Analysis of the Effect of Health Promotion on The Knowledge of Blood Supplement Tablets among Adolescent Students of Midwifery

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ABSTRACT

Anemia among adolescent girls remains a critical public health issue in Indonesia, with low adherence to Iron-Folic Acid (IFA) or Blood Supplement Tablets (TTD). Effective health promotion is essential to improve knowledge and combat this problem. This study aimed to analyze the effect of health promotion using an e-flyer on knowledge about TTD among first-year midwifery students. A quasi-experimental one-group pretest-posttest design was used. The population was all 133 first-year female midwifery students at a health polytechnic in Manado. A sample of 115 students was selected based on inclusion criteria (active, willing to participate). The intervention was a digital educational e-flyer on TTD. Data were collected via a validated e-questionnaire and hemoglobin (Hb) measurement before and after the intervention. Analysis included univariate description and a paired sample t-test of bivariate analysis. There was a significant increase in knowledge after the intervention. The proportion of students with 'Good' knowledge rose from 13.9% to 93.0%. The paired t-test showed a statistically significant difference (mean difference = -33.730, t = -21.513, p = 0.000). Hb levels also improved markedly, with 97.4% achieving non-anemic levels (>11 g/dL) post-intervention compared to 21.7% beforehand. Targeted digital health promotion via an e-flyer significantly improved knowledge about TTD and was associated with better hemoglobin levels among midwifery students. Integrating similar digital health education into health professional curricula is recommended. Future research should employ controlled longitudinal designs to confirm causality and assess long-term knowledge retention and behavioral impact.

Keywords: adolescent, blood supplement tablets, health promotion, knowledge, midwifery students.

INTRODUCTION

Anemia among adolescent girls remains a significant public health challenge in Indonesia and globally, with far-reaching implications for health, education, and future maternal outcomes.[1] In Indonesia, the prevalence of anemia has alarmingly increased from 37.1% in 2013 to 48.7% in 2018.[2] Adolescent girls are particularly vulnerable due to rapid growth, increased nutritional needs, and menstrual blood loss, which heightens the risk of iron deficiency.[3] The consequences are severe, impacting cognitive function, academic performance, physical stamina, and weakening the immune system-a critical concern especially during health crises like the COVID-19 pandemic.[4,5] Furthermore, untreated adolescent anemia predisposes women to adverse pregnancy outcomes, including poor fetal development, childbirth complications, and elevated maternal mortality risks.[6] Despite the availability of preventive measures such as Iron and Folic Acid (IFA) supplementation, often referred to as *Tablet Tambah Darah* (TTD), compliance and knowledge among the target demographic remain critically low. Riskesdas 2018 data indicates that a staggering 98.6% of adolescents consume less than the recommended 52 tablets annually, with only 1.4% achieving adequate intake, primarily through school-based programs.[7] This gap between availability and utilization underscores a failure in effective health promotion and education strategies. Systematic reviews highlight that adherence to iron supplementation among adolescent girls is influenced by various determinants, including knowledge, attitudes, and the delivery method of interventions.[8,9] Therefore, merely providing supplements is insufficient; it must be coupled with effective, targeted education to improve knowledge and self-efficacy.

Health promotion is a vital strategy to bridge this gap. Effective health education can empower individuals with

the knowledge necessary for behavioral change, as posited by health behavior theories like Social Cognitive Theory.[10] In the digital age, innovative approaches such as using flyers, videos, and mobile applications show promise in enhancing the reach and impact of health messages.[11,12] Previous studies have established a foundation for this research.[1] Globally, systematic reviews underscore the low adherence to iron supplementation among adolescent girls and identify key determinants such as knowledge, side effects, and social support.[8,9,13] Regionally in Indonesia, research highlights the effectiveness of educational interventions, such as video and modified packaging, in improving knowledge and attitudes toward TTD.[11] Local studies further affirm that nutrition education can significantly enhance hemoglobin levels and nutritional knowledge among adolescent girls.[14] However, a critical research gap persists. While much of the literature focuses on compliance determinants or general school-based populations, there is a scarcity of quasi-experimental studies that specifically measure the direct effect of a singular health promotion tool—such as a digital flyer—on the knowledge levels of adolescent female students already enrolled in a health professional program. This population represents a unique cohort; as future midwives, their foundational knowledge is crucial for both personal health and their future professional capacity as health educators. Therefore, the novelty of this study lies in its targeted approach: it employs a quasi-experimental one-group pretest-posttest design to quantitatively analyze the specific impact of a structured e-flyer intervention on TTD knowledge within this strategic, yet under-researched, group of first-year midwifery students in Manado, thereby contributing a focused evidence base for tailored health promotion in professional health education settings. This study aimed to analyze the effect of health promotion using an e-flyer on the knowledge about Blood Supplement Tablets (TTD) among first-year midwifery students. The findings demonstrate a significant increase in knowledge post-intervention, as evