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KNOWLEDGE AND ECONOMIC STATUS ASSOCIATED WITH CHRONIC ENERGY DEFICIENCY AMONG PREGNANT WOMEN IN MUARA EMBURUNG

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ABSTRACT

Background: Chronic Energy Deficiency (CED) in pregnant women remains a nutritional problem that may affect maternal and fetal health. Nutritional knowledge and economic status are among factors associated with CED.

Objective: This study aimed to determine the association between nutritional knowledge, economic status, and CED among pregnant women in the Muara Emburung Community Health Center Work Area, Muara Enim Regency.

Methods: This analytical observational study used a cross-sectional design. Data were collected from November 24 to December 20, 2025. The population comprised pregnant women in their second and third trimesters. A total of 63 respondents were selected using purposive sampling. Nutritional knowledge, economic status, and CED were assessed using structured questionnaires and mid-upper arm circumference measurements. Data were analyzed using univariate and bivariate analyses with the Pearson Chi-Square test and contingency coefficient.

Results: Of 63 respondents, 42 (66.7%) had poor nutritional knowledge, 42 (66.7%) had an economic status below the regional minimum wage, and 25 (39.7%) experienced CED. Nutritional knowledge was significantly associated with CED ($\chi^2 = 16.372$; $p < 0.001$; $C = 0.454$). Economic status was also significantly associated with CED ($\chi^2 = 11.970$; $p = 0.001$; $C = 0.400$). Both associations were moderate.

Conclusion: Nutritional knowledge and economic status were moderately associated with CED among pregnant women. Strengthening nutrition education and routine CED screening during antenatal care may support early identification and prevention of CED.

Keywords: Chronic Energy Deficiency; economic status; nutritional knowledge; pregnant women

INTRODUCTION

Chronic Energy Deficiency (CED) remains an important nutritional problem among pregnant women and may adversely affect maternal and fetal health. CED is commonly assessed using mid-upper arm circumference (MUAC), with a measurement of less than 23.5 cm indicating CED. Maternal CED has been associated with adverse pregnancy outcomes and therefore requires early identification and appropriate nutritional management during antenatal care (ANC) [1]. The persistence of CED indicates that maternal nutritional status during pregnancy remains an important concern for maternal health services.

At the regional level, CED remains a continuing concern in Muara Enim Regency. Data from the Muara Enim District Health Office showed that 967 of 12,684 pregnant women experienced CED in 2020 (7.6%). In 2021, 851 of 12,712 pregnant women experienced CED (6.7%), while in 2022, the number increased to 888 of 11,857 pregnant women (7.5%). Although the proportion fluctuated, it remained within the range of 6.7%–7.6% during 2020–2022 [11]. At the primary healthcare level, the problem was also evident in the Muara Emburung Community Health Center working area. According to the health center report, the number of pregnant women recorded with CED increased from 102 cases in 2023 to 114 cases in 2024 [12]. These data indicate that CED remains a relevant maternal nutrition problem in this setting and provide a local basis for investigating factors associated with its occurrence.

Previous research indicates that CED is influenced by multiple nutritional, socioeconomic, behavioral, and contextual factors. Analysis of the 2023 Indonesian Health Survey found that CED among pregnant women was associated with maternal characteristics, area of residence, and supplementary feeding [2]. A multilevel study in Madura further demonstrated the contribution of socioeconomic and cultural factors to CED [3]. Although these studies indicate that CED is multifactorial, not all factors are equally relevant to routine antenatal care. The present study therefore focuses on two factors that are particularly relevant to maternal nutrition and potentially addressable through primary maternal health services: nutritional knowledge and economic status.

Economic status may influence maternal nutritional status by affecting the ability of households to obtain sufficient and diverse food during pregnancy. Previous studies have reported associations between socioeconomic conditions, nutritional intake, and CED among pregnant women [1,5]. In addition, a study conducted in a disaster-prone area of

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Palu found that low household income, food insecurity, limited healthcare access, and other socioeconomic and behavioral factors were associated with CED among pregnant women [6]. These findings suggest that economic conditions may shape the resources available to pregnant women to meet increased nutritional requirements. However, the strength and pattern of this association may differ across communities according to local socioeconomic and food-access conditions.

Nutritional knowledge represents another potentially modifiable factor because it may influence food choices and the application of nutrition recommendations during pregnancy. Hutabarat et al. [4] reported a significant relationship between pregnant women's knowledge of pregnancy nutrition and CED. Similarly, Afriyanti et al. [9] found significant relationships between nutritional knowledge, eating patterns, macronutrient intake, and CED. Putri et al. [10] also reported an association between nutritional knowledge and nutritional status among pregnant women. However, adequate knowledge alone may not ensure adequate nutritional status because the ability to implement nutritional recommendations may also depend on household economic conditions and access to adequate food [7]. Thus, nutritional knowledge and economic status need to be considered within the specific context in which pregnant women receive care.

What remains insufficiently understood is whether nutritional knowledge and economic status are associated with CED among pregnant women in the Muara Emburung Community Health Center working area. Previous studies have provided evidence from other regions and healthcare settings [1–7,9,10], but their findings cannot necessarily be assumed to represent the circumstances of pregnant women in Muara Emburung. This is important because local socioeconomic conditions, food availability, and access to maternal health services may influence the distribution of nutritional risk. The increasing number of recorded CED cases in Muara Emburung from 102 in 2023 to 114 in 2024 further emphasizes the need for local empirical evidence. Therefore, examining nutritional knowledge and economic status in this setting may provide context-specific evidence to support the identification of pregnant women at risk of CED.

The findings are also relevant to midwifery practice and ANC. Nutritional assessment and counseling are integral components of antenatal care, and midwives have an important role in identifying pregnant women at nutritional risk, monitoring MUAC, providing individualized nutrition education, and facilitating appropriate support or referral. Understanding the association of nutritional knowledge and economic status with CED may help midwives identify women who require more targeted nutritional counseling and closer nutritional monitoring. The findings may also provide evidence for primary healthcare facilities to strengthen CED prevention and nutrition education strategies according to the characteristics of their service population.



Therefore, this study aimed to determine the association between nutritional knowledge and economic status with Chronic Energy Deficiency among pregnant women in the working area of Muara Emburung Community Health Center, Muara Enim Regency.

METHODS

This study employed an analytic observational design with a cross-sectional approach to examine the associations between maternal nutritional knowledge, household income, and chronic energy deficiency (CED) among pregnant women. The study was conducted in the working area of Muara Emburung Public Health Center, Muara Enim Regency, South Sumatra, Indonesia, from November 17 to December 30, 2025, with data collection conducted from November 24 to December 20, 2025.

The study population consisted of 172 pregnant women in the second and third trimesters. The sample size was estimated using the Slovin formula with a 10% margin of error, resulting in approximately 63 participants. Participants were selected using purposive sampling based on predefined eligibility criteria. Eligible participants were pregnant women in the second or third trimester who resided in the study area, were able to communicate and complete the questionnaire, and provided informed consent. Women in the first trimester were excluded because the study focused on pregnant women in the second and third trimesters. Women with chronic diseases or severe pregnancy complications were excluded because these conditions may independently affect maternal nutritional status and potentially influence the assessment of CED. Women with severe edema or abnormalities of the upper arm were also excluded because these conditions could interfere with accurate MUAC measurement.

Data were collected directly during antenatal care (ANC) visits at the health center and community health service settings. Maternal nutritional knowledge was assessed using a structured questionnaire consisting of [number] items developed/adapted from [source]. The questionnaire assessed knowledge of nutritional requirements during pregnancy, dietary patterns, micronutrients, supplementation, and antenatal care. Each correct answer was assigned a score of [scoring method], and the total score was converted into a percentage. Nutritional knowledge was categorized as poor (<56%), moderate (56–75%), or good (>75–100%) based on [reference/validation basis]. The questionnaire had been [validated and tested for reliability / previously validated] with [population/sample, if applicable], with a reliability coefficient of [value].

Household income was assessed based on total monthly household income and categorized according to the regional minimum wage (UMR) of IDR 3,863,417. Participants were classified as having household income below the UMR or equal to/above the UMR. This variable was operationalized as household income category rather than multidimensional socioeconomic status.



CED was assessed using mid-upper arm circumference (MUAC). MUAC was measured using a standardized MUAC measuring tape by [trained researcher/health personnel]. The measurement was performed at the midpoint between the acromion and olecranon processes with the participant's arm in a relaxed position. MUAC was measured [once/twice], and the measurement was recorded in centimeters. A MUAC <23.5 cm was classified as CED, while MUAC $\geq$ 23.5 cm was classified as non-CED. [If applicable: The measurement procedure was standardized before data collection to ensure consistency and accuracy.]

Before data collection, participants received an explanation of the study objectives, procedures, potential risks, and benefits and provided written informed consent. Participant confidentiality was maintained throughout the data collection, data management, and analysis processes.

Data were analyzed using univariate and bivariate analyses. Univariate analysis was used to describe the distribution of maternal nutritional knowledge, household income category, and CED. Associations between the independent variables and CED were initially assessed using the Pearson chi-square test. Expected cell frequencies were examined to assess the assumptions of the chi-square test. When the chi-square assumptions were not met, the Fisher–Freeman–Halton exact test was used for the 3×2 contingency table. Statistical significance was set at $\alpha = 0.05$. The contingency coefficient was used to assess the strength of the associations.

RESULTS

The study included 63 pregnant women in the second and third trimesters who received antenatal care within the working area of Muara Emburung Public Health Center, Muara Enim, South Sumatra. Data were collected between November 24 and December 20, 2025. Nutritional knowledge and socioeconomic status were assessed using structured questionnaires, while chronic energy deficiency (CED) was determined based on mid-upper arm circumference (MUAC), with MUAC <23.5 cm classified as CED.



Table 1. Distribution of nutritional knowledge, socioeconomic status, and chronic energy deficiency among pregnant women

No	Variable	Frequency (f)	Percentage (%)
1	Nutritional knowledge		
	Poor	42	66.7
	Moderate	13	20.6
	Good	8	12.7
2	Socioeconomic status		
	< Regional minimum wage	42	66.7
	≥ Regional minimum wage	21	33.3
3	Chronic energy deficiency (CED)		
	CED	25	39.7
	No CED	38	60.3

The majority of respondents had poor nutritional knowledge (66.7%) and household income below the regional minimum wage (66.7%). CED was identified in 25 respondents (39.7%), while 38 respondents (60.3%) did not meet the CED criterion.

Table 2. Association between nutritional knowledge and chronic energy deficiency among pregnant women

Knowledge		Chronic Energy Deficiency						χ^2	p	C
		CED		No CED		n				
		f	%	f	%	f	%			
Poor		24	57.1	18	42.9	42	100	16.372	0.000	0.454
Moderate		0	0.0	13	100	13	100			
Good		1	12.5	7	87.5	8	100			
Total		25	39.7	38	60.3	63	100			

CED = Chronic Energy Deficiency; χ^2 = Pearson Chi-Square; C = Contingency Coefficient

The cross-tabulation showed that among the 42 pregnant women with poor knowledge, 24 (57.1%) experienced chronic energy deficiency (CED), while 18 (42.9%) did not. Among the 13 pregnant women with moderate knowledge, none experienced CED, whereas all 13 (100%) did not experience CED. Among the 8 pregnant women with good knowledge, 1 (12.5%) experienced CED and 7 (87.5%) did not. The Pearson Chi-Square test

indicated a statistically significant association between maternal knowledge and CED ($\chi^2 = 16.372$, $p < 0.001$). The Contingency Coefficient was 0.454, indicating a moderate association between maternal knowledge and CED.

Table 3. Association between socioeconomic status and chronic energy deficiency among pregnant women

Economic Status	Chronic Energy Deficiency						χ^2	p	$PR_{95\%}$
	CED		No CED		n				
	f	%	f	%	f	%			
< Regional minimum wage	23	54.8	19	45.2	42	100	11.970	0.001	5.75 (1.50–22.11)
≥ Regional minimum wage	2	9.5	19	90.5	21	100			
Total	25	39.7	38	60.3	63	100			

CED = Chronic Energy Deficiency; χ^2 = Pearson Chi-Square

Among pregnant women with household income below the regional minimum wage, 23 of 42 (54.8%) experienced CED, compared with 2 of 21 (9.5%) among those with household income at or above the regional minimum wage. Pearson's chi-square test showed a statistically significant association between household income category and CED ($\chi^2 = 11.970$, $p = 0.001$). The prevalence ratio was 5.75 (95% CI: 1.50–22.11), indicating that CED was approximately 5.75 times as prevalent among pregnant women from households with income below the regional minimum wage.

Regarding nutritional knowledge, 24 of 42 pregnant women (57.1%) with poor nutritional knowledge experienced CED. None of the 13 women with moderate nutritional knowledge experienced CED, whereas 1 of 8 women (12.5%) with good nutritional knowledge experienced CED. The association between nutritional knowledge and CED was statistically significant ($\chi^2 = 16.372$, $p < 0.001$), with a contingency coefficient of 0.454. Because one observed cell had a frequency of zero, the assumptions of the Pearson's chi-square test should be assessed based on the expected cell frequencies, and an exact test should be considered if these assumptions were not met.

DISCUSSION

Relationship Between Nutritional Knowledge and Chronic Energy Deficiency

The findings of this study showed a significant relationship between nutritional knowledge and the Chronic Energy Deficiency (CED) among pregnant women in the working area of Muara Emburung Community Health Center. Among 42 pregnant women with poor nutritional knowledge, 24 (57.1%) experienced CED, whereas only 1 (12.5%) of

the 8 pregnant women with good nutritional knowledge experienced CED. The Pearson chi-square test showed a significant relationship between nutritional knowledge and CED ($\chi^2=16.372$; $p<0.001$), with a contingency coefficient of 0.454, indicating a moderate strength of association. This finding suggests that pregnant women with inadequate nutritional knowledge were more likely to experience CED.

Nutritional knowledge is an important component of maternal behavior because it determines a woman's understanding of the nutritional requirements of pregnancy and may influence decisions regarding food selection, meal frequency, dietary diversity, and the utilization of nutritional information obtained during antenatal care. When nutritional knowledge is inadequate, pregnant women may not fully understand the increased requirements for energy, protein, vitamins, and minerals during pregnancy. Consequently, food intake may remain insufficient in quantity or quality, increasing the possibility of inadequate nutritional status.

The present finding is consistent with the study by Afriyanti et al. (2026), which found a significant relationship between nutritional knowledge and CED among pregnant women ($p=0.001$). The study also identified significant associations between CED and protein intake, carbohydrate intake, and eating patterns. These findings indicate that nutritional knowledge may be related to CED through dietary practices, particularly the selection and adequacy of nutrient-rich foods. Thus, knowledge is not merely an information component but may contribute to the formation of dietary behaviors that influence maternal nutritional status[9].

A similar result was reported by Ariyanti et al. (2025). Their study found a significant relationship between nutritional knowledge and CED, with pregnant women who had inadequate knowledge being 17.739 times more likely to experience CED. The authors emphasized the importance of strengthening nutrition education and integrating nutritional counseling into antenatal care. The similarity between these findings and the present study strengthens the evidence that nutritional knowledge is an important factor associated with maternal nutritional status[9].

The findings are also supported by Hutabarat et al. (2025), who reported a significant relationship between knowledge of pregnancy nutrition and CED ($p=0.012$). In their study, 57.5% of pregnant women had inadequate nutritional knowledge and 55% experienced CED. This pattern is comparable to the present study, in which two-thirds of respondents had poor nutritional knowledge and CED was identified in 39.7% of the respondents. The consistency of findings across different geographical settings suggests that inadequate nutritional knowledge remains an important issue in efforts to prevent CED among pregnant women[4].

However, nutritional knowledge should not be interpreted as the sole determinant of CED. Putri et al. (2025), based on data from 402 pregnant women in Pekanbaru, found a significant relationship between nutritional knowledge and nutritional status ($p=0.004$), but 15.9% of pregnant women with good nutritional knowledge still experienced CED. This



finding indicates that good knowledge does not always translate into adequate nutritional status. Factors such as household economic capacity, food availability, access to health services, cultural practices, and actual dietary intake may influence the ability of pregnant women to implement the knowledge they possess[10].

This consideration is particularly relevant to the present study because nutritional knowledge and socioeconomic status were both associated with CED. A pregnant woman may understand the importance of consuming protein-rich foods, vegetables, fruits, and other nutrient-dense foods, but her ability to implement these recommendations may be restricted by household purchasing power. Therefore, these findings suggest that prevention strategies may consider that improve access to adequate and affordable food and strengthen family support for maternal nutrition.

Relationship Between Socioeconomic Status and Chronic Energy Deficiency

The results also demonstrated a significant relationship between socioeconomic status and CED among pregnant women. Among respondents with socioeconomic status below the regional minimum wage, 23 of 42 women (54.8%) experienced CED, compared with only 2 of 21 women (9.5%) whose socioeconomic status was at or above the regional minimum wage. Pearson's chi-square test demonstrated a statistically significant relationship between socioeconomic status and CED ($\chi^2=11.970$; $p=0.001$). The contingency coefficient was 0.400, indicating a moderate association.

The higher proportion of CED among pregnant women from households with lower socioeconomic status can be explained by the relationship between economic resources and the ability to fulfill nutritional needs. Pregnancy requires additional energy and nutrient intake, and meeting these requirements depends partly on the availability and affordability of nutritious foods. Limited household income may lead families to prioritize inexpensive foods with lower nutritional diversity, potentially resulting in inadequate intake of protein and other essential nutrients. Over time, such dietary limitations may contribute to poor maternal nutritional status and increase the risk of CED.

The present finding is consistent with Dewi et al. (2026), who found a significant relationship between income and CED among pregnant women, with an odds ratio of 3.45 ($p=0.007$). Their findings indicate that pregnant women living in households with limited economic resources are more vulnerable to CED. The authors emphasized that socioeconomic and health-related factors should be addressed together, particularly in areas with limited resources[4].

A similar relationship was reported by Anggraeni et al. (2026), who found a significant association between socioeconomic status and CED among pregnant women at the Balen Community Health Center, with $p=0.000$. This finding is particularly relevant because the study examined socioeconomic status as one of the main variables associated with CED, similar to the present study[1]. The consistency of these findings suggests that household



economic conditions may remain an important determinant of maternal nutritional status across different primary healthcare settings.

The results are also supported by Saleh and Retnaningsih (2025), who examined nutritional intake and economic status among pregnant women in the Patilanggio Community Health Center working area. Their study found that all respondents had energy and protein intake below 90% of the recommended dietary allowance and were categorized as having CED, while all respondents were also classified as having low economic status. Although the study had a relatively homogeneous socioeconomic sample, the findings illustrate the close relationship between economic limitations, inadequate nutritional intake, and maternal CED[5].

Aiman et al. (2025) further demonstrated that socioeconomic factors interact with other determinants of CED. In their study of pregnant women in a disaster-prone area of Palu, low household income was significantly associated with CED, together with food insecurity, inadequate macronutrient intake, limited healthcare access, poor maternal knowledge, and other behavioral factors. These findings indicate that socioeconomic status may affect CED through several pathways rather than through income alone. Limited economic resources may restrict food choices, reduce household food security, and make access to health and nutrition services more difficult[6].

The relationship between socioeconomic status and maternal nutritional status also has implications for other pregnancy outcomes. Nurdin et al. (2026) found that low socioeconomic status was significantly associated with anemia among pregnant women in rural Gorontalo. Their analysis further showed that CED partially mediated the relationship between socioeconomic status and anemia, accounting for 23.76% of the total effect. This finding provides an important perspective that socioeconomic disadvantage may contribute to maternal health problems through nutritional pathways, including inadequate nutritional status[8].

The moderate contingency coefficient observed in the present study ($C=0.400$) indicates that socioeconomic status is associated with CED but does not fully explain its occurrence. This is important because pregnant women with similar economic conditions may have different nutritional statuses. Differences in nutritional knowledge, dietary habits, family support, food preferences, access to health services, and other maternal characteristics may contribute to these differences. Therefore, economic status should be considered one component within the broader multifactorial context of CED[11][12].

The findings of this study indicate that both nutritional knowledge and socioeconomic status are significantly associated with CED among pregnant women. The moderate strength of both associations suggests that neither factor operates independently as the sole explanation for CED. Instead, nutritional knowledge and socioeconomic status may jointly contribute to determining the extent to which pregnant women are able to fulfill their nutritional requirements[13].



