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Reproductive Nutrition Education as a Preventive Measure Against Imbalanced Dietary Patterns and Malnutrition Risks among Adolescent Girls

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Abstract

Background of study: Indonesian adolescent girls face a triple burden of malnutrition: anemia, undernutrition, and obesity. Driven by poor nutritional literacy and eating disorders, these issues threaten long-term reproductive health. This community service program aims to provide reproductive nutrition education and measure the nutritional status of 40 adolescent girls at SMA Batik 1 Surakarta.

Methods: The knowledge variable was measured using a 22-item instrument regarding reproductive nutrition with proven validity and reliability, while the nutritional status variable was determined using the body mass index (BMI) formula following weight and height measurements. The educational activity was conducted using a booklet containing reproductive nutrition materials, with the following time breakdown: preparation and opening (10 minutes), pretest (25 minutes), educational session using a reproductive nutrition booklet (30 minutes), posttest (25 minutes), weight and height measurements (90 minutes), and discussion and closing (30 minutes).

Result: Reproductive nutrition education significantly improved knowledge scores, with the average rising from 82.4 to 88.3 ($p = 0.001$). While average BMI measurements of adolescent girls remained within normal ranges, but individual data showed substantial variation, particularly in weight, which ranged widely from 35.70 kg to 83.00 kg.

Conclusion: Continuous programs are essential to address the lack of reproductive nutrition knowledge and malnutrition to prevent imbalanced dietary patterns, fostering awareness and health readiness for adolescent girls as future mothers to ensure healthy future generations.

A. Introduction

Adolescence represents a critical transitional period characterized by rapid physical, psychological, and cognitive development. During this phase, nutritional requirements increase significantly. For adolescent girls, optimal nutritional fulfillment is not only essential for supporting puberty but also serves as a vital health investment during the preconception stage (Ohly et al., 2025; Parajuli & Prangthip, 2025). In fact, adolescent girls in Indonesia currently face the triple burden of malnutrition, encompassing micronutrient

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deficiencies, notably resulting in a high prevalence of anemia, underweight (wasting), and overweight or obesity (Indonesian Ministry of Health, 2020).

Based on the results of the 2023 Indonesian Health Survey, the nutritional status of adolescents exhibits trends that require serious attention. The prevalence of anemia among adolescents aged 15–24 years ranges from 15.5% to 18%. Furthermore, the prevalence of undernutrition in adolescents aged 13–15 years was recorded at 7.6%, reaching 8.3% in the 16–18 years age group. Conversely, the rate of overnutrition (overweight and obesity) reached 16.2% for those aged 13–15 years and 12.1% for the 16–18 years age group (Indonesian Ministry of Health, 2023).

These three nutritional issues inflict significant clinical impacts, particularly on the stability of adolescent girls' reproductive health and their future quality of life or birth outcomes such as the occurrence of stunting (Desweni et al., 2026). Anemia not only causes immediate fatigue and a decline in learning concentration but also serves as a precursor to a high risk of postpartum hemorrhage in the future (Puteri et al., 2024). Undernutrition or chronic energy deficiency (CED) can hinder the maturation of reproductive organs, trigger menstrual cycle disorders (amenorrhea), and contribute to the intergenerational cycle of stunting due to the risk of delivering Low Birth Weight (LBW) infants (Jana et al., 2023; Qoni'ah et al., 2026). On the other hand, overnutrition or obesity poses threats in the form of hormonal imbalances, such as Polycystic Ovary Syndrome (PCOS), which disrupts menstruation, reduces fertility rates, and elevates the risk of pregnancy complications such as preeclampsia and gestational diabetes (Konwisser & Korytko, 2022; Kim et al., 2025).

These complex nutritional problems are rooted in the high prevalence of imbalanced dietary patterns, driven by poor nutritional literacy. Various research findings indicate that adolescents' level of knowledge regarding balanced nutrition guidelines generally remains low. This lack of awareness directly impacts the quality of their daily dietary intake. The majority of adolescents have been shown to consume inadequate levels of macronutrient and micronutrients. The intake of energy, protein, and iron frequently falls well below the Recommended Dietary Allowances (RDA) (Telisa & Eliza, 2020). Ironically, this deficit in essential nutrients is accompanied by flawed consumption patterns. Studies reveal a shift in adolescent dietary patterns, marked by a strong preference for ultra-processed foods. The current daily intake of adolescent girls is dominated by fast food, packaged snacks, and contemporary beverages that are exceedingly high in sugar, salt, and fat, along with unhealthy processed foods that are nutrient-poor (empty calories) (Andarwulan et al., 2021; Mititelu et al., 2024).

Adolescent girls constitute a nutritionally vulnerable group due to their rapid phases of physical growth, cognitive development, and reproductive maturation. As future mothers or women of childbearing age (WCA), adolescence is a critical period and a window of opportunity to prepare for optimal health and nutritional status prior to future pregnancies, often referred to as the preconception or pre-pregnancy phase (WHO, 2013; Padhani et al., 2024). Furthermore, the tendency to engage in misguided strict diets due to body image dissatisfaction further exacerbates iron and protein deficiencies (Garrido-Bueno et al., 2025; Zieba et al., 2025).

Based on an initial survey at SMA Batik 1 Surakarta, there had been no previous education on reproductive nutrition; thus, data obtained from interviews with a small number of adolescent girls indicated a lack of understanding regarding this topic. In an effort to break the chain of nutritional problems among adolescent girls, interventions in the form of nutrition education are crucial. Comprehensive and relevant reproductive nutrition education materials for adolescent girls must focus on several key aspects (Raut et al., 2024). These include introducing the concept of eating according to balanced nutrition guidelines tailored to adolescents' caloric and protein needs; emphasizing the importance of iron intake from both animal and plant sources, folic acid, and calcium as the foundation of reproductive health (Soliman et al., 2022); increasing awareness of and compliance with iron supplementation consumption of at least one tablet per week to prevent anemia (Sumiati et al., 2026); and promoting body positivity to avoid extreme dieting, alongside nutritional literacy in reading food labels to limit the consumption of ultra-processed foods high in sugar, salt, and fat (Mediratta et al., 2023).

In implementing nutrition education activities, innovations are required to enhance their effectiveness. The innovation and novelty applied in this community service program involved the use of a self-

developed booklet on reproductive nutrition. Furthermore, the instrument used to measure knowledge was also independently developed through proper instrument construction stages, resulting in a final 22-item questionnaire that encompasses dimensions and indicators meeting the criteria for validity and reliability (Cronbach's alpha = 0.916).

Based on the described background, this community service activity aims to educate adolescent girls on reproductive nutrition while assessing their nutritional status. This educational intervention is expected to increase their knowledge of reproductive nutrition and prevent imbalanced dietary patterns, leading to improved nutritional status, optimal physical readiness for future motherhood, and the ability to bear a healthy future generation.

B. Methods

This community service program, conducted in the form of reproductive nutrition education, outlined its implementation as follows:

1. Target Population and Timeline
   The target audience for this educational program consists of 40 adolescent girls at SMA Batik 1 Surakarta. The program was implemented over a period of 6 months (May – November 2025), encompassing the entire timeline from proposal preparation to the drafting of the publication article.
2. Preparation Stage
   The implementation phases commenced with the preparation stage, which involves processing administrative permits, developing educational materials and media, assembling the implementation team, preparing the necessary equipment (questionnaires for knowledge assessment and anthropometric tools), and arranging the venue. The instrument used to assess reproductive nutrition knowledge was self-developed through standard instrument development phases and evaluated for content validity (yielding CVR values of 1 for all items and scale-CVI values of 1). The final set of 22 items with true-or-false responses also fulfilled the reliability requirements, demonstrating item-total correlation *r* values > 0.3 and a Cronbach's alpha for internal consistency of 0.916.
3. Implementation Process
   The execution of the educational activities began with the administration of a pretest, followed by the delivery of reproductive nutrition education (using booklets as educational media, distributed to all participants), posttest, the completion of anthropometric nutritional status measurements, and concluded with discussion and closing. The assessment instrument consists of 22 questions covering various aspects and indicators of reproductive nutrition. The educational activity was conducted with the following time breakdown: preparation and opening (10 minutes), pretest (25 minutes), educational session using a reproductive nutrition booklet (30 minutes), posttest (25 minutes), weight and height measurements (90 minutes), and discussion and closing (30 minutes).
4. Evaluation Stage
   The evaluation of the educational program's success is conducted through several stages: (a) input analysis: Assessing the alignment between planning and implementation, which includes evaluating the permitting process, materials and media, human resources, and the infrastructure utilized. (b) process evaluation: Carried out during the implementation phase by observing the smooth execution of the educational activities and the enthusiasm of the participants. (c) output evaluation: Performed by comparing the pretest and posttest results. Participants' scores were converted to a 100-point scale. Consequently, with a total of 22 questions, each item was assigned a weight of 4.54 points. Descriptive statistics, including the mean, median, standard deviation, minimum, and maximum values, were used to analyze the score of knowledge and nutritional status of adolescent girls. Furthermore, the Wilcoxon signed-rank test was employed to analyze knowledge scores from result of the pretest and posttest.

