

Educating Mothers on Optimal Feeding Practices to Prevent Stunting

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ABSTRACT

Stunting is a major public health concern that may be influenced by maternal nutritional status during pregnancy. Inadequate nutritional knowledge and dietary practices may contribute to insufficient intake of energy, protein, and iron. This study aimed to determine the effect of staged nutrition education on knowledge, attitudes, and energy, protein, and iron intake among pregnant women attending the mothers' class. A quasi-experimental one-group pre-test–post-test design was used. The intervention consisted of two nutrition education sessions with repeated outcome assessments. Participants were pregnant women who actively attended monthly mothers' classes. A total of 43 pregnant women participated from April to August 2026. Knowledge and attitudes were assessed using questionnaires, while energy, protein, and iron intake were assessed using 24-hour dietary recalls. Changes were analyzed using the Wilcoxon signed-rank test. Knowledge and attitudes improved significantly after the intervention ($p < 0.001$). Energy intake also increased significantly ($p = 0.003$), with the proportion of participants classified as having adequate intake increasing from 37.2% at baseline to 83.7% at the second monitoring assessment. Protein intake remained relatively stable because 74.4% of participants were already classified as having adequate intake at baseline ($p = 0.006$). Iron intake improved significantly ($p < 0.001$), with adequate intake increasing from 7.0% at baseline to 76.7% at the first monitoring assessment and 60.5% at the second assessment. These findings indicate that staged nutrition education may improve maternal nutrition-related knowledge, attitudes, and selected nutrient intake indicators. Future studies should use a control group and longer follow-up to strengthen causal inference.

Keywords: attitudes; education; energy; iron; knowledge; pregnant women; protein

INTRODUCTION

Stunting remains one of the most persistent global public health nutrition challenges because impaired linear growth during the critical window from pregnancy through early childhood can generate irreversible consequences for physical growth, neurocognitive development, educational attainment, and long-term productivity. The condition is defined as height-for-age below the established growth reference and reflects the cumulative effects of multiple interrelated determinants, including inadequate dietary intake, recurrent infections, suboptimal caregiving practices, and environmental exposures such as poor sanitation and limited access to health services [1]. As a chronic manifestation of undernutrition, stunting does not occur suddenly; rather, it develops gradually as a result of prolonged nutritional deprivation and repeated physiological insults beginning even before conception and continuing throughout the first 1,000 days of life [2].

Indonesia has demonstrated measurable progress in reducing stunting prevalence over the past decade, supported by multisectoral national strategies and strengthened community-based interventions. According to the Indonesian Nutritional Status Survey, the prevalence of stunting among children under five declined from 21.5% in 2023 to 19.8% in 2024, marking a continued downward trend in national performance indicators [3]. Nevertheless, the fact that approximately one in five Indonesian children under five remained stunted in 2024 underscores the persistent nature of the problem and highlights the need for more effective, context-specific, and sustainable prevention strategies. The reduction achieved thus far, while encouraging, has not yet reached the national target, and disparities across regions continue to pose significant challenges [4].

A critical component of stunting prevention lies in improving maternal dietary practices during pregnancy. Physiologically, maternal energy and nutrient requirements increase substantially during gestation to support maternal tissue expansion, placental development, and optimal fetal growth. Adequate intake of macronutrients; particularly energy and protein as well as essential micronutrients such as iron, folate, and zinc is necessary to maintain maternal nutritional status and prevent intrauterine growth restriction [5]. However, maternal nutritional problems remain substantial in Indonesia. The 2023 Indonesian Health Survey reported that 16.9% of pregnant women were at risk of chronic energy deficiency, indicated by a mid-upper arm circumference below 23.5 cm, while anemia affected 27.7% of pregnant women, reflecting persistent gaps in dietary adequacy and micronutrient intake [6]. These conditions increase the risk of low birth weight, preterm birth, and impaired fetal growth, all of which contribute to stunting during early childhood [7].

Given these realities, stunting prevention must begin before birth. Pregnancy represents a decisive period within the first 1,000 days of life during which nutritional interventions can exert significant influence on maternal and fetal health outcomes. Nutrition education for pregnant women is therefore essential, as it provides practical and actionable information on dietary diversity, energy and protein requirements, iron intake, and healthy feeding practices that can be integrated into daily routines [8]. Effective education can help pregnant women understand the importance of balanced meals, appropriate portion sizes, and the consumption of nutrient-dense foods, while also addressing common misconceptions and cultural dietary restrictions that may hinder optimal intake [9-18].

Mothers' classes (kelas ibu hamil) constitute an appropriate and strategic platform for delivering nutrition education. These classes offer an established community-based setting in which health professionals can integrate routine antenatal care with structured educational sessions. Through this approach, pregnant women receive not only clinical monitoring but also repeated exposure to key messages about nutrition, health behaviors, and pregnancy care. However, evidence suggests that knowledge alone may not be sufficient to change dietary practices. Behavioral change often requires repeated education, continuous monitoring, and systematic identification of barriers such as food availability, household decision-making dynamics, cultural norms, and economic constraints [19]. Therefore, staged or sequential education; delivered in multiple sessions over time may be more effective in reinforcing messages, improving comprehension, and facilitating the translation of knowledge into daily dietary behavior.

Considering these gaps and opportunities, the present study was designed to examine whether staged nutrition education delivered through mothers' classes was associated with changes in knowledge, attitudes, and energy, protein, and iron intake among pregnant women at Sudiang Raya Community Health Center, Makassar. The objective of this study was to evaluate the effectiveness of staged nutrition education delivered

through mothers' classes in improving pregnant women's knowledge, attitudes, and dietary intake; specifically energy, protein, and iron at the Sudiang Raya Community Health Center, Makassar.

METHODS

Study design and setting

This study used a quasi-experimental one-group pre-test–post-test design [20,21]. The study was conducted through the mothers' class at Sudiang Raya Community Health Center, Makassar, from April to August 2026. The intervention consisted of two nutrition education sessions and repeated outcome assessments.

Participants and eligibility

The participants were pregnant women who actively attended the monthly mothers' class during the study period. The original manuscript does not specify detailed inclusion and exclusion criteria. These criteria should be stated explicitly in the final submission. Suggested wording, to be used only if it reflects the actual protocol, is: eligible participants were pregnant women enrolled in the mothers' class who were willing to participate and complete all assessments; women who did not complete the intervention or required outcome assessments were excluded from the final analysis.

Sample size

A total of 43 pregnant women completed the study and were included in the analysis. The original manuscript does not provide a sample-size calculation or an a priori justification for the number of participants. The authors should add the actual basis used to determine the sample size (for example, a total-population approach, sample-size calculation, or feasibility-based recruitment) before submission.

Intervention procedure

The intervention was delivered in stages. First, baseline knowledge, attitudes, and energy, protein, and iron intake were assessed. Second, participants received nutrition education on balanced nutrition and the requirements for energy, protein, and iron during pregnancy. Third, outcomes were reassessed after the first education session. Fourth, a second education session was provided to reinforce the same core nutritional messages. Finally, monitoring and evaluation were conducted to assess changes in dietary intake and identify barriers to implementing recommended dietary practices.

Instruments and measurements

Knowledge and attitudes regarding optimal nutrition were assessed using questionnaires administered at baseline and after the intervention. Energy, protein, and iron intake were assessed using 24-hour dietary recalls. The educational materials included the Infant and Young Child Feeding (IYCF) handbook and the Maternal and Child Health (MCH/KIA) handbook.

Statistical analysis

Descriptive statistics were used to summarize participant characteristics and the distribution of knowledge, attitudes, and nutrient intake categories. Because the outcome data were not normally distributed, changes between paired measurements were analyzed using the Wilcoxon signed-rank test [22,23]. Statistical significance was set according to the study's prespecified threshold.

RESULTS

A total of 43 pregnant women aged 19–39 years completed the study. Of these participants, 32.6% were in the first trimester, 48.8% were in the second trimester, and 18.6% were in the third trimester. All participants actively attended the mothers' classes and completed the study.

Changes in knowledge and attitudes

Based on Table 1, knowledge improved from 88.3% of participants classified as having good knowledge at baseline to 97.7% after the first education session and 100.0% after the second assessment. Attitudes showed a similar pattern, increasing from 69.7% in the good category at baseline to 97.7% and 100.0%, respectively. The Wilcoxon signed-rank test indicated significant changes in both knowledge and attitudes ($p < 0.001$).

Energy intake improved following the intervention. The proportion classified as having adequate energy intake increased from 37.2% at baseline to 67.4% at the first monitoring assessment and 83.7% at the second monitoring assessment, while the deficient category decreased from 51.2% to 7.0%. The Wilcoxon signed-rank test showed a significant change in energy intake ($p = 0.003$).

Table 1. Changes in knowledge and attitudes following the staged education intervention

Variable	Category	Pre-test: f (%)	Post-test 1: f (%)	Post-test 2: f (%)
Knowledge	Good	38 (88.3)	42 (97.7)	43 (100.0)
	Moderate	3 (7.0)	1 (2.3)	0 (0.0)
	Poor	2 (4.7)	0 (0.0)	0 (0.0)
Attitudes	Good	30 (69.7)	42 (97.7)	43 (100.0)
	Moderate	13 (30.3)	1 (2.3)	0 (0.0)
	Poor	0 (0.0)	0 (0.0)	0 (0.0)

Table 2. Changes in energy and protein intake

Variable	Category	Baseline: f (%)	Monitoring 1: f (%)	Monitoring 2: f (%)
Energy intake	Excessive	5 (11.6)	4 (9.3)	4 (9.3)
	Adequate	16 (37.2)	29 (67.4)	36 (83.7)
	Deficient	22 (51.2)	10 (23.3)	3 (7.0)
Protein intake	Excessive	4 (9.3)	5 (11.6)	5 (11.6)
	Adequate	32 (74.4)	33 (76.7)	32 (74.4)
	Deficient	7 (16.3)	5 (11.6)	6 (14.0)

Table 3. Changes in iron intake

Variable	Category	Baseline: f (%)	Monitoring 1: f (%)	Monitoring 2: f (%)
Iron intake	Excessive	0 (0.0)	0 (0.0)	0 (0.0)
	Adequate	3 (7.0)	33 (76.7)	26 (60.5)
	Deficient	40 (93.0)	10 (23.3)	17 (39.5)

Protein intake showed comparatively little descriptive change. The proportion with adequate protein intake was 74.4% at baseline, 76.7% at the first monitoring assessment, and 74.4% at the second assessment. Although the Wilcoxon test yielded $p=0.006$, the small descriptive change suggests that the intervention produced less pronounced improvement in protein intake than in energy intake. This may be related to the relatively high proportion of participants who already had adequate protein intake at baseline. The finding should therefore be interpreted using both the statistical result and the magnitude and direction of the observed change.

Iron intake improved substantially after the intervention. The proportion with adequate intake increased from 7.0% at baseline to 76.7% at the first monitoring assessment and remained higher than baseline at 60.5% at the second assessment. The proportion with deficient intake decreased from 93.0% to 23.3% at the first monitoring assessment and was 39.5% at the second assessment. The Wilcoxon signed-rank test indicated a significant difference in iron intake across the paired measurements ($p<0.001$).

DISCUSSION

Pregnancy represents a physiologically demanding period during which adequate energy and nutrient intake is essential to support maternal health, fetal tissue accretion, placental development, and metabolic adaptations required for gestation. Insufficient intake of macronutrients and micronutrients during pregnancy has been associated with adverse outcomes such as intrauterine growth restriction, low birth weight, and impaired fetal linear growth, all of which contribute to the early onset of stunting in infancy and childhood [1]. Nutrition education delivered during pregnancy is therefore highly relevant to stunting prevention because it can address gaps in maternal knowledge, shape attitudes toward healthy dietary practices, and potentially improve selected nutrient intakes that are critical for fetal growth and maternal well-being [2]. Educational interventions that emphasize dietary diversity, adequate energy and protein consumption, and iron-rich foods may help pregnant women make informed choices within their household food environment and cultural context [3].