The relationship can be understood through a pathway in which socioeconomic conditions influence access to food and health resources, while nutritional knowledge influences the ability to select and utilize those resources appropriately. A woman with good nutritional knowledge but limited economic resources may understand the importance of a balanced diet but face difficulties in purchasing adequate food. Conversely, a woman with sufficient economic resources but inadequate nutritional knowledge may have access to food but not necessarily make appropriate nutritional choices. Therefore, interventions aimed at reducing CED need to consider both individual-level and household-level factors[12].

These findings have implications for midwifery practice, particularly in antenatal care. Nutritional assessment should not be limited to measuring MUAC but should also include identification of pregnant women with inadequate nutritional knowledge and limited socioeconomic resources. Pregnant women at higher risk can receive more intensive nutrition counseling, while families can be involved in planning affordable and nutritionally adequate diets. This approach is consistent with recent evidence emphasizing that nutrition education is more effective when supported by adequate food access, family support, and appropriate health services[10][6].

Nutrition education should be tailored to the level of understanding of pregnant women and should provide practical information about affordable sources of protein, energy, and other essential nutrients. At the same time, pregnant women from economically disadvantaged households may require additional support through existing maternal nutrition programs and supplementary food interventions. Such an approach may be more effective than relying solely on education, because the ability to apply nutritional knowledge is closely related to the socioeconomic resources available to pregnant women and their families[11].

CONCLUSION

This study found that poor nutritional knowledge was significantly associated with chronic energy deficiency (CED) among pregnant women in the working area of Muara Emburung Community Health Center, Muara Enim Regency. Pregnant women with poor nutritional knowledge were more likely to have CED in this study. Socioeconomic status was also significantly associated with CED, with CED occurring more frequently among pregnant women from households with income below the regional minimum wage. These findings indicate that nutritional knowledge and socioeconomic conditions are associated with the nutritional status of pregnant women.

Prevention of CED should consider an integrated approach that strengthens maternal nutrition education while addressing the socioeconomic conditions of pregnant women and their families. Antenatal care should include regular nutritional assessment, targeted nutrition counseling, and early identification of pregnant women who may require



additional nutritional support, particularly those with poor nutritional knowledge and limited economic resources.

However, the findings should be interpreted with caution because the study was conducted at a single health center, used purposive sampling, included a relatively small sample, and employed a cross-sectional design. Therefore, the findings may not be generalizable to pregnant women in other settings.

IMPLICATIONS FOR MIDWIFERY PRACTICE

The findings have practical implications for strengthening midwifery care during antenatal care (ANC). Midwives can integrate regular mid-upper arm circumference (MUAC) screening into ANC to identify pregnant women at risk of Chronic Energy Deficiency (CED) and monitor changes in nutritional status throughout pregnancy. Pregnant women identified with poor nutritional knowledge should receive individualized nutrition counseling tailored to their nutritional needs, understanding, and pregnancy conditions.

In addition to nutritional assessment, midwives should explore the socioeconomic circumstances of pregnant women and their families to identify those who may face difficulties in accessing adequate food or nutritional support. Pregnant women with nutritional risks or socioeconomic constraints should receive appropriate follow-up and, when necessary, referral to available nutrition support programs or other relevant health and social services. These actions can support early identification, individualized counseling, continuous MUAC monitoring, and appropriate referral as part of comprehensive midwifery care for the prevention and management of CED during pregnancy.

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ETHICAL STATEMENT AND CONFLICT OF INTEREST

All participants were informed about the purpose and procedures of the study and provided informed consent before data collection. Participants' confidentiality and privacy



were maintained throughout the research process, and the collected data were used solely for research purposes.

Conflict of Interest: The authors declare that there is no conflict of interest related to the conduct, analysis, or publication of this study.

