PROCEEDING
5th International Conference of Health Polytechnic of Jambi 2025
icon@poltekkesjambi.ac.id
http://journal.poltekkesjambi.ac.id/index.php/ICoHPJ
doi.org/10.35910/icohpj.v5i0

ANALYSIS OF BEHAVIOURAL FACTORS CONTRIBUTING TO CHRONIC ENERGY DEFICIENCY (CHD) AMONG PREGNANT WOMEN IN DEVELOPING COUNTRIES: A SYSTEMATIC REVIEW

Moch Taufik Hidayatullah[1]*, Sri Achadi Nugraheni[2], Bagoes Widjanarko[2], Apoina Kartini[2]
[1]Programme of Doctor Public Health, Faculty of Public Health, Diponegoro University, Semarang, Indonesia
[2]Faculty of Public Health, Diponegoro University, Semarang, Indonesia
Corresponding Author: moch_taufik@undikma.ac.id

ABSTRACT

Background: *The nutritional condition of pregnant women is still a problem that needs serious attention in developing countries. In Indonesia, many pregnant women still experience nutritional problems, especially Chronic Energy Deficiency (CED). This achievement shows that efforts to reduce the number of CEDs have not reached the expected target, indicating the importance of increasing nutritional interventions for pregnant women. This systematic literature review aims to identify and analyze various behavioral risk factors of malnourished pregnant women through an article review.*
Methods: *Inclusion criteria in this study were community-based studies in developing countries with analytical observational research designs such as cross-sectional, case-control, and cohort. Exclusion criteria were literature review studies and studies that did not report relevant results.*
Results: *Behavioural risk factors contributing to undernutrition or CED in pregnant women consist of knowledge, attitudes, and actions such as ANC utilization, diet, and food aversion. Pregnant women's knowledge can influence their attitudes toward efforts to prevent or overcome malnutrition or chronic energy deficiency. Pregnant women who have positive behavioral risk factors are less likely to experience malnutrition or chronic energy deficiency than pregnant women who have negative behavioral risk factors.*
Conclusion : *Behavioral risk factors such as knowledge, attitudes, and actions related to ANC, diet, and food aversion contribute to malnutrition in pregnant women with CED, so community empowerment through health workers is needed to overcome this..*
Keywords: *Behavioural Risk Factors; Undernutrition; Chronic Energy Deficiency; Pregnant Women*

INTRODUCTION

Nutritional problems that often occur in pregnant women include chronic energy deficiency (CED). CED in pregnant women is one of the health problems in developing countries. As in Ethiopia, the prevalence of malnourished pregnant women is still high (Zewude et al., 2024). Indonesia, based on the results of the Indonesian Health Survey (IHS) 2023, published in 2024, reported that CED in pregnant women was 16.9% (Kementerian Kesehatan RI, 2023). This figure has not met the target set in the National Medium-Term Development Plan 2020-2024 of 11.5% by 2023 (Kementerian Kesehatan RI, 2020). CED can occur when a pregnant woman experiences energy deficiency that lasts for a long period, which can have a negative impact not only on maternal health but also on fetal development (Tanoto Foundation, 2023). Energy deficiency is often caused by inadequate nutritional intake, which can worsen health conditions during pregnancy (Fitri & WIji, 2019). Preterm labor, low birth weight kids, and maternal and fetal death are among the pregnancy issues that are more likely to occur in pregnant women with CED. This condition affects the mother's health and threatens the quality of health of the next generation (Tanoto Foundation, 2023).

Previous studies have found that the risk factors for malnutrition, especially SEA in pregnant women, are many, including illiteracy, and lack of dietary advice. (Zewude et al., 2024). Other factors such as knowledge, (Hasriantirisna, 2023), (Meri Agritubella &

Delvira, 2020), attitudes (Palimbo et al., 2014) Antenatal care (ANC) visits (Fitrianingtyas et al., 2018), and the diet of pregnant women can influence CED. Age, spacing of pregnancies, economic status, and social and family support can also influence CED in pregnant women. (Ummah & Woro Tri Utami, 2024). In addition, dietary diversity, iron supplementation, food intake, maternal education, income, and ambition to become pregnant (Getaneh et al., 2021). There is also a substantial correlation between the incidence of CED in pregnant women and other factors that affect the consumption of calories, protein, vitamins, folate, and calcium (Wati et al., 2024). Various risk factors related to malnutrition or CED problems in pregnant women indicate that not only can food intake factors can affect the problem of CED in pregnant women, but the behavioral problems of pregnant women are also worth noting.

However, previous studies have highlighted behavioral variables partially. There has been no research that discusses the behavioral risk factors of pregnant women comprehensively. A person's behavior in adopting a behavior can involve three main domains: knowledge, attitude, and action. (Notoatmodjo, 2014). This process begins with an individual's understanding of the meaning or benefits of the behavior for themselves and their family. After gaining knowledge, individuals then form an attitude or judgment towards the stimulus or object. The final stage is action, where individuals are expected to practice what they have known and perceived positively. (Salim, 2014).

This systematic review aims to identify and analyze behavioral risk factors that contribute to undernutrition or chronic energy deficiency in pregnant women. With a deeper understanding of these factors, it is hoped that it can be used to develop more effective behavioral interventions to prevent and address CED in pregnant women and improve the health of mothers and their babies.

