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Prevention And Treatment Of Chronic Energy Deficiency In Pregnant Women: A Scoping Review

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ABSTRACT

Background: Chronic Energy Deficiency (CED) in pregnant women remains an important maternal health problem, particularly in low- and middle-income settings. CED is associated with inadequate nutritional intake and may contribute to adverse maternal and neonatal outcomes. Therefore, a comprehensive understanding of its determinants, impacts, and management strategies is needed.
Methods: This study used a scoping review design guided by the PRISMA-ScR framework and the PCC (Population, Concept, Context) approach. Literature was searched in PubMed, Wiley Online Library, ProQuest, and ScienceDirect for Indonesian- and English-language articles published between 2020 and 2025. The study selection process was conducted using predefined inclusion and exclusion criteria and managed using Rayyan. Of 665 records initially identified, 44 duplicates were removed, and 10 studies were included in the final review.
Results: Four major themes were identified: (1) risk factors for CED in pregnant women, including age, socioeconomic conditions, dietary intake, and infectious diseases; (2) the impact of CED on pregnancy and infant health, such as low birth weight, prematurity, and maternal complications; (3) nutritional interventions for CED management, including nutrition education, supplementation, and local food-based supplementary feeding; and (4) prevention strategies through public health policies and community-based support.
Conclusion: The evidence indicates that CED in pregnant women is influenced by multidimensional factors and requires integrated prevention and management strategies. Nutrition education, supplementation, local food utilization, and stronger policy implementation are essential to improve maternal nutritional status and pregnancy outcomes.

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INTRODUCTION

Chronic Energy Deficiency (CED) among pregnant women remains a pressing global health issue, particularly in developing nations. This condition is typically diagnosed through the measurement of Upper Arm Circumference (LILA), where a reading below 23.5 cm signals a heightened risk of malnutrition, potentially endangering both maternal and fetal health (Unicef, 2023). According to The State of Food Security and Nutrition in the World 2022 report, an estimated 45 million pregnant and lactating women worldwide suffer from undernutrition, with the highest prevalence recorded in South Asia and Sub-Saharan Africa (FAO IFAD UNICEF WFP and WHO, 2022). In Indonesia, findings from the 2022 Indonesian Nutrition Status Survey (SSGI) indicate that 17.8% of pregnant women are affected by CED, contributing to the continued incidence of low birth weight infants (Kementrian Kesehatan RI, 2022).

The implications of CED during pregnancy are severe, leading to an increased likelihood of anemia, preeclampsia, and elevated risks of maternal and neonatal mortality (Unicef, 2023). Infants born to mothers experiencing CED are more susceptible to growth retardation, cognitive impairments, and a greater predisposition to metabolic diseases later in life (Victora et al., 2022). Furthermore, the WHO (2023) highlights that inadequate maternal nutrition exacerbates the cycle of intergenerational malnutrition, as girls born with low birth weight face a higher probability of experiencing CED in adulthood, subsequently encountering similar pregnancy-related complications.

Addressing this issue requires a multifaceted approach, involving both global and national policy interventions. WHO (2023) advocates for targeted nutritional strategies, including the administration of iron and folic acid supplements, the provision of protein and micronutrient-enriched food support, and educational programs focused on maternal nutrition to mitigate and manage CED. In Indonesia, the government has integrated CED prevention efforts into the National Action Plan for the Acceleration of Nutrition Improvement 2021-2024. This initiative includes the distribution of Iron Folic Acid (IFA) tablets, regular nutritional assessments of pregnant women through Posyandu services, and the alignment of nutrition-sensitive programs with broader food security strategies (Kementrian Kesehatan RI, 2022).

The widespread prevalence of CED in expectant mothers remains a significant concern at the community level due to its long-term effects on familial well-being and the overall quality of human resources in the future. International agencies such as UNICEF and WHO continue to advocate for public awareness campaigns aimed at emphasizing the importance of maternal nutrition (Unicef, 2023). In Indonesia, community-driven programs such as Isi Piringku and Posyandu have played a crucial role in educating pregnant women on maintaining balanced diets and adhering to iron and folic acid supplementation regimens (Kementrian Kesehatan RI, 2022). Furthermore, collaborative efforts from non-governmental organizations (NGOs) and private sector entities have significantly contributed to reducing low birth weight cases through maternal support programs in various regions (Kementrian Kesehatan RI, 2022).