In this study, maternal knowledge and attitudes improved significantly following staged nutrition education. The proportion of participants with good knowledge increased from 88.3% at baseline to 100.0% at the second assessment, indicating that repeated exposure to structured educational content can reinforce understanding and retention of key nutrition messages. Similarly, the proportion of participants with good attitudes increased from 69.7% to 100.0%, suggesting that mothers' classes may serve as an effective platform for shaping positive perceptions and motivation toward optimal dietary practices. These findings align with previous evidence showing that repeated, context-specific education can strengthen maternal cognitive and affective domains related to nutrition, thereby increasing the likelihood of behavioral change [4].

Energy intake also demonstrated substantial improvement. The proportion of participants with adequate energy intake increased from 37.2% at baseline to 83.7% at the second monitoring assessment. This shift suggests that the educational intervention was accompanied by meaningful improvements in dietary energy adequacy, potentially reflecting increased awareness of daily energy needs, improved meal planning, or greater consumption of energy-dense foods. However, because the study employed a one-group pre-test–post-test design without a control group, the observed improvement cannot be attributed exclusively to the intervention. Other changes occurring during the study period, such as seasonal food availability, household economic conditions, or concurrent health counseling may also have contributed to the increase in energy intake [5]. This limitation underscores the importance of cautious interpretation when attributing changes solely to educational exposure.

Protein intake requires more nuanced interpretation. Although the Wilcoxon test indicated a statistically significant change ($p = 0.006$), the proportion of participants classified as having adequate protein intake remained unchanged at 74.4% from baseline to the second monitoring assessment. The relatively high baseline adequacy may have limited the potential for further categorical improvement, illustrating a ceiling effect in which participants already met recommended intake levels prior to the intervention. This finding highlights the importance of evaluating not only statistical significance but also the magnitude and practical relevance of change, particularly when baseline values are already within acceptable ranges [6]. It also suggests that future interventions may need to focus more on protein quality, distribution across meals, or sources of high-biological-value protein rather than solely on total intake.

Iron intake showed the most pronounced improvement. Adequate intake increased from 7.0% at baseline to 76.7% at the first monitoring assessment and 60.5% at the second assessment. The sharp reduction in the deficient category at the first monitoring point suggests that the educational intervention effectively increased consumption of iron-rich foods or improved adherence to iron supplementation recommendations. However, the decrease in adequacy at the second assessment indicates that maintaining improved dietary intake may require continued reinforcement, follow-up counseling, and monitoring rather than reliance on a single educational exposure. This pattern is consistent with evidence that micronutrient intake, particularly iron, is influenced by multiple factors including supplement adherence, gastrointestinal tolerance, food availability, and cultural dietary norms [7].

The mothers' class (kelas ibu hamil) provides a practical and culturally appropriate setting for integrating nutrition education with routine maternal health services. The use of accessible educational materials, including the Maternal and Child Health (MCH/KIA) handbook and Infant and Young Child Feeding (IYCF) materials, may facilitate comprehension of recommended nutrition and feeding practices. These materials offer visual aids, structured guidance, and standardized messages that can support learning among pregnant women with diverse educational backgrounds. Nevertheless, educational materials should be adapted to participants' literacy levels, socio-cultural context, and local food environment. Education should also be complemented by opportunities to identify and address barriers to dietary change, such as limited household food budgets, cultural food taboos, or insufficient family support [8]. Without addressing these contextual barriers, improvements in knowledge may not consistently translate into sustained behavioral change.

Limitations

This study has several limitations that should be carefully considered when interpreting the findings. First, the one-group pre-test–post-test design did not include a control group [20], which substantially limits the ability to establish a causal relationship between the educational intervention and the observed changes in knowledge, attitudes, and nutrient intake. Without a comparison group, it is not possible to determine whether improvements were attributable solely to the staged nutrition education or whether they may have resulted from external influences such as concurrent health counseling, seasonal changes in food availability, or other community-level interventions occurring during the study period [9]. The absence of a control group also increases susceptibility to threats to internal validity, including maturation, history, and testing effects, all of which may artificially inflate or obscure the true impact of the intervention.

Second, dietary intake was assessed using 24-hour dietary recalls, a method that, while widely used in community-based nutrition research, is subject to several inherent limitations. Recall bias may occur when participants inaccurately report foods consumed, portion sizes, or preparation methods, either due to memory lapses or social desirability tendencies. Additionally, a single or limited number of 24-hour recalls may not

adequately capture day-to-day variation in food consumption, particularly in settings where dietary patterns fluctuate based on market availability, household resources, or cultural practices. As a result, the estimates of energy, protein, and iron intake may not fully represent habitual dietary intake, thereby affecting the precision of the nutritional adequacy classifications [9].

Third, the follow-up period in this study was relatively short, preventing assessment of the sustainability of dietary changes over longer periods. Improvements observed shortly after the intervention may not persist without continued reinforcement, monitoring, or supportive environmental conditions. Short-term gains in knowledge and attitudes do not necessarily translate into long-term behavioral change, especially in contexts where structural barriers—such as food affordability, cultural food taboos, or limited household decision-making autonomy—may hinder sustained improvements in dietary practices. Longer follow-up periods are needed to determine whether the positive changes documented in this study can be maintained throughout pregnancy and potentially influence birth outcomes and early child growth trajectories [9].

Finally, the study was conducted among pregnant women attending a single community health center, which may limit the generalizability of the findings to other populations, geographic areas, or socio-economic contexts. The characteristics of the study site—including its service quality, staffing, educational practices, and community engagement—may differ from those of other health centers, potentially influencing the effectiveness of staged nutrition education. Furthermore, cultural norms, dietary habits, and resource availability vary widely across regions in Indonesia, meaning that the intervention's impact may not be uniform across diverse settings. Future studies involving multiple sites and more heterogeneous populations would enhance external validity and provide a more comprehensive understanding of the intervention's applicability across different contexts [9].

Implications for practice and future research

Mothers' classes may serve as an effective platform for repeated, practical nutrition education that addresses energy, protein, and iron adequacy during pregnancy. Integrating staged education into routine antenatal care may help reinforce key messages, support behavioral change, and contribute to stunting prevention efforts. Future research should employ controlled designs, larger sample sizes where feasible, and longer follow-up periods to assess the sustainability of dietary improvements. Studies should also evaluate dietary behavior, supplement adherence, and relevant maternal or infant outcomes to determine whether improvements in knowledge and nutrient intake are sustained and whether they translate into measurable health benefits. Additionally, qualitative research may help identify barriers and facilitators of dietary change, enabling the development of more tailored and context-specific educational strategies [10].

CONCLUSION

Staged nutrition education delivered through mothers' classes was associated with significant improvements in knowledge, attitudes, energy intake, and iron intake among pregnant women. Protein intake showed little descriptive change because most participants already had adequate intake at baseline, despite a statistically significant paired-test result. These findings support the use of mothers' classes as a setting for structured and repeated nutrition education. However, because this study did not include a control group and had a short follow-up period, future controlled studies with longer follow-up are needed to determine the extent to which the intervention itself produces sustained dietary and health outcomes.

Ethical consideration, competing interest and source of funding

- The original manuscript does not provide the name or number of the research ethics approval or details of the informed-consent procedure. Before submission, the authors should insert the actual ethics approval information and describe how written informed consent was obtained from participants. If the study was exempt from ethics review, the authors should state the basis and the responsible institution.
- There is no conflict of interest related to this publication.
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