METHODS

The research method used was a literature review of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Checklist. (Matthew J Page, Joanne E McKenzie, Patrick M Bossuyt, Larissa Shamseer, Jennifer M Tetzlaff, Cynthia D Mulrow, Larissa Shamseer, Jennifer M Tetzlaff, 2021) The literature was collected using three English databases, namely Scopus, ScienceDirect, and PubMed. Articles in these databases were published from 2019 to 2024, or the last five years, using English with the document type article and sourced from journals with open access, or articles can be downloaded for free. Articles were searched using the keywords “chronic energy deficiency” OR “maternal undernutrition” AND pregnancy OR “pregnant women” AND “risk factors” OR predictors. The inclusion criteria in this study were research with an analytical observational design using cross-sectional, case-control, and cohort approaches. Respondents in the study were only pregnant women, and the location of the study was in developing countries. Exclusion criteria in this study were Systematic Literature Review studies and studies that reported irrelevant results. There were 134 articles found based on predetermined keywords which were then selected according to the inclusion criteria, 9 articles were obtained and reviewed by four reviewers.

RESULTS AND DISCUSSION

RESULTS

Nine kinds of literature were found based on the results of literature screening using the PRISMA Checklist. Literature was searched through three databases, such as Scopus, ScienceDirect, and Pubmed, using the keywords “chronic energy deficiency” OR “maternal undernutrition” AND pregnancy OR

"pregnant women" AND "risk factors" OR predictors. The following is a literature review based on the PRISMA 2020 checklist.