REFERENCES

- [1] Y. Anggraeni, S. Patonah, W. Utami, and F. Azizah, "The Relationship Between Socio-Economical and Pregnancy Spacing with the Incidence of Chronic Energy Deficiency (CED) in Pregnant Women at the Balen Community Health Center," *Medalion J. Med. Res. nursing, Heal. midwifery Particip.*, vol. 07, no. 02, pp. 255–259, 2026, doi: <https://doi.org/10.59733/medalion.v7i2.311>.
- [2] L. Tarina and R. Mutahar, "Factors Associated with The Incidence of Chronic Energy De8iciency (CED) Among Pregnant Women in Indonesia : an Analysis of Indonesian Health Survey (IHS) 2023," *J. Med. Syah Kuala*, vol. 25, no. 1, pp. 1–10, 2025.
- [3] R. Indriyani, B. Murti, N. A. Anggraini, and Y. Puspitasari, "Multilevel Analysis of Socioeconomic and Cultural Factors on Chronic Energy Deficiency among Pregnant Women in Madura," *J. Nurs. Pract.*, vol. 9, no. 3, pp. 688–696, 2026, doi: <https://doi.org/10.30994/jnp.v9i3.1089>.
- [4] D. S. Hutabarat, F. L. Saragih, S. M. P. Bakara, and D. S. Butarbutar, "The Relationship Between Pregnant Women'S Knowledge About Pregnancy Nutrition And The Incidence Of Chronic Energy Deficiency (CED) In Pregnant Women At The Timbaan Village Health Post, Bandar District, Simalungun Regency, North Sumatra Province In 2024," *J. Public Heal. Sci.*, vol. 2, no. 2, pp. 322–326, 2025.
- [5] S. Saleh and R. Retnaningsih, "Analysis of Nutritional Intake and Economic Status as Risk Factors for Chronic Energy Deficiency (CED) in Pregnant Women at Patilanggio Community Health Center," *Nurs. Appl. J.*, vol. 3, no. 3, pp. 193–204, 2025, doi: <https://doi.org/10.57213/naj.v3i3.1019>.
- [6] U. Aiman *et al.*, "A cross-sectional study on determinant factors of Chronic Energy Deficiency (CED) among pregnant women in disaster-prone areas : A case study at Talise Community Health Center , Palu City," *Nutr. Clin.*, vol. 45, no. 3, pp. 392–401, 2025, doi: 10.12873/453aiman.
- [7] R. U. Arianti and Mustamin, "Journal Health Care and Dietetics," *J. Heal. Care Diet.*, vol. 1, no. 1, pp. 45–52, 2026.

Penulis Pertama, dkk., Judul Artikel dalam 4 kata disambung



- [8] S. Surya, I. Nurdin, S. Mukarramah, Z. F. Ahmad, and Y. Yunus, "Chronic Energy Deficiency Mediates the Effect of Socioeconomic Status on Anemia in Pregnancy : A Case-Control Study in Rural Gorontalo," *Media Kesehat.*, vol. XXI, no. 1, pp. 96–103, 2026.
- [9] N. Afriyanti, S. S. Syahrir, and S. Sabar, "The Relationship between Macronutrient Intake, Eating Patterns, and Nutritional Knowledge with the Incidence of CED in Pregnant Women," *J. Pregnancy Infant Nutr.*, vol. 1, no. 1, pp. 15–22, 2026.
- [10] D. K. Putri *et al.*, "The Relationship between Nutritional Status and Nutritional Knowledge among Pregnant Women Nutra : Jurnal Gizi Dan Kesehatan," *Nutra J. Gizi dan Kesehat.*, vol. 03, no. 01, 2025, doi: 10.69632/jgkk.v3i01.59.
- [11] Munanto, H., Sunarsih, & Labanudi. (2020). Relationship between nutritional knowledge and economic status with chronic energy deficiency in pregnant women in Selatan Konawe. *Asian Journal of Research in Nursing and Health*, 3(1), 152–159. Article no. AJRNH.60609.
- [12] Kurniasih, H., Zuhriyatun, F., & Amalia, R. (2026). Family-based nutritional assistance to improve knowledge, attitudes, and nutritional status of pregnant women with chronic energy deficiency in Karangtengah Village. *Jurnal Ilmiah Pengabdian Masyarakat Bidang Kesehatan (Abdigermas)*, 4(2), 122–138. doi.org
- [13] Dewi, E. R., Pangaribuan, I. K., Sinaga, R., & Miftasari, K. (2026). Socioeconomic and health-related factors associated with chronic energy deficiency among pregnant women: A cross-sectional study. *Journal of Applied Nursing and Health*, 8(1), 327–335. doi.org

