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The Effect of Dragon Fruit Juice (Hylocereus polyrhizus) Administration on Hemoglobin Levels Among Adolescent Girls: Implications for Midwifery Education

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ABSTRACT

Anemia remains a pervasive nutritional problem among adolescent girls, especially in developing regions, due to increased iron requirements during puberty and menstruation. Despite government supplementation programs, adherence remains low, and sustainable dietary interventions are urgently needed. This study aimed to evaluate the effectiveness of daily red dragon fruit (Hylocereus polyrhizus) juice supplementation in improving hemoglobin levels among anemic adolescent girls at SMP Budi Mulia Pakisaji, Malang. A quantitative, pre-experimental one-group pretest-posttest design was used, involving 37 girls aged 11–13 years with mild anemia. Participants received 250 grams of red dragon fruit blended with 100 ml water each morning for ten consecutive days. Hemoglobin levels were measured before and after the intervention using the Easy Touch GCHb device. Results showed a significant improvement: the mean hemoglobin increased from 11.61 g/dL to 11.83 g/dL ($p = 0.001$), with nearly half of the participants reaching normal values (>12 g/dL) post-intervention. The study concludes that red dragon fruit juice is an effective, practical, and natural dietary intervention to increase hemoglobin levels in adolescent girls with mild anemia. This finding supports its integration into school health programs and midwifery education as a non-pharmacological approach to anemia prevention. Further research with larger samples, longer follow-up, and comprehensive dietary monitoring is recommended to confirm long-term efficacy and generalizability.

Keywords: adolescents, anemia, dragon fruit, hemoglobin, nutrition intervention

INTRODUCTION

Adolescence is a critical developmental stage marked by rapid physical, cognitive, and psychosocial changes, making adolescents particularly vulnerable to various health problems, especially nutritional deficiencies such as anemia (Fitriasnani et al., 2020; World Health Organization [WHO], 2020). Globally, anemia remains one of the most prevalent nutritional disorders, affecting an estimated 1.62 billion people or about a quarter of the world's population (Kassebaum et al., 2014; WHO, 2020). Adolescent girls are at higher risk due to increased iron requirements associated with growth and menstruation (Irfani Nur Sa'adah et al., 2024; Madoori et al., 2020). The prevalence of anemia among adolescent girls in developing countries can reach up to 53.7% (WHO, 2020), with the highest rates observed in Asia and Africa (McLean et al., 2009). In Indonesia, national data indicate that the prevalence of anemia among females aged 15–24 years is 18.4%, with even higher rates among adolescent girls aged 13–18 years (RI, 2019; RIK Sari et al., 2023). A study in East Java found that 42% of adolescent girls suffered from anemia (Dinkes Jatim, 2020). Local preliminary studies at SMP Budi Mulia Pakisaji Kabupaten Malang found that out of 215 adolescent girls, 41 experienced mild to moderate anemia. Anemia during adolescence is not only associated with decreased academic performance, fatigue, and impaired cognitive development (Rosa et al., 2022; Nair et al., 2013), but also increases future risks of maternal and perinatal complications, including low birth weight (Mekonnen et al., 2018).

Despite national iron supplementation programs, anemia rates remain high due to poor adherence, limited awareness, dietary habits, and the side effects associated with iron tablets (Petry et al., 2016; Rosely et al., 2021). Adolescents often lack knowledge about anemia prevention and are unaware of food sources that help prevent iron deficiency (Siddiqui et al., 2020). Current solutions for anemia involve both pharmacological (iron supplementation) and non-pharmacological strategies (dietary modifications), but there is a growing need for more acceptable and sustainable interventions (Kawade, 2012; Petry et al., 2016).