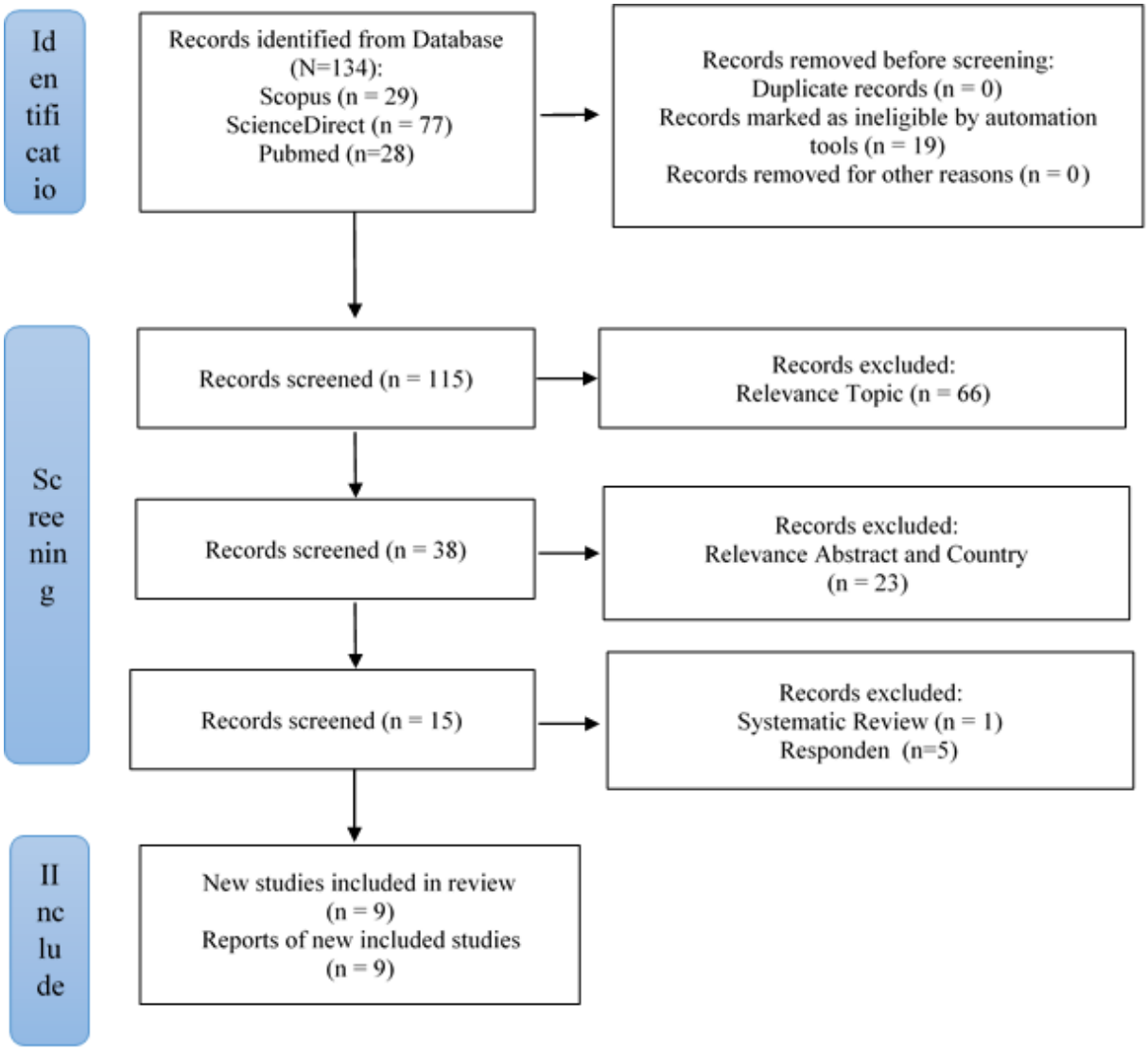

Figure 1. Search Flow Using PRISMA Checklist

Table 1. Summary of literature

No	Author, Title	Method	Sample	Results	Conclusion
1	Meron Demisew, Habtamu Fekadu Gemede, Kassahun Ayele Prevalence of undernutrition and its associated factors among pregnant women in north Shewa, Ethiopia: A multi-center cross-sectional study.	Cross-Sectional Study	334 respondents were pregnant women.	The prevalence of undernutrition was 22.2%. Significant contributing factors included low household income (AOR = 3.69), limited maternal education (AOR = 1.24), poor nutritional attitudes (AOR = 2.54), and low dietary diversity score (AOR = 4.42).	The prevalence of maternal undernutrition was exceptionally high based on WHO standards. Contributing factors included low average monthly household income, limited education among pregnant women, poor nutritional practices, and low dietary diversity scores.

No	Author, Title	Method	Sample	Results	Conclusion
2	Erna K. Wati, Retno Murwani, Martha I. Kartasurya, Sulistiyani Determinants of chronic energy deficiency (CED) incidence in pregnant women: A cross-sectional study in Banyumas, Indonesian	Cross-Sectional Study	100 respondents were pregnant women.	CED affected 32% of pregnant women. Key risk factors included extreme maternal age (OR: 3.49), low education (OR: 4.12), short pregnancy interval (OR: 7.30), infrequent ANC visits (OR: 3.06), and low protein intake (OR: 6.80), based on multivariate analysis. Significant associations were also found with poor nutritional knowledge and inadequate intake of energy, vitamin C, folate, and calcium.	The conclusion of this study indicates that 32% of pregnant women experience chronic energy deficiency (CED), influenced by several determinant factors. Significant factors contributing to the occurrence of CED include extreme age, short pregnancy intervals, low educational levels, low frequency of antenatal care (ANC) visits, and inadequate protein intake. Good nutritional knowledge and adequate dietary intake also contribute to the nutritional status of pregnant women.
3	Asmaul Husna, Fauziah Andika Factors Related to Nutritional Status of Pregnant Women in the Working Area of Baiturrahman Health Center, Banda Aceh	Case-Control Study	80 respondents were pregnant women.	The population in this study consisted of all pregnant women in their second and third trimesters, with 80 individuals selected as the sample. The results indicated that knowledge (P=0.015, OR=4.608), attitude (P=0.008, OR=7.933), family support (P=0.035, OR=3.857), and family income level (p=0.598, OR=1.593) had an impact. Multivariate analysis revealed that the most dominant variable related to the nutritional status of pregnant women was attitude (OR = 8.576)	There was a relationship between knowledge, attitudes, and family support and the nutritional status of pregnant women. In contrast, family income level did not show a significant association with the nutritional status of pregnant women. The attitude variable emerged as a key risk factor for Chronic Energy Deficiency (CED).
4	Solomon Zewdie, Sagni Girma Fage, Abera Kenay Tura, Fitsum Weldegebreal Undernutrition among Pregnant Women in Rural Communities in Southern Ethiopia	Cross-Sectional Study	376 respondents were pregnant women.	The prevalence of undernutrition among pregnant women was found to be 41.2% (95% CI 36.3%–46.3%). Unintended pregnancies (AOR 2.06, 95% CI 1.27–3.36) and nonparticipation in	Undernutrition among pregnant women was significantly common in the study area. Efforts to mitigate undernutrition should prioritize discouraging teenage and unintended pregnancies, addressing household

No	Author, Title	Method	Sample	Results	Conclusion
				Women's Health Development Army meetings (AOR 3.64, 95% CI 1.51–8.77) were identified as independent predictors of undernutrition. Conversely, having a minimum dietary diversity of five or more food groups (AOR 0.24, 95% CI 0.07–0.82), attending at least one antenatal care visit (AOR 0.46, 95% CI 0.27–0.78), being aged 20 years or older at first pregnancy (AOR 0.39, 95% CI 0.21–0.76), and coming from food-secure households (AOR 0.26, 95% CI 0.16–0.43) were independent protective factors against undernutrition.	food insecurity, promoting antenatal care visits, and encouraging women to consume a diverse diet. Enhancing the current network of the Women's Health Development Army appears to be crucial.
5	Berhe Gebremichael , Tadesse Misgana, Dawit Tamiru, Mandaras Tariku, Dejene Tesfaye, Daniel Alemu, Adisu Birhanu Weldesenbet, Merga Dheresa Undernutrition and associated factors among rural pregnant women in Eastern Ethiopia	Cross-Sectional Study	1.834 Pregnant women in Kersa and 1.036 Pregnant women in Haramaya.	The prevalence of undernutrition among pregnant women was found to be 43.8% (95% confidence interval: 40.8, 47.0). Significant predictors of undernutrition included early marriage (adjusted odds ratio = 2.63, confidence interval: 2.00, 3.47), lack of antenatal care follow-up (adjusted odds ratio = 1.73, 95% confidence interval: 1.31, 2.29), inadequately diversified diet (adjusted odds ratio = 2.48, 95% confidence interval: 1.77, 3.48), current substance use (adjusted odds ratio = 1.50, 95% confidence interval: 1.02, 2.19), history of mental illness (adjusted odds ratio = 2.44, 95%	Undernutrition represented a major public health concern for pregnant women in rural areas. Factors such as the age at which they first married, attendance at antenatal care, dietary diversity, current substance use, past mental health issues, and common mental disorders were identified as independent predictors of undernutrition. Consequently, the health authorities in the Kersa and Haramaya districts should focus their efforts on preventing undernutrition among pregnant women by providing nutrition counseling and education, as well as mental health and psychosocial support.