This scoping review aims to systematically examine existing research related to the prevention and management of Chronic Energy Deficiency (CED) in pregnant women by assessing key interventions, policy frameworks, and community-based initiatives both globally and in Indonesia. The review intends to evaluate the effectiveness of nutritional interventions, supplementation programs, and healthcare strategies in mitigating CED prevalence and its associated health risks. Additionally, this study seeks to identify knowledge gaps and provide evidence-based recommendations for future policies and programs aimed at improving maternal nutrition and optimizing pregnancy outcomes.

METHOD

This study employed a scoping review design to map the breadth of evidence related to the prevention and management of chronic energy deficiency (CED) in pregnant women. The review followed the PRISMA Extension for Scoping Reviews (PRISMA-ScR) and the framework of Arksey and O'Malley, which includes five stages: identifying the review question, identifying relevant studies, selecting eligible studies, charting the data, and collating and summarizing the findings.

Formulate Review Questions

To formulate research questions in the scoping review, the PCC (Population, Concept, and Context) framework was utilized. This model helps refine and define the study's focus by developing more precise research questions. The central question guiding this review is: "What evidence is available regarding the risk factors, impacts, interventions, and prevention strategies related to chronic energy deficiency in pregnant women?"

Table 1: Research Question Framework

P (*Population*)	C (*Concept*)	C(*Contex*)
Pregnant women	Chronic energy deficiency, its determinants, impacts, prevention, and management	Health services, community settings, and public health programs

Identifying Relevant Articles

This phase involved identifying relevant studies and formulating a structured search strategy. This process included defining the search locations, selecting appropriate keywords, determining accessible sources, setting a specific timeframe, and selecting the language of the studies. To ensure a comprehensive and well-targeted search for articles relevant to the scoping review, the initial step was to establish inclusion and exclusion criteria based on the predefined framework. This approach helps maintain a focused data search, preventing deviations beyond the study's intended scope. The inclusion and exclusion criteria for this scoping review are outlined as follows:

Table 2. Identifying relevant articles

Inclusion criteria	Exclusion criteria
1. Focused on pregnant women with or at risk of chronic energy deficiency 2. Examined determinants, impacts, prevention strategies, or management interventions related to CED 3. Were original research articles 4. Were available in full text **5.** Were published in English or Indonesian between 2020 and 2025.	1. Review articles 2. Opinion papers, editorials, or books 3. Not focused on CED in pregnant women 4. Not available in full text; 5. Outside the publication period or language criteria.

Article Selection

The article search in this review used PubMed, Wiley Online Library, Proquest, and Sciendirect. The search was conducted in 2025 with the year of publication of the article between 2020 - 2025 and using English or Indonesian with a search strategy using keywords and Boolean as follows:

Table 3. Article keywords

Focus	Series of Searches
Pregnant Women	Woman OR pregnancy prevention OR pregnant women Woman Reproductive ages
Protein Intake	Nutrition, Maternal malnutrition, Nutritional counseling AND pregnancy outcomes
Chronic Energy Deficiency	treatment strategies AND Energy deficiency in pregnancy, Energy deficiency" AND "pregnancy

A total of 665 records were identified from the four databases: PubMed (n=32), Wiley Online Library (n=180), ProQuest (n=395), and ScienceDirect (n=58). After removing 44 duplicates, 621 records remained for title and abstract screening using Rayyan. Full texts of potentially relevant studies were then assessed against the eligibility criteria. Studies were excluded at the full-text stage for reasons such as irrelevant population, non-CED focus, non-original article type, unavailable full text, or failure to address prevention or management of CED. Finally, 10 studies were included in the review.

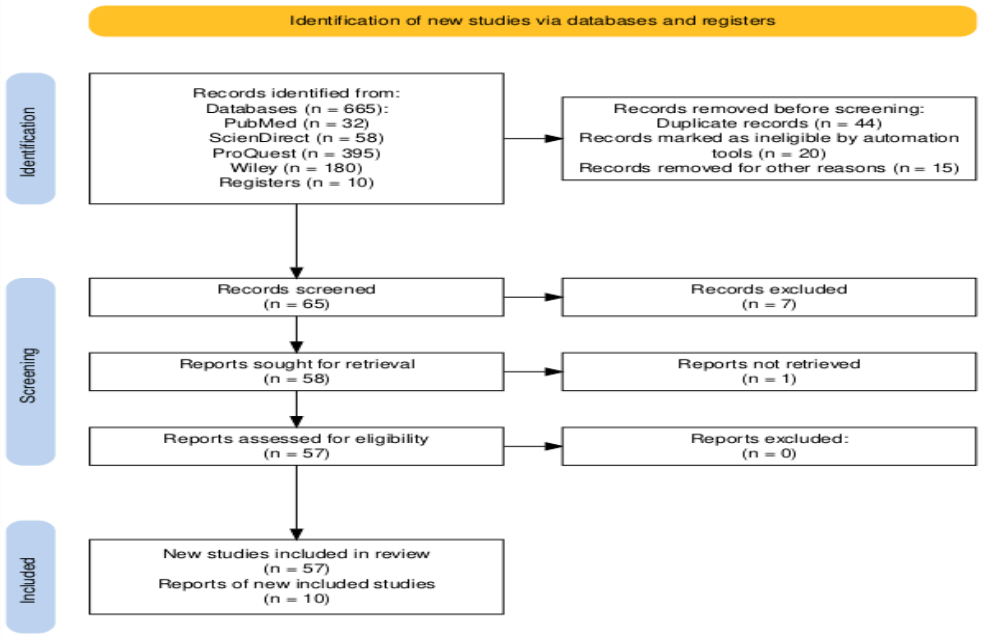

Figure 1. PRISMA diagram

Critical appraisal

Although critical appraisal is not mandatory in scoping reviews, a methodological appraisal was conducted in this study to provide contextual information about the overall characteristics and methodological rigor of the included evidence. The appraisal was not used to exclude studies from the review, but rather to assist in interpreting the strength and limitations of the available literature. Appraisal tools were selected according to study design, with Joanna Briggs Institute (JBI) critical appraisal tools applied to relevant quantitative and qualitative studies. The results of the appraisal were summarized narratively and considered during interpretation of the findings, particularly in relation to the predominance of observational designs and the limited number of intervention studies.

Data Charting

Data from the included studies were charted using a standardized extraction form, including author, publication year, study location, aim, design, sample characteristics, and key findings. The findings were then synthesized descriptively and organized into thematic categories to identify patterns in risk factors, impacts, interventions, and prevention strategies related to CED in pregnant women.

Table 5. Charting Data

Article Code	Article Title	Country	Research Objectives	Research Design	Data Collection Methods	Data Analysis Method	Research Results
A1	*Affecting factors the incidence of chronic energy deficiency (CED) in pregnant women* (Fauziah & Febriyanti, 2023)	Indonesia	Knowing the factors that influence the incidence of chronic energy deficiency in pregnant women at the Ketapang Health Center	Case-control	Survey, interview, medical record data	Chi-square test	There was an association of age and anemia with chronic energy deficiency (p-value <0.05), but no association of parity with chronic energy deficiency.
A2	*The Relationship Between Energy, Nutrient Intake, and Occupational Status with Chronic Energy Deficiency (CED) in Pregnant Women* (Melinasari et al., 2024)	Indonesia	To determine the relationship between energy and nutrient intake and employment status on the incidence of chronic energy deficiency	Cross-sectional	3x24 hour food recall, interview questionnaire	Bivariate analysis	Energy and carbohydrate intake were associated with chronic energy deficiency (p<0.05), but protein, fat, vitamin A, and employment status were not associated with chronic energy deficiency.
A3	*Macronutrient Intake of Chronic Energy Deficiency Pregnant Women in Pekanbaru City* (Erowati et al., 2022)	Indonesia	Explaining macronutrient intake of pregnant women with chronic energy deficiency	Descriptive, cross-sectional	Interview questionnaire, 2x24 hour food recall, anthropometric measurements	Descriptive analysis	Macronutrient intake of pregnant women with chronic energy deficiency does not meet their nutritional needs.
A4	*The Effect of Supplementary Feeding on Body Weight of Pregnant Women Who Have Chronic Energy Deficiency in Indonesia* (Rahmah, H., Nurlinda, A., Kurnaesih, 2022)	Indonesia	Determining the effect of supplementary feeding on body weight of pregnant women with chronic energy deficiency	Quasi-experimental with Pretest-Posttest Control Group Design	Observation, interview	Paired Sample t-Test	Significant increase in body weight after supplementary feeding (p=0.000).
A5	*Education on Supplementary Feeding and Types of Local Food for Pregnant*	Indonesia	Knowing the effect of education about supplementary food and local food types on	Descriptive with group counseling method	Survey, interview	Descriptive analysis	Improved knowledge of chronic energy deficiency and supplementary