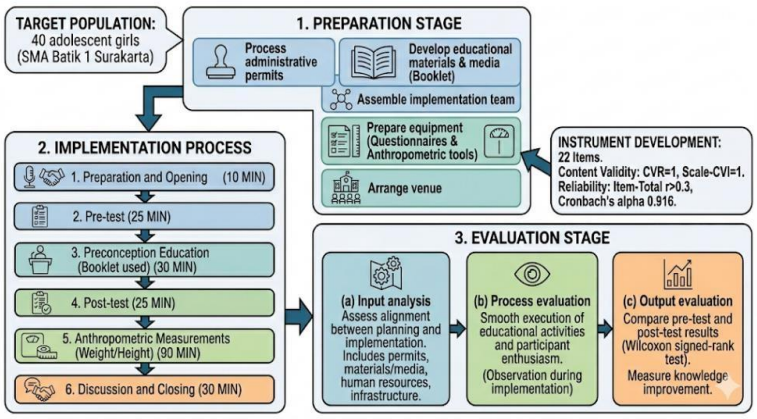

Figure 1. Flowchart of the Stage of Reproductive Nutrition Education on Adolescent Girls

C. Results and Discussion

The evaluation results of the program inputs, such as the permitting process, human resource team preparation, timeline, and infrastructure, went smoothly without any obstacles, allowing the event to proceed according to plan. The evaluation of the educational activity's process demonstrated good enthusiasm, punctual participant attendance, and a highly conducive response during the pretest and posttest implementation, enabling the material delivery and discussion sessions to run smoothly within the allocated time.

The output evaluation of this reproductive nutrition education program for adolescent girls was conducted by evaluating questionnaires responses covering reproductive-age nutrition topics. These included the basic concepts of women of reproductive age, nutrients related to reproductive health (both macro and micronutrients), nutritional requirements during the reproductive age, the importance of physical activity and a healthy lifestyle, and stress management. The results of the knowledge measurements before (pretest) and after (posttest) the educational intervention are presented in Table 1.

Table 1. Comparison of Adolescent Girls' Knowledge Scores Before and After Education

Knowledge Score	Before Education	After Education	p-value
Mean ± SD	82.4 ± 7.6	88.3 ± 6.7	0.001*
Median (Minimum - Maximum)	86.4 (63.6 – 100)	86.4 (72.7 – 100)	
Normality p-value	0.001	0.001	

*Wilcoxon Signed-Rank Test

Observing the data presented in Table 1, it can be interpreted that there was an increase in the average knowledge score of adolescent girls regarding reproductive nutrition, rising from 82.4 before the education to 88.3 after the education. Although the median value remained unchanged, there was an increase in the minimum score obtained by the participants, improving from 63.6 before education to 72.7 after education. Normality testing indicated that the data were not normally distributed in either condition. Consequently, the Wilcoxon signed-rank test yielded a p-value = 0.001, indicating a significant difference in knowledge scores before and after the educational intervention.

This increase in adolescents' reproductive nutrition knowledge indicates that nutrition education serves as a highly essential upstream intervention. Education for adolescent girls aims to enhance their nutritional awareness and literacy, enabling them to understand that their current dietary intake will affect their future reproductive functions and pregnancies (Zulaekah et al., 2025). Increased knowledge through education has been proven to positively correlate with improvements in attitudes and daily dietary practices (Yee et al., 2022; Mancone et al., 2024; Vasquez-Mamani et al., 2025). With heightened awareness, adolescent girls are

empowered to avoid imbalanced dietary patterns, choose well-balanced nutritious foods, and actively prevent the risk of malnutrition from an early stage (Pratami et al., 2024).