No	Author, Title	Method	Sample	Results	Conclusion
				confidence interval: 1.02, 5.82), and common mental disorders (adjusted odds ratio = 1.81, 95% confidence interval: 1.34, 2.43)	
6	Tona Zema Diddana Factors associated with dietary practice and nutritional status of pregnant women in Dessie town, northeastern Ethiopia: a community-based cross-sectional study	Cross-Sectional Study	604 respondents were pregnant women.	Approximately 54.8% of pregnant women exhibited poor dietary practices, and 19.5% were found to be undernourished. Factors significantly associated with poor dietary practices included being in the first trimester of pregnancy (AOR = 0.46; 95% CI: 0.26, 0.80), having no history of illness two weeks before data collection (AOR = 0.42; 95% CI: 0.22, 0.80), poor perceived severity of the situation (AOR = 1.64; 95% CI: 1.15, 2.33), poor perceived benefits of good nutrition (AOR = 1.63; 95% CI: 1.14, 2.32), and low self-efficacy (AOR = 4.74; 95% CI: 2.94, 7.65). Additionally, factors significantly linked to undernutrition included not attending antenatal care (ANC) (AOR = 3.46; 95% CI: 2.07, 5.78), having an illness (AOR = 1.93; 95% CI: 1.10, 3.5), inadequate dietary diversity (AOR = 5.92; 95% CI: 3.59, 9.76), poor nutrition knowledge (AOR = 3.03; 95% CI: 1.87, 4.92), poor dietary practices (AOR = 3.25; 95% CI: 1.91, 5.54), and low perceived self-efficacy (AOR = 5.59; 95% CI: 3.56, 8.79), all of which were	Dietary practices among pregnant women were inadequate, leading to a relatively high prevalence of nutritional issues. Factors such as being in the first trimester and having no illness history were linked to better practices, while poor perceptions of malnutrition severity, benefits of good nutrition, and self-efficacy were associated with inadequate practices. Additionally, not attending antenatal care (ANC), illness history, low dietary diversity, poor nutritional knowledge, and low self-efficacy were linked to undernutrition. To improve this situation, government and health workers should encourage ANC attendance, promote health during pregnancy, and provide support to enhance dietary diversity and practices, focusing on positive beliefs about nutrition.

No	Author, Title	Method	Sample	Results	Conclusion
				statistically significant (P < 0.05).	
7	**Turufat Paskal Gebre**, **Temesgen Tafesse**, **Teshome Abuka Abebo** Food aversion and its association with pregnant women's nutritional status in Teticha Woreda, Sidama Region, Ethiopia: A community-based mixed comparative cross-sectional study.(Gebre et al., 2024)	Cross-Sectional Study	446 respondents were pregnant women.	Maternal undernutrition was identified in 109 pregnant women (48.9%; 95% CI: 42.4%–55.4%) who experienced food aversion, while 69 women (30.9%; 95% CI: 25.1%–37.2%) without food aversion were also assessed (with a mid-upper arm circumference of 23 cm). A notable portion of mothers, specifically 95 (42.6%), reported that their food aversion was related to the taste or smell of certain foods. Some mothers avoided "Enset," while others refrained from consuming foods such as cereals, milk, and coffee. The Chi-square test indicated that pregnant women with food aversion had a higher likelihood of experiencing maternal undernutrition compared to those without food aversion (p-value of 0.000)	This study revealed a greater prevalence of undernutrition in pregnant women who experienced food aversion compared to those who did not. To address maternal undernutrition effectively, it is crucial to implement nutritional interventions, particularly counseling that addresses food aversion.
8	Abel Girma Tilahun, Dinaol Abdissa Fufa, Rahel Dereje Taddesse Undernutrition and its associated factors among pregnant women at the public hospitals of Bench-Sheko and Kaffa zone, southwest Ethiopia	Cross-Sectional Study	566 Pregnant Women	A total of 566 pregnant women were involved in our study, resulting in a response rate of 98.3%. The prevalence of undernutrition among these women was 42.4% (95% CI: 38.3, 46.5). The multivariate logistic regression analysis identified several significant factors related to undernutrition, including mothers aged 16-24 years (AOR = 3.9, 95% CI: 1.60, 9.70), household food	Based on the findings of this study, the prevalence of undernutrition was notably high in the study area, significantly associated with women aged 16–24 years, poor dietary knowledge, and household food insecurity. Therefore, strategies and programs aimed at reducing and preventing undernutrition among pregnant women should be implemented at all levels to enhance

No	Author, Title	Method	Sample	Results	Conclusion
				insecurity (AOR = 1.81, 95% CI: 1.04, 3.15), and inadequate dietary knowledge (AOR = 3.25, 95% CI: 1.94, 5.47).	their nutritional status, along with providing health information, nutrition counseling, and food assistance.
9	Mohammed Muze, Mubarek Yesse, Shemsu Kedir, and Abdilmejid Mustafa Prevalence and associated factors of undernutrition among pregnant women visiting ANC clinics in Silte zone, Southern Ethiopia.	cross-sectional study	422 Pregnant Women	In this study, the overall prevalence of undernutrition among the participants was found to be 21.8%. Factors significantly associated with undernutrition included being over 31 years of age (AOR = 0.15; 95% CI: 0.03, 0.93), having birth intervals greater than 2 years (AOR = 0.18; 95% CI: 0.04, 0.76), possessing good nutritional knowledge (AOR = 0.34; 95% CI: 0.17, 0.67), and not experiencing any dietary changes due to the current pregnancy (AOR = 6.02; 95% CI: 2.99, 12.14).	The prevalence of undernutrition among pregnant women was found to be 21.8%. This current estimate is lower than what was previously reported in the study area but higher than figures from developed countries. Key risk factors or predictors of undernutrition (MUAC < 23 cm) included the age of women, birth intervals, dietary changes due to the current pregnancy, and nutritional knowledge. It is recommended that interventions focus on maternal nutrition education and child spacing, particularly emphasizing the needs of adolescent pregnant women.

DISCUSSION

Based on the results of the literature review that meets the inclusion criteria in this systematic literature review, nine articles found that the risk factors for malnutrition in pregnant women and chronic energy deficiency (CHD) consist of many factors. This study's systematic review is limited only to pregnant women's behavioral risk factors. The following are the findings of behavioral risk factors contained in the nine kinds of literature that have been collected.

3.1. Knowledge

Nutritional knowledge in pregnant women is a crucial factor that influences eating decisions and behaviors during pregnancy. Recent studies have shown that many pregnant women have inadequate nutritional knowledge, which may negatively impact their nutritional status. For example, research by Demisew et al, (2024) showed that only 30.8% of the participants had good knowledge of nutrition, while the other 69.2% had inadequate. This result aligns with research by Wati EK et al. (2024) carried out in one city in Indonesia, revealing that 76% of expectant mothers lacked sufficient nutritional knowledge. (Wati et al., 2024).

Statistics show that there is a significant relationship between the level of nutritional knowledge and the incidence of CED. (Wati et al., 2024), (Husna & Andika, 2019). As seen from the results of Husna A et al (2019), out of 80 respondents, 27 pregnant women had low knowledge, and among them, 37% experienced CED. In contrast, only 11.3% of 53 pregnant women with high knowledge experienced

CED. The analysis results showed a p=0.015 value and an Odds Ratio (OR) of 4.608, indicating that pregnant women with low knowledge had a 4.6 times greater risk of experiencing CED compared to those with high knowledge. (Husna & Andika, 2019).

Diddana TZ's 2019 study confirmed that pregnant women with poor nutrition knowledge were at a higher risk of malnutrition. The Odds Ratio (AOR) for women with poor nutrition knowledge was 3.03, which means they were 3.03 times more likely to experience malnutrition compared to women with good nutrition knowledge. (Diddana, 2019). A study in Southwest Ethiopia at Bench-Sheko and Kaffa Zone General Hospitals found that dietary knowledge among pregnant women showed a significant association with their nutritional status. Findings indicated that pregnant women with inadequate dietary knowledge were 3.25 times more likely to experience undernutrition compared to those with good dietary knowledge (AOR = 3.25, 95% CI: 1.94, 5.47) (Tilahun et al., 2022). A subsequent study in Silte Zone, Southern Ethiopia, also found that there was a significant association between pregnant women's knowledge of nutrition and their nutritional status. Pregnant women who had good knowledge tended to have better nutritional status. The p-value obtained was 0.015, with an Odds Ratio (OR) of 4.608 (Muze et al., 2020).

Based on these results, it can be seen that pregnant women who have good nutrition knowledge tend to be better able to fulfill their nutritional needs, thus reducing the risk of CED. Good knowledge allows mothers to make healthier and more balanced food choices and understand the importance of adequate energy and protein intake during pregnancy. This low knowledge contributes to the prevalence of undernutrition among pregnant women. Studies have found that pregnant women with insufficient knowledge about nutrition are more likely to be undernourished compared to those with good knowledge. (Demisew et al., 2024), (Tilahun, Fufa, and Taddesse, 2022), (Muze et al., 2020).

Taken together, these results suggest that good nutritional knowledge among pregnant women contributes to better fulfillment of nutritional needs, thereby reducing the risk of CED. Conversely, low knowledge contributes to undernutrition in pregnant women, indicating the need for nutrition education interventions to improve understanding of the importance of nutrition during pregnancy.