Recent research suggests that incorporating iron-rich foods and enhancers of iron absorption, such as vitamin C, into the daily diet can be effective in combating iron deficiency anemia (IDAn) (Sarma et al., 2021; Lane et al., 2022). Red dragon fruit (Hylocereus polyrhizus) has been identified as a promising functional food, being rich in iron and vitamin C, both of which are crucial for hemoglobin synthesis and iron absorption (Mahdi et al., 2021; Rahmalia et al., 2022). Scientific evidence demonstrates that vitamin C enhances the absorption of non-heme iron by reducing ferric to ferrous iron in the gastrointestinal tract, thus facilitating its bioavailability (Teucher et al., 2004; Lane et al., 2022). Several experimental studies in Indonesia and abroad have reported significant increases in hemoglobin levels among adolescents following daily supplementation with dragon fruit juice (Sari & Widyanti, 2023; Thamrin et al., 2018; Sari et al., 2023; Al-Kafaween et al., 2023; Mahdi et al., 2021).

Multiple studies have highlighted the potential of dragon fruit to increase hemoglobin in different populations. For instance, Sari & Widyanti (2023) and Thamrin et al. (2018) found that consumption of 200 ml dragon fruit juice daily for 10 days significantly raised hemoglobin in adolescent girls. Similar findings were reported by Munadira et al. (2021), who observed improved hemoglobin levels in anemic high school girls after daily dragon fruit juice intake. Comparative studies also indicate the effectiveness of combining dragon fruit with iron tablets (Decy Priyanti et al., 2023), and other research has shown its superiority over certain alternatives like date fruit or spinach in some cases (Al-Kafaween et al., 2023). However, the magnitude of hemoglobin change, optimal dosage, and real-world applicability in different Indonesian school settings remain inconsistently reported, and data specific to SMP Budi Mulia Pakisaji Kabupaten Malang are lacking. Furthermore, while the mechanism of vitamin C in enhancing non-heme iron absorption is well understood (Teucher et al., 2004; Lane et al., 2022), evidence comparing the impact of routine dragon fruit juice intake as a preventive strategy (not just a treatment) among non-hospitalized adolescent girls is still limited. Recent systematic reviews call for more robust, context-specific studies using standardized protocols to support dietary recommendations for anemia prevention among Indonesian adolescents (Mahdi et al., 2021; Lane et al., 2022; Sarma et al., 2021).

Based on the gaps identified, this study aims to evaluate the effect of red dragon fruit juice (Hylocereus polyrhizus) supplementation on hemoglobin levels among adolescent girls at SMP Budi Mulia Pakisaji Kabupaten Malang. The novelty of this study lies in its focus on a practical, food-based intervention tailored to the local adolescent population, assessing real-world effectiveness outside of controlled laboratory or clinical settings. The hypothesis is that daily intake of dragon fruit juice will significantly increase hemoglobin concentrations compared to baseline levels. This research contributes to the growing body of evidence supporting non-pharmacological, food-based strategies for anemia prevention among

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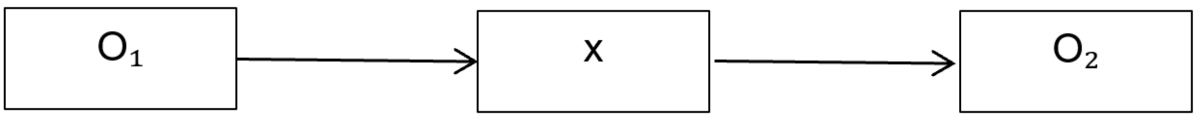
adolescents in Indonesia, with direct implications for school health promotion and midwifery education. The study also provides much-needed data for local health authorities and educators, potentially guiding broader community interventions for adolescent health.

METHOD

Research Design

This research employed a quantitative, pre-experimental design, specifically the One Group Pretest-Posttest model, to evaluate the effect of red dragon fruit (*Hylocereus polyrhizus*) juice on hemoglobin levels in anemic adolescent girls. Quantitative methods are widely used to test causal relationships by collecting numerical data before and after an intervention (Creswell & Creswell, 2018; Polit & Beck, 2021). This design, though lacking a control group, is practical in school-based health research where ethical or logistical constraints prevent randomized controls (Suresh, 2011). The **One Group Pretest-Posttest** design is outlined as follows:

Figure 1. Research Design Diagram



Note: **O_1:** Hemoglobin level before intervention (pretest); **X:** Intervention—red dragon fruit juice; **O_2:** Hemoglobin level after intervention (posttest)

This design allows the observation of changes attributable to the intervention (Campbell & Stanley, 2015).