In addition to facilitate the interpretation of the knowledge data and provide information that is more comprehensible to the target audience and the school, the knowledge level was categorized into poor and good using the mean cut-off value of the pre- and posttest knowledge scores (85.5). Based on the categorized data, an increase was observed in the good knowledge category among adolescent girls, growing from 57.5% before the education to 82.5% after the education. In the modern era, continuous nutrition education remains highly relevant, as lifestyle transitions can trigger a high incidence of imbalanced dietary patterns among adolescents (Parajuli & Prangthip, 2025). These behaviors are typically characterized by a high consumption of ultra-processed foods, fast food, and calorie-dense snacks that lack essential micronutrients (such as iron, folic acid, zinc, and calcium) (Soans et al., 2025). Furthermore, misconceptions regarding body image frequently drive adolescent girls to engage in extreme dieting, restrict intake excessively, skip meals, and suffer from various eating disorders (Garrido-Bueno et al., 2025; Zieba et al., 2025).

This educational activity also included anthropometric measurements. This aimed not only to determine the nutritional status of the adolescent girls but also to educate them on the importance of regular weight and height measurements to monitor malnutrition risks, particularly instances of undernutrition or overnutrition and obesity. Table 2 presents the results of the nutritional status measurements of the adolescent girls.

Table 2. Nutritional Status Measurement Results of Adolescent Girls

Anthropometry	**Mean ± SD**	**Median (Minimum – Maximum)**
Weight (kg)	55.45 ± 11.32	53.00 (35.70 – 83.00)
Height (cm)	157.03 ± 4.52	158.35 (147.50 – 165.30)
BMI (kg/m²)	22.53 ± 4.84	21.62 (15.93 – 37.14)
Nutritional Status Category	**n (%)**	
Mild-to-Severe Thinness	10 (25.00)	
Normal	19 (47.50)	
Mild-to-Severe Overweight	11 (27.50)	

When examining the average values of weight, height, and BMI in Table 2, all fall within the normal range. However, when interpreted based on minimum and maximum values, there is a substantial variation, particularly in the weight data (the minimum value is 35.70 kg, while the maximum value is vastly different at 83.00 kg). A similar pattern is observed in the BMI data (the minimum value of 15.93 kg/m² falls into the severe thinness category, and the maximum value of 37.14 kg/m² falls into the severe obesity category). From a young age, adolescent girls must be aware of their nutritional status because, as a group of reproductive-age women, they are the future mothers of the children they will bear (Cunningham et al., 2020).

These imbalanced dietary patterns have a direct impact on the high risk of malnutrition among adolescent girls. This malnutrition can have a double manifestation, presenting either as undernutrition, such as CED, mild to severe thinness, and iron deficiency anemia or as overnutrition, such as being overweight and obese (Hasan et al., 2022; Prithishkumar et al., 2024). In the short term, malnutrition reduces immunity, learning concentration, and productivity. In the long term, adolescent girls experiencing chronic malnutrition face a high risk of future pregnancy complications, delivering LBW infants, and contributing to the intergenerational stunting cycle (Umisah & Puspitasari, 2017; Jana et al., 2023).

Despite its structured approach, this community service program presents certain limitations primarily related to time constraints. Allocating only 30 minutes for the core educational session might be insufficient to comprehensively cover the complexities of reproductive nutrition, meaning participants might lack the necessary time to fully digest the booklet's content or ask clarifying questions, potentially leading to a superficial understanding. Furthermore, because the posttest was administered immediately

following this brief session, the evaluation solely captures short-term memory recall and immediate comprehension.

Figure 2. Implementation of Reproductive Nutrition Education and Anthropometric Measurement

D. Conclusion

The reproductive nutrition education program for adolescent girls demonstrated a measurable increase in knowledge from the pre-education to the post-education phase. Nevertheless, a subset of participants still possesses knowledge levels below the average threshold. Furthermore, the nutritional status measurements revealed the persistent presence of both mild-to-severe thinness and mild-to-severe overweight among the adolescent girls. Given that nutritional quality during adolescence dictates not only their present well-being to prevent imbalanced dietary patterns, but also the health outcomes of future generations, it is imperative to conduct continuous, well-programmed educational interventions. This sustainability can be achieved through strategic collaborations between schools and primary health care facilities, such as community health centers, or health-focused educational institutions. To address these limitations, future community service programs should consider extending the duration of the educational sessions or dividing the material into a series of meetings. Furthermore, incorporating longitudinal follow-up assessments, such as evaluating participants one to three months post-intervention, is highly recommended to measure long-term knowledge retention.

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F. Author Contribution Statement

Author contributions for this program included idea conceptualization and program direction (MM), instrument development and material validation (DI, SZ, NL, FI, SA), fieldwork implementation and supervision (MM, KK, AT), data processing and analysis (MM, KK, AT, MA), drafting and writing of the publication article (MM, MA).

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