3.2. Attitude

The perspective of pregnant women regarding nutrition plays a crucial role in shaping their dietary habits and nutritional choices throughout pregnancy. These attitudes include the perceptions, emotions, and motivations that pregnant women have regarding the importance of good nutrition. Recent research by Demisew et al. (2024) showed that unfavorable attitudes towards nutrition were associated with the prevalence of undernutrition in pregnant women. Pregnant women who have unfavorable attitudes towards nutrition are more likely to experience malnutrition, which can impact their health and that of their fetus. This study found that pregnant women who did not have a positive perspective or attitude towards nutrition were more likely to have a low dietary diversity score (DDS), indicating that they did not consume a variety of foods necessary to meet their nutritional needs.(Demisew et al., 2024)

Furthermore, statistical analyses showed a significant association between pregnant women's attitudes and their nutritional status. In one study, a *p*=0.008 value and an Odds Ratio (OR) of 7.933 were obtained, indicating that pregnant women with negative attitudes had almost eight times greater risk of developing nutritional energy deficiency (CED) compared to those with positive attitudes. This finding confirms the importance of positive attitudes towards nutrition as a protective factor against the risk of undernutrition. (Husna & Andika, 2019).

A positive attitude towards nutrition not only encourages pregnant women to choose healthier and more nutritious foods but also increases their awareness of the importance of a balanced nutritional intake during pregnancy. Therefore, interventions that aim to increase positive attitudes towards nutrition among pregnant women are essential. Effective nutrition education programs can help change pregnant women's perceptions and motivations so that they can better make food choices that support their health and fetal development. Overall, pregnant women's attitudes towards nutrition play a significant role in determining their nutritional status. This study highlights the need for more attention to psychological and social aspects in efforts to modify the nutritional status of pregnant women, with the hope of reducing the prevalence of undernutrition and improving maternal and child health.

3.3. Antenatal Care (ANC)

ANC visits are an essential component of monitoring maternal and fetal health during pregnancy. ANC provides an opportunity to educate women on proper nutrition, the importance of a balanced diet, and how to manage mental health. By attending ANC, women can receive the necessary information and support to maintain their health and optimal fetal development. Antenatal visits often include education on nutrition and health during pregnancy. Mothers who visit health facilities for ANC tend to be better informed about their nutritional needs, which can help them make healthier food choices and improve their nutritional status. Antenatal care (ANC) visits or utilization is a significant behavioral factor. ANC service utilization is low if pregnant women access the service less than twice during the first and second trimesters, and high if twice or more. Mothers who regularly utilize ANC services tend to get better information and support on nutrition and health during pregnancy, which can help prevent Chronic Energy Deficiency (CED) (Wati et al., 2024).

Research on the undernutrition of pregnant women in rural communities in Southern Ethiopia suggests that antenatal care (ANC) visits play an important role in preventing undernutrition. The study has found that pregnant women who had at least one antenatal visit had an odds ratio (AOR) of 0.46, meaning they were 54% less likely to be undernourished compared to women who did not have ANC. This suggests that antenatal visits serve as a protective factor against undernutrition. (Zewdie et al., 2021). Meanwhile, Eastern Ethiopia also showed the same thing, that pregnant women who did not attend ANC had a higher risk of being undernourished. In the logistic regression analysis, women who did not receive antenatal care had an adjusted odds ratio (AOR) of 1.73, with a 95% confidence interval between 1.31 and 2.29. This suggests that women who did not attend ANC were almost twice as likely to be undernourished compared to those who did attend ANC. (Gebremichael et al., 2022) In Northeast Ethiopia, Disse City also experienced the same thing. ANC services are also a risk factor for nutritional problems.(Diddana, 2019)

Overall, these studies strengthen the argument that ANC is important for maternal and fetal health and a key strategy in preventing malnutrition, especially in resource-limited settings. Thus, improving access to and utilization of ANC services should be a priority in reducing the risk of malnutrition among pregnant women, especially in vulnerable communities.

3.4. Diet (Diet Diversity and Frequency)

A balanced diet is essential during pregnancy to support fetal growth and development as well as maternal health. Pregnant women need to consume a variety of foods that are rich in nutrients, including protein, vitamins, and minerals. (Muze et al., 2020). Not only that, but the variety of foods and frequency of meals are also determinants.

Diet in terms of food variety is identified as one of the important factors affecting the nutritional status of pregnant women. A diverse diet is essential to ensure that pregnant women get all the necessary nutrients to support their health and fetal development. Adequate nutrition during pregnancy contributes to healthy growth and development and reduces the risk of complications.

Research shows that pregnant women who have a diet with low diversity are more likely to experience malnutrition. Analyses showed that women with low levels of dietary diversity had a higher risk of undernutrition compared to those with more diverse diets. Low dietary diversity was identified as an independent predictor of undernutrition. Women who did not consume a wide variety of foods, including vegetables, fruits, protein, and carbohydrate sources, showed a higher prevalence of undernutrition. (Gebremichael et al., 2022). Women who consumed less than five food groups in the 24 hours before data collection were considered to have poor dietary diversity. Those with poor dietary diversity had an AOR of 5.92, indicating a higher risk of undernutrition. (Diddana, 2019).