Population and Sample

The population in this study consisted of all adolescent girls aged 11–13 years diagnosed with anemia at SMP Budi Mulia Pakisaji, totaling 41 individuals. The selection of this population was based on the need to focus on groups at risk for the outcome being studied, aligning with recommendations for effective health research (Etikan & Bala, 2017; Maulina et al., 2022). The sample size was calculated using the Slovin formula, resulting in 37 participants who met the requirements for inclusion in the study. The sampling method used was purposive sampling, where only those adolescent girls who fit the predetermined inclusion and exclusion criteria were selected (Etikan et al., 2016). The inclusion criteria were as follows: adolescent girls with mild anemia, aged 11–13 years, who had already experienced menstruation, and who agreed to participate in the study. Conversely, exclusion criteria included adolescent girls with severe anemia or those suffering from chronic diseases known to affect hemoglobin levels, such as chronic liver disease, chronic kidney disease, or leukemia. This probability-based purposive sampling technique ensured that the study recruited subjects who were most relevant to the research objectives, consistent with current best practices in public health research

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(Etikan & Bala, 2017). The research was conducted at SMP Budi Mulia Pakisaji, Kabupaten Malang, over the period from February 3 to February 18, 2025.

Variables, Operational Definitions, and Measurement

The primary variables in this study consisted of one independent and one dependent variable. The independent variable was the administration of red dragon fruit (Hylocereus polyrhizus) juice, which served as the main intervention provided to the participants. The dependent variable was the hemoglobin (Hb) level, measured in grams per deciliter (g/dL), which reflects the key health outcome of interest (Polit & Beck, 2021).

Operationally, the independent variable was defined as the provision of red dragon fruit juice to adolescent girls for a continuous period of ten days. Each serving consisted of 250 grams of fresh red dragon fruit blended with 100 milliliters of water and was given once daily in the morning. The dependent variable, hemoglobin level, was operationalized as the quantitative value of hemoglobin in the participant's blood, assessed before and after the intervention period.

Measurement of hemoglobin levels was conducted by trained health workers using the Easy Touch GCHb device, a validated point-of-care hemoglobin analyzer. All instruments were calibrated prior to use, and the measurements were performed following standard operating procedures to ensure accuracy and reliability of the results (Hardani et al., 2022). Pre-intervention measurements were taken prior to the first administration of the juice, while post-intervention measurements were collected after ten days of consecutive juice administration. This approach allowed for an objective assessment of any changes in hemoglobin levels attributable to the intervention.

Table 1. Operational Definitions

No	Variable	Operational Definition	Parameter	Category/Score	Scale	Instrument
1	Independent	250g dragon fruit + 100ml water daily × 10 days (morning)	250g fruit per serving	Given/not given	–	SOP for fruit juice preparation
2	Dependent (Hb)	Measured by Easy Touch GCHb device before and after 10 days	Hb (g/dL)	1: ≥12 2: 11–11.9 3: 8–10.9 4: <8	Ratio	Easy Touch GCHb, observation form

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Data Collection Procedures

The data collection procedures in this study involved several systematic steps to ensure the reliability and validity of the findings. Primary data were obtained directly from participants through the measurement of hemoglobin levels and the use of structured observation sheets. The main instruments utilized included the Easy Touch GCHb device for the accurate assessment of hemoglobin concentrations and observation forms for recording relevant participant information and measurement results.

The data collection process began with obtaining ethical approval and all necessary permits from the relevant institutional and school authorities. Once permission was granted, the researchers conducted a socialization session to inform both participants and their guardians about the objectives, procedures, and ethical considerations of the study, followed by obtaining written informed consent. Baseline hemoglobin levels were then measured for all eligible participants as a pretest. Subsequently, the intervention was administered in the form of daily consumption of red dragon fruit juice—consisting of 250 grams of fruit blended with 100 milliliters of water—for a period of ten consecutive days. Following the completion of the intervention, hemoglobin levels were measured again (posttest) using the same device and procedures to ensure consistency. All data collected were systematically recorded and compiled for subsequent analysis.

Data Processing and Analysis

The data processing phase in this study encompassed several critical steps to ensure the accuracy and reliability of the dataset. Initially, all collected data underwent a thorough editing process to check for completeness and consistency, thereby minimizing missing values or anomalies. Next, a scoring and coding system was implemented in which numerical values were assigned to participant responses and hemoglobin measurements for ease of analysis. For example, hemoglobin (Hb) values were coded as follows: less than 8 g/dL as 1, 8–10.9 g/dL as 2, 11–11.9 g/dL as 3, and 12 g/dL or higher as 4. Additionally, the administration of dragon fruit juice was coded as 1. After coding, the data were tabulated and organized into structured tables using Microsoft Excel, which facilitated efficient handling and preliminary review. All data entries were then manually input into computer-based statistical software, specifically SPSS version 22 or an equivalent, followed by a meticulous cleaning process where data were double-checked for potential entry errors or inconsistencies (Notoatmodjo, 2018).

For statistical analysis, both univariate and bivariate approaches were utilized. Univariate analysis was used to describe the central tendencies—such as mean and standard deviation—and the frequency distributions of hemoglobin levels before and after the intervention. To assess the effect of the intervention, bivariate analysis was conducted. If the data distribution was normal, a paired t-test was applied to compare the mean hemoglobin values before and after the intervention (Kim, 2015). In cases where the data were not normally distributed, the Wilcoxon Signed Rank Test, a non-parametric alternative, was used. The statistical significance threshold was set at $p < 0.05$, ensuring that the findings were robust and reliable (Kim, 2015).

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Ethical Considerations

Ethical considerations were given high priority throughout the research process to ensure the protection and well-being of all study participants. Ethics clearance for the study was formally obtained from the Research Ethics Board of ITSK RS dr. Soepraoen Malang, ensuring that all research procedures adhered to established ethical guidelines (Hardani et al., 2022). The research was carefully designed to provide meaningful social and scientific value, contributing to advancements in adolescent health and potentially informing future health interventions (Resnik, 2018). Prior to data collection, informed consent was obtained from all participants and their guardians after they received detailed information about the study's objectives, procedures, potential risks, and benefits. A thorough risk and benefit analysis was conducted, confirming that the intervention posed minimal risk to participants while offering direct health benefits. Selection of subjects was performed equitably, without discrimination, and results were intended to be generalizable to the broader population of local adolescents. No coercive incentives were provided to participants; any tokens or forms of appreciation were kept to a minimal and ethical standard. Participant privacy was strictly maintained by assigning unique codes to respondents and safeguarding all data in a secure and confidential manner, accessible only to the research team (Polit & Beck, 2021).

RESULTS AND DISCUSSION

This study was conducted at SMP Budi Mulia Pakisaji, located at Jl. Simpang Anjasmoro No. 294, Bendo, Kec. Pakisaji, Kabupaten Malang, from February 3 to February 18, 2025. A total of 37 adolescent girls, aged 11 to 13 years and diagnosed with mild anemia, participated in this study following a purposive sampling technique. The intervention consisted of providing 250 grams of red dragon fruit (*Hylocereus polyrhizus*) blended with 100 ml water, administered once daily for ten consecutive days.

Table 2. Characteristics of Respondents

Variable	Category	F	%
Age	11 years	16	43.2
	12 years	15	40.5
	13 years	6	16.2
Total		37	100.0
Economic Status	Lower-middle	13	35.1
	Middle	16	43.2
	Upper-middle	8	21.6
Total		37	100.0

The results show that the majority of participants were aged 11 years (43.2%), followed by those aged 12 years (40.5%), and the remaining 16.2% aged 13 years. Most respondents belonged to families with middle economic status (43.2%), while 35.1% were from lower-middle, and 21.6% from upper-middle economic backgrounds.

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Table 3. Pre-intervention Hemoglobin Levels

Hb Level (g/dL)	Frequency (f)	Percentage (%)
<8.0	0	0.0
8.0–10.9	0	0.0
11.0–11.9	37	100.0
>12.0	0	0.0
Total	37	100.0

Prior to the intervention, all respondents (100%) had hemoglobin levels in the range of 11.0–11.9 g/dL, indicating mild anemia according to WHO standards (WHO, 2020; Kassebaum et al., 2014).

Table 4. Post-intervention Hemoglobin Levels

Hb Level (g/dL)	Frequency (f)	Percentage (%)
<8.0	0	0.0
8.0–10.9	0	0.0
11.0–11.9	19	51.3
>12.0	18	48.7
Total	37	100.0

Following the intervention, a significant improvement was observed: 48.7% of respondents had normal hemoglobin levels (>12 g/dL), while the proportion with mild anemia dropped to 51.3%.

Table 5. Descriptive Statistics of Hemoglobin Levels

Variable	Mean	Median	Skewness	SD
Hb Pre	11.61	11.60	-0.685	0.2307
Hb Post	11.83	11.90	-0.578	0.4109

The mean hemoglobin increased from 11.61 g/dL (SD: 0.2307) before intervention to 11.83 g/dL (SD: 0.4109) after intervention. Median and skewness values suggest data distribution with the majority of values close to or above the average.

Table 6. Normality Test (Shapiro-Wilk)

Variable	df	Sig.	Description
Hb Pre	37	0.016	Non-normal
Hb Post	37	0.003	Non-normal

The Shapiro-Wilk test revealed that both pre- and post-intervention data did not follow a normal distribution ($p < 0.05$).

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Table 7. Wilcoxon Test for Hb Pre vs. Post Intervention

	Z	Asymp. Sig. (2-tailed)
Hb Diff	-3.364	0.001

The Wilcoxon test showed a statistically significant difference in hemoglobin levels before and after intervention ($p = 0.001 < 0.05$). This indicates a meaningful improvement in hemoglobin status following regular consumption of red dragon fruit juice.

Efficacy of Red Dragon Fruit on Hemoglobin

This study's finding that regular intake of red dragon fruit juice significantly improves hemoglobin levels among anemic adolescent girls is consistent with numerous previous reports. Sari & Widyanti (2023) found that daily consumption of 200 ml of red dragon fruit juice for 10 days increased hemoglobin by an average of 0.6 g/dL. Thamrin et al. (2018) also reported significant increases in hemoglobin after providing *Hylocereus polyrhizus* juice, especially in populations with iron deficiency anemia. Research by Al-Kafaween et al. (2023) using a randomized controlled trial confirmed that red dragon fruit supplementation improved hemoglobin parameters in adolescent girls. Mahdi et al. (2021), in a systematic review, concluded that fruit-based iron interventions such as dragon fruit are promising strategies for combating anemia, particularly in adolescents. The effect is attributed not only to the fruit's iron content but also its high vitamin C and antioxidant levels, which facilitate non-heme iron absorption and erythropoiesis (Teucher et al., 2004; Lane et al., 2022; Wicaksono et al., 2023). Similarly, Decy Priyanti et al. (2023) and Munadira et al. (2021) observed that interventions combining dragon fruit with iron tablets or given alone resulted in better hemoglobin outcomes compared to standard care. In addition, studies in India, Malaysia, and Africa have reported increased efficacy of plant-based iron and vitamin C sources in addressing adolescent anemia, supporting the results of the current research (Kawade, 2012; Sarma et al., 2021; Chathuranga et al., 2021).

Comparison to Iron Supplementation and Other Non-Pharmacological Approaches

Although iron tablets are a standard pharmacological intervention for anemia, studies indicate poor compliance due to gastrointestinal side effects, taste aversion, and limited awareness (Petry et al., 2016; Rosely et al., 2021). Non-pharmacological dietary interventions, particularly using locally available, palatable, and vitamin C-rich foods, are thus essential for sustainable anemia prevention (Siddiqui et al., 2020; Lane et al., 2022). Red dragon fruit is especially advantageous because, in addition to iron and vitamin C, it contains betacyanins, polyphenols, and other antioxidants that support erythropoiesis and reduce oxidative stress (Gunadi et al., 2022; Hua et al., 2018; Fadila, 2022). The present findings also resonate with research comparing dragon fruit to other iron-rich foods. Ambar Yanti & Sugiatini (2021) observed that while both dragon fruit and beetroot could improve Hb, the efficacy was slightly higher with beetroot and citrus combinations; however, the palatability and accessibility of dragon fruit made it more feasible in many community settings.

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Mechanism: Vitamin C and Non-Heme Iron Absorption

The role of vitamin C in enhancing iron absorption is well documented. Teucher et al. (2004) and Lane et al. (2022) demonstrated that vitamin C (ascorbic acid) reduces ferric iron ($Fe3+$) to ferrous iron ($Fe2+$), forming a complex that is more readily absorbed in the duodenum. This is supported by meta-analyses indicating that vitamin C supplementation or increased dietary intake enhances the efficacy of non-heme iron sources in raising Hb levels (Sarma et al., 2021; Lane et al., 2022).

Importance of Fruit-Based Interventions in Adolescents

Recent systematic reviews advocate for fruit-based interventions in adolescent populations due to their acceptability, safety, and additional health benefits (Mahdi et al., 2021; Kawade, 2012). Such interventions not only address iron deficiency anemia but also contribute to improved gut health, antioxidant status, and overall well-being (Gunadi et al., 2022; Fadila, 2022).

Alignment and Differences with Global Findings

While global anemia prevalence among adolescent girls remains high—reaching over 50% in some regions (WHO, 2020; Kassebaum et al., 2014)—studies in Africa and South Asia have shown that context-appropriate, locally sourced dietary interventions such as dragon fruit can be as effective as, or complementary to, traditional iron supplementation programs (Chathuranga et al., 2021; Mekonnen et al., 2018; McLean et al., 2009). A limitation across studies, including the present one, is that short intervention durations may not fully capture long-term effects. Additionally, external factors such as overall dietary patterns, menstrual blood loss, and infection status can influence hemoglobin outcomes (Kassebaum et al., 2014; Petry et al., 2016).

The Importance of the Findings

The demonstrated efficacy of red dragon fruit juice as a simple, food-based intervention to increase hemoglobin levels among anemic adolescent girls holds important public health implications. Anemia during adolescence impairs cognitive development, academic achievement, and future reproductive health, making early intervention vital (Nair et al., 2013; Rosa et al., 2022; Mekonnen et al., 2018). Integrating such fruit-based interventions into school health programs offers a culturally acceptable, accessible, and cost-effective alternative or adjunct to iron supplementation, especially in communities where compliance with tablets is low (Siddiqui et al., 2020; Petry et al., 2016). The findings support calls for nutrition education and policy shifts emphasizing natural, whole-food approaches to adolescent health.

This research contributes to the growing body of literature demonstrating the value of functional foods in addressing micronutrient deficiencies. The results corroborate international findings and provide context-specific evidence for Indonesian and Southeast Asian populations, which can be used to inform both local and national anemia control strategies (Mahdi et al., 2021; Chathuranga et al., 2021).

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This study had some limitations. The sample was limited to one school, with a relatively small number of participants and a short intervention period, which may restrict generalizability. Factors such as dietary intake and physical activity were not strictly controlled, potentially introducing confounding variables. Future studies should consider multi-center designs, larger sample sizes, longer interventions, and more comprehensive dietary monitoring.

The findings reinforce theories regarding the role of vitamin C in iron metabolism and the efficacy of combining plant-based dietary sources for anemia management. For policy makers, this supports scaling up school-based fruit supplementation or gardening initiatives, fostering both improved health outcomes and nutritional literacy among adolescents (Lane et al., 2022; Mahdi et al., 2021; Chathuranga et al., 2021).

Implications for Midwifery Education

The findings from this study highlight several important implications for midwifery education, especially in preparing future midwives to address adolescent anemia through both clinical and community-based strategies. Integrating the evidence of red dragon fruit juice's effectiveness in improving hemoglobin levels among anemic adolescent girls into midwifery education can enrich both theoretical understanding and practical skills among students. The results encourage midwifery education programs to update and expand their nutrition curriculum. Students should not only learn about pharmacological interventions such as iron supplementation but also develop a solid understanding of food-based, non-pharmacological interventions for anemia. By studying functional foods like red dragon fruit, students can appreciate the role of local dietary resources in managing and preventing anemia. Educators can incorporate case studies, community nutrition projects, and discussions on food synergy—such as the combined role of vitamin C and iron absorption—into coursework to strengthen evidence-based learning.

Midwifery students need clinical competencies in screening for anemia, nutritional assessment, and dietary counseling. The study demonstrates the importance of accurate hemoglobin measurement, intervention planning, and follow-up evaluation. Training should include practical modules on how to educate adolescents and their families about anemia, assess dietary habits, and recommend affordable, locally available interventions like dragon fruit. Skills in motivational interviewing, communication, and cultural sensitivity are crucial for effective client education and health promotion. The study's outcomes support a shift in midwifery education from a curative to a preventive and holistic model. Future midwives must be equipped to promote healthy eating habits, identify at-risk adolescents early, and collaborate with schools and community leaders to implement food-based interventions. This means integrating concepts of health promotion, school health programs, and adolescent well-being into the core curriculum, and training students to work in multidisciplinary teams.

Findings such as these empower midwifery students and practitioners to base their practice on current research. By fostering a culture of evidence-based practice, midwifery education can encourage students to evaluate the effectiveness of both medical and non-medical interventions, critically appraise research, and contribute to local innovations in community health. This can also inspire students to conduct small-scale research or quality improvement projects during their education. Midwives are often on the frontline of health education. This study underscores the need for midwifery students to develop strong skills in health education, not just for pregnant women, but for adolescents and the broader community. Students should be encouraged to participate in school health programs, create educational materials, and advocate for the use of accessible, evidence-based interventions such as dragon fruit juice for anemia prevention.

The results reinforce the importance of community engagement in midwifery education. Future midwives should be prepared to work in diverse community settings, understand local food culture, and partner with families, schools, and community organizations to address nutritional problems among adolescents. Community-based learning experiences and outreach projects can foster these skills. Integrating such findings into midwifery education also prepares students for leadership roles in public health. As advocates for maternal and adolescent health, midwives who are knowledgeable about practical, cost-effective, and culturally acceptable interventions can lead school-based or community-based anemia prevention programs, influence policy, and serve as resources for colleagues and policymakers. Given the evolving nature of health challenges and interventions, midwifery education should encourage lifelong learning and adaptability. Exposing students to research like this study encourages them to stay updated with current evidence and be open to integrating new, context-appropriate strategies into their future practice.

CONCLUSION

The primary aim of this research was to evaluate the effect of daily red dragon fruit (Hylocereus polyrhizus) juice supplementation on hemoglobin levels among adolescent girls with mild anemia at SMP Budi Mulia Pakisaji Kabupaten Malang. The main finding revealed that regular consumption of red dragon fruit juice over ten days significantly improved hemoglobin concentrations, with nearly half of participants achieving normal levels post-intervention, as confirmed by statistical analysis. This study contributes valuable evidence supporting the use of functional, food-based interventions as a practical and accessible strategy for anemia prevention and management among adolescents. Furthermore, these findings underscore the importance of integrating nutrition-focused, evidence-based practices into midwifery education and school health programs, highlighting the potential for natural dietary solutions to enhance adolescent health and inform broader community health initiatives.

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