	Women with Chronic Energy Deficiency in Makassar City (Henny et al., 2022)		pregnant women with chronic energy deficiency				feeding after education.
A6	*Energy Intake and Food Restriction as Determinant Factors of Chronic Energy Deficiency among Pregnant Women in Rural Area of Sungai Sembilan, Riau, Indonesia* (Afrinis et al., 2022)	Indonesia	Identifying factors associated with chronic energy deficiency among pregnant women in rural areas	Cross-sectional	Questionnaire, interview	Multiple logistic regression	Energy intake and dietary restriction were risk factors for chronic energy deficiency (AOR=3.04, p<0.05).
A7	*Improving the Nutritional Status of Pregnant Women Who Experience Chronic Energy Deficiency with Spirulina Platensis* (Kundarti et al., 2024)	Indonesia	Analyzing the effect of *Spirulina Platensis* on the nutritional status of pregnant women with chronic energy deficiency	Quasi-experiment	Field experiment	Chi-square	Significant improvement in nutritional status of pregnant women after *Spirulina Platensis* consumption.
A8	*Nutrition Assistance Increases the Size of Middle-Upper Arm Circumference of Pregnant Women with Chronic Energy Deficiency* (Abadi et al., 2020)	Indonesia	To determine the effect of nutritional support on the upper arm circumference of pregnant women with chronic energy deficiency	Pre-experimental, pretest-posttest	Observation, interview	Wilcoxon sign rank test	Nutritional support significantly increased the upper arm circumference of pregnant women with chronic energy deficiency (p=0.000).
A9	*Evaluation of Chronic Energy Deficiency (KEK) Management Program for Pregnant Women in the Work Area of Puskesmas, Polewali Mandar Regency* (Nurjamilah et al., 2021)	Indonesia	Evaluate the treatment program for chronic energy deficiency in pregnant women	Descriptive qualitative with evaluation approach	In-depth interview, observation, documentation	Data triangulation	The program has not yet reached the optimal target; there are still weaknesses in supervision and mobilization of health workers.
A10	*Effectiveness of Moringa Biscuit (Moringa oleifera) and Snakehead Fish (Channa striata) in Improving the Nutritional*	Indonesia	Analyzing the effectiveness of moringa biscuits and cork fish in improving the nutritional status of pregnant	Randomized control trial (RCT)	Field experiments, anthropometric measurements	Paired t-test	The provision of biscuits significantly improved the nutritional status of pregnant women with chronic energy

Status of Pregnant Women with Chronic Energy Deficiency (Setyawati et al., 2024)	women with chronic energy deficiency	deficiency (p=0.000).

RESULTS AND DISCUSSION

Results

Article Characteristics by Country

All studies in articles A1 to A10 were from Indonesia with a total of 10 articles. This shows that Chronic Energy Deficiency (CED) in pregnant women is a health issue that is still a major concern in Indonesia. The large number of studies conducted in various regions in Indonesia reflects the efforts of academics and health practitioners in understanding the causal factors, impacts, and interventions that can be applied to address the problem of CED in this country.

Characteristics by Study Design

Based on the distribution of research designs from articles A1 to A10, the Cross-sectional method was the most widely used with 2 articles, indicating that this approach is often used to observe the relationship between variables at one specific point in time. Meanwhile, other research designs were used in 1 article each, including Case-control, Descriptive cross-sectional, Quasi-experimental, Descriptive, Quasi-experimental, Pre-experimental, Descriptive qualitative, and Randomized Control Trial (RCT). This indicates that research on Chronic Energy Deficiency (CED) in pregnant women uses a variety of methodological approaches, with the majority of studies focusing on observing variable relationships and experimental interventions to understand and address the problem of CED.

Characteristics Based on Year of Publication

The distribution of the number of articles by year of publication showed that 2022 had the highest number of publications with 4 articles, followed by 2024 with 3 articles, while 2020, 2021, and 2023 each had 1 article. This indicates that research related to Chronic Energy Deficiency (CED) in pregnant women peaked in 2022, while in other years there were still studies conducted, albeit in smaller numbers. This trend shows that the issue of CED remains a concern in the academic world, especially with the increase again in 2024.

Theme Mapping

Theme	Subtheme	Article Code
1. Risk Factors for CED in Pregnant Women	1. Relationship between age, socioeconomic status, and nutritional status of pregnant women with CED	A1, A6, A2
	2. Impact of diet and consumption habits on the incidence of CED	A3, A2
	3. Influence of infectious diseases on CED in pregnant women	A6, A2
2. Impact of CED on Pregnancy and Infant Health	1. CED and its impact on labor and newborn health	A7, A4, A3
	2. Risk of low birth weight (LBW) and prematurity	A3, A2
	3. SEW as a risk factor for complications of pregnancy and childbirth	A7, A4
3. Nutrition Interventions for the Management of CED	1. Nutrition education and supplementation in addressing CED in pregnant women	A5, A10
	2. Providing supplementary food based on local food	A8, A7, A10
	3. The role of iron and protein supplements in improving the nutritional status of pregnant women	A10, A7, A9
4. CED Prevention Strategies in Public Health Policy	The role of government and community in reducing CED rates	A9, A5, A8

DISCUSSION

This scoping review shows that chronic energy deficiency (CED) in pregnant women is a multidimensional problem influenced by nutritional, socioeconomic, behavioral, and health-related factors. Across the included studies, maternal age, low socioeconomic status, inadequate dietary intake, food restriction practices, and infectious diseases consistently emerged as important determinants of CED (A1, A2, A3, A6). These findings indicate that CED should not be understood only as a consequence of insufficient food intake, but also as a condition closely related to maternal vulnerability, poverty, and limited access to nutritious foods. This pattern is in line with the findings of Siregar et al (2024), who reported that economic status and food culture were significantly associated with the incidence of CED.

The included studies also suggest that inadequate maternal diet remains one of the strongest pathways leading to CED. Low intake of energy, protein, and other macronutrients was repeatedly identified as a contributing factor to poor maternal nutritional status during pregnancy (A2, A3). In addition, food restriction and unbalanced consumption habits appear to aggravate this condition, particularly among women in rural or economically constrained settings (A6). These findings are supported by Farisni et al (2023), who emphasized that locally available foods rich in energy, protein, fat, and minerals have considerable potential to help meet the nutritional needs of pregnant women. Therefore, improving maternal nutritional intake should not rely solely on supplementation, but also on culturally appropriate nutrition education and better access to diverse, nutrient-dense foods.

Another important finding is that maternal health conditions may worsen the burden of CED and contribute to adverse pregnancy outcomes. The reviewed studies suggest that poor nutritional status often coexists with anemia, infection, and other maternal health problems, creating a cycle in which inadequate nutrition increases susceptibility to illness, while illness further worsens nutritional status (A2, A6). This interpretation is consistent with Rustan & Kartini (2024), who found that CED in pregnant women was closely related to iron tablet consumption patterns

and hemoglobin status. These findings imply that prevention of CED should be integrated with broader maternal health services, including early screening, infection prevention, and routine antenatal monitoring.

This review also indicates that CED has important consequences for maternal and infant health. Across the included studies, CED was associated with low birth weight, prematurity, impaired fetal growth, and increased risk of pregnancy and childbirth complications (A3, A4, A7). These findings are comparable with Umar & Wardani (2022), who reported a strong relationship between low maternal hemoglobin levels and low birth weight, as well as with Maolida et al (2024), who also identified a significant association between maternal nutritional problems and adverse birth outcomes. Taken together, these findings strengthen the view that CED is not only a maternal nutrition issue, but also an important determinant of neonatal health and future child development.

With regard to intervention strategies, the included studies show that nutrition education, supplementation, and local food-based interventions are the most frequently discussed approaches for the prevention and management of CED in pregnant women (A5, A7, A8, A10). Educational interventions improved maternal knowledge and awareness regarding nutritional needs, while supplementation and food-based support contributed to improvements in hemoglobin levels, body mass index, and overall nutritional status. These findings are strengthened by Manurung et al (2024), who found that nutrition education improved mothers' understanding of nutritional needs and prevention of complications, and by Farisni et al (2023), who highlighted the value of local food resources in supporting maternal nutrition. This suggests that combining education with practical nutritional support may be more effective than relying on a single strategy alone.

The role of supplementation was particularly prominent in the reviewed evidence. Iron and protein supplementation, as well as nutrient-rich local food products, were reported to improve maternal nutritional indicators and support recovery among pregnant women with CED (A7, A9, A10). However, the findings also imply that the success of supplementation depends not only on the biological efficacy of the intervention, but also on adherence, monitoring, and continuity of care. This interpretation is in line with Rustan & Kartini (2024), who emphasized the importance of regular Fe tablet consumption, and with Manurung et al (2024), who pointed out that educational reinforcement is still needed to improve maternal compliance. Therefore, supplementation programs should be accompanied by strong counseling and follow-up mechanisms to ensure that their benefits are sustained in routine practice.

At the policy and community level, this review shows that successful CED prevention requires more than individual-level nutritional support. Government programs, health center-based education, and community participation were identified as important components of prevention and management efforts, but their implementation remains uneven (A5, A8, A9). Some studies suggest that program effectiveness is limited by weak monitoring, insufficient educational reinforcement, and inconsistent community engagement. This finding is comparable with Manurung et al (2024), who noted that nutrition education programs were beneficial but still required broader coverage and sustainability. Thus, the prevention of CED needs stronger coordination between health services, local governments, and communities, so that policy commitment can be translated into more effective and continuous field implementation.

Overall, this review highlights several important knowledge gaps. First, the included studies were dominated by Indonesian settings and were largely observational in design, particularly cross-sectional studies, which limits causal interpretation and broader generalizability (A1, A2, A3, A6). Second, although intervention studies showed promising results, comparative evidence on the relative effectiveness of different intervention models remains limited (A4, A7, A10). Third, only a small number of studies discussed the interaction between nutritional, cultural, socioeconomic, and health system factors in an integrated manner. These patterns suggest the need for future research using stronger study designs, longer follow-up, and more standardized outcome measures

to generate more robust evidence for maternal nutrition policy and more standardized outcome measures to generate more robust evidence for maternal nutrition policy and practice.

CONCLUSION

Chronic energy deficiency in pregnant women is influenced by multiple interrelated factors, including socioeconomic vulnerability, inadequate dietary intake, food-related behaviors, and maternal health conditions. The reviewed evidence indicates that CED is associated with adverse maternal and infant outcomes, particularly low birth weight, prematurity, and pregnancy-related complications. Nutritional education, supplementation, and local food-based interventions appear promising in improving maternal nutritional status, but their effectiveness depends on sustained implementation, monitoring, and community engagement. Overall, the prevention and management of CED require integrated strategies that combine individual-level nutrition support with stronger health system and public policy responses.

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AUTHOR CONTRIBUTION STATEMENT

SM, S, FK contributed to the conception, design, and development of the research framework; SM conducted the literature search and data extraction; S and FK performed the critical appraisal and thematic analysis; SM drafted the manuscript; S and FK reviewed and refined the manuscript. All authors approved the final version of the manuscript..

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