Research by Diddana TZ (2019 found that 54.8% of pregnant women had poor dietary practices. This suggests that more than half of the studied population did not meet the standards of healthy dietary practices during pregnancy, which may contribute to nutritional problems. Poor dietary practices are directly related to inadequate nutritional status. Pregnant women who had poor dietary practices had an odds ratio (AOR) of 3.25, indicating that they were 3.25 times more likely to be undernourished compared to those who had good dietary practices. The study noted the eating frequency of pregnant women, where about 47% of them consumed less than three meals per day. Low meal frequency may contribute to inadequate nutrient intake, which is important for maternal health and fetal development. (Diddana, 2019).

Low dietary diversity and minimal meal frequency are independent predictors of undernutrition in pregnant women. Therefore, ensuring a balanced, diverse diet and adequate meal frequency during pregnancy is crucial to prevent malnutrition and related complications.

3.5. Food aversion

In the study, it was found that most pregnant women experienced food aversions. A total of 95 (42.6%) pregnant women reported that they avoided certain foods, with the main reason being the food's unpalatable taste or smell. Frequently avoided food types included cereals, dairy products, and coffee. This suggests that food aversions may affect the intake of important nutrients during pregnancy. Food aversions can cause pregnant women to avoid nutrient-rich foods, which are important for their health and fetal development. For example, avoiding dairy products may reduce calcium intake, which is important for fetal bone development.

Furthermore, about 58.6% of pregnant women reported avoiding at least one type of food during pregnancy. The reasons for this avoidance vary, including personal dislikes, religious beliefs, and culture. Avoidance of certain foods may reduce the intake of essential nutrients required during pregnancy. (Diddana, 2019). Aversion to staple foods such as ‘Enset’ and cereals may result in a lack of carbohydrates and energy, which are necessary during pregnancy. Hormonal changes during pregnancy can affect the sense of smell and taste, making previously favored foods unappealing. Pregnancy symptoms such as nausea and vomiting can also exacerbate aversion to certain foods, making pregnant women more likely to avoid foods that trigger these symptoms. (Gebre et al., 2024).

The limitation of this study is that the researcher did not discuss all the risk factors found in the article, but only limited it to behavioral risk factors. Therefore, risk factor variables that correlate with malnutrition or chronic energy deficiency in pregnant women

were not included in this study. This study was also limited to English-language articles, so other valuable articles in local languages were not discussed in this study.

CONCLUSION

Meeting nutritional needs during pregnancy is closely related to behavioral risk factors, including knowledge, attitudes, and practices. Good nutrition knowledge enables pregnant women to understand the importance of a balanced nutritional intake, while positive attitudes towards nutrition encourage motivation to adopt healthy eating habits. Practices, such as a diverse diet, adequate meal frequency, and regular antenatal care (ANC) visits, are actions that support the fulfillment of nutritional needs. Conversely, lack of knowledge, negative attitudes, and poor practices, such as low dietary diversity and food aversions, increase the risk of undernutrition. Therefore, increasing knowledge, changing attitudes, and strengthening good nutritional practices are integral strategies to support maternal health and fetal development.

ACKNOWLEDGEMENT

The researcher appreciates all parties involved in supporting and assisting in the process of making this article so that it can be completed.

CONFLICT OF INTEREST

All researchers declare that no conflict of interest arose in the process of preparing this article. All data used in this study were obtained objectively and transparently, without any influence from certain parties that could affect the results or interpretation of the research.

REFERENCES

Demisew, M., Fekadu Gemede, H., & Ayele, K. (2024). Prevalence of undernutrition and its associated factors among pregnant women in north Shewa, Ethiopia: A multi-center cross-sectional study. *Women's Health (London, England)*, *20*, 17455057241290884. https://doi.org/10.1177/17455057241290883

Diddana, T. Z. (2019). Factors associated with dietary practice and nutritional status of pregnant women in Dessie town, northeastern Ethiopia: a community-based cross-sectional study. *BMC Pregnancy and Childbirth*, *19*(1), 517. https://doi.org/10.1186/s12884-019-2649-0

Fitri, I., & WIji, R. N. (2019). *Buku Ajar Gizi Reproduksi dan Bukti* (Pertama). Gosyen Publishing.

Fitrianingtyas, I., Pertiwi, F. D., & Rachmania, W. (2018). Faktor-Faktor Yang Berhubungan Dengan Kejadian Kurang Energi Kronis (Kek) Pada Ibu Hamil Di Puskesmas Warung Jambu Kota Bogor. *Hearty*, *6*(2). https://doi.org/10.32832/hearty.v6i2.1275

Gebre, T. P., Tafesse, T., & Abebo, T. A. (2024). Food aversion and its association with pregnant women's nutritional status in Teticha Woreda, Sidama Region, Ethiopia: A community-based mixed comparative cross-sectional study. *SAGE Open Medicine*, *12*, 20503121241284950. https://doi.org/10.1177/20503121241284950

Gebremichael, B., Misgana, T., Tamiru, D., Tariku, M., Tesfaye, D., Alemu, D., Weldesenbet, A. B., & Dheresa, M. (2022). Undernutrition and associated factors among rural pregnant women in Eastern Ethiopia. *SAGE Open Medicine*, *10*.

https://doi.org/10.1177/20503121221104430

Getaneh, T., Negesse, A., Dessie, G., Desta, M., Assemie, M. A., & Tigabu, A. (2021). Predictors of malnutrition among pregnant women in Ethiopia: A systematic review and meta-analysis. *Human Nutrition & Metabolism*, *26*, 200131. https://doi.org/https://doi.org/10.1016/j.hnm.2021.200131

Hasriantirisna. (2023). Relationship Between Knowledge and the Incidence of Chronic Energy Deficiency in Pregnant Women. *Journal of Public Health and Pharmacy*, *3*(1), 1–4. https://doi.org/10.56338/jphp.v3i1.4167

Husna, A., & Andika, F. (2019). Factors Related to Nutritional Status of Pregnant Women in the Working Area of Baiturrahman Health Center Banda Aceh. *Unnes Journal of Public Health*, *8*(2), 112–116. https://doi.org/10.15294/ujph.v0i0.27472

Kementerian Kesehatan RI. (2020). Pedoman Indikator Program Kesehatan Masyarakat dalam RPJMN dan Renstra Kementrian Kesehatan tahun 2020-2024. In *Pedoman Indikator Program Kesehatan Masyarakat dalam RPJMN dan Renstra Kementrian Kesehatan tahun 2020-2024* (I, p. 99). Kementrian Kesehatan Republik Indonesia.

Kementerian Kesehatan RI. (2023). Survei Kesehatan Indonesia (SKI) Dalam Angka. In *Kementerian Kesehatan Republik Indonesia Badan Kebijakan Pembanguan*.

Matthew J Page, Joanne E McKenzie, Patrick M Bossuyt, Larissa Shamseer, Jennifer M Tetzlaff, Cynthia D Mulrow, Larissa Shamseer, Jennifer M Tetzlaff, D. M. (2021). Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. *Journal Of Clinical Epidemiology*, *134*, 103–112.

Meri Agritubella, S., & Delvira, W. (2020). Efektifitas Poster Pola Diit 1000 Hari Pertama Kehidupan (HPK) terhadap Pengetahuan Ibu Hamil tentang Nutrisi dalam Pencegahan Stunting di Puskesmas Rambah Kabupaten Rokan Hulu. *Jurnal Endurance*, *5*(1), 168. https://doi.org/10.22216/jen.v5i1.5027

Muze, M., Yesse, M., Kedir, S., & Mustefa, A. (2020). Prevalence and associated factors of undernutrition among pregnant women visiting ANC clinics in Silte zone, Southern Ethiopia. *BMC Pregnancy and Childbirth*, *20*(1), 707. https://doi.org/10.1186/s12884-020-03404-x

Notoatmodjo, S. (2014). *Ilmu Perilaku Kesehatan* (2nd ed.). PT. Rineka Cipta.

Palimbo, A., Firdaus, S., & Rafiah. (2014). Hubungan Pengetahuan Dan Sikap Ibu Hamil Terhadap Kejadian Kekurangan Energi Kronis (KEK). *Dinamika Kesehatan Jurnal Kebidanan Dan Keperawatan*, *5*(2), 1–10. http://ojs.dinamikakesehatan.stikessarimulia.ac.id/index.php/dksm/article/view/171/144

Salim, G. (2014). *Effective Coaching*. Buana Ilmu Populer.

Tanoto Foundation. (2023). Stunting-Pedia Apa yang Perlu Diketahui Tentang Stunting (Jilid 1) Konsep Stunting dan Daur Kehidupan. In *Stunting-Pedia*.

Tilahun, A. G., Fufa, D. A., & Taddesse, R. D. (2022). Undernutrition and its associated factors among pregnant women at the public hospitals of Bench-Sheko and Kaffa zone, southwest Ethiopia. *Heliyon*, *8*(5), e09380. https://doi.org/https://doi.org/10.1016/j.heliyon.2022.e09380

Ummah, W., & Woro Tri Utami. (2024). Faktor-Faktor Yang Mempengaruhi Kejadian Kekurangan Energi Kronis (Kek) Pada Ibu Hamil: Literatur Review. *ASSYIFA : Jurnal Ilmu Kesehatan*, *2*(1), 189–196. https://doi.org/10.62085/ajk.v2i1.59

Wati, E. K., Murwani, R., Kartasurya, M. I., & Sulistiyani, and S. (2024). Determinants of chronic energy deficiency (CED) incidence in pregnant women: A cross- sectional study in Banyumas, Indonesia. *Narra J*, *4*, 1–8.

Zewdie, S., Fage, S. G., Tura, A. K., & Weldegebreal, F. (2021). Undernutrition among Pregnant Women in Rural Communities in Southern Ethiopia. *International Journal of Women's Health*, *13*, 73–79. https://doi.org/10.2147/IJWH.S285132

Zewude, S. B., Beshah, M. H., Ahunie, M. A., Arega, D. T., & Addisu, D. (2024). Undernutrition and associated factors among pregnant women in Ethiopia. A systematic review and meta-analysis. *Frontiers in Nutrition*, *11*. https://doi.org/10.3389/fnut.2024.1347851