023), (Tantriana, 2025) which showed that irregular eating patterns, low meal frequency, and insufficient consumption of balanced nutritious foods are associated with an increased incidence of CED. In addition, inadequate intake of macronutrients such as energy, protein, carbohydrates, and fats also contributes to the occurrence of CED. Dietary patterns influenced by food taboos during pregnancy may further worsen maternal nutritional status. The variation in findings regarding the relationship between nutritional patterns and CED can be explained by the presence of confounding factors. Factors such as socioeconomic status, education level, nutritional knowledge, family income, and family support significantly influence maternal dietary patterns. Mothers with lower education levels and limited income tend to have reduced access to nutritious foods, increasing their risk of CED. Furthermore, health conditions such as infectious diseases and hyperemesis gravidarum may also affect appetite and nutrient absorption.

Some pregnant women who experience CED are not only influenced by dietary patterns during pregnancy but also by their pre-pregnancy nutritional status. Low energy reserves before pregnancy can increase the risk of CED, even if nutrient intake during pregnancy is relatively adequate. Therefore, the incidence of CED is influenced not only by factors during pregnancy but also by prior health and nutritional conditions. Based on the above explanation, it can be concluded that nutritional patterns are an important factor contributing to the incidence of CED in pregnant women. However, the influence of nutritional patterns is complex and affected by various factors such as socioeconomic conditions, knowledge, health status, and cultural practices. The incidence of CED is a multifactorial problem that requires a comprehensive approach through nutrition education, improved access to nutritious foods, and continuous monitoring of maternal health. (Pratiwi, 2026)

Conclusion

Based on the results of this literature review of 14 studies, it can be concluded that nutritional patterns are associated with the incidence of Chronic Energy Deficiency (CED) in pregnant women. Most studies indicate that pregnant women with unbalanced dietary patterns, low energy and nutrient intake, and poor eating habits are more likely to experience CED. The findings also show some variation, where several studies emphasize that the incidence of CED is not solely influenced by nutritional patterns. This suggests that nutritional patterns are not a single determinant but interact with other factors such as socioeconomic status, education level, nutritional knowledge, health conditions, and family support. The incidence of CED in pregnant women is multifactorial and requires a comprehensive approach for prevention and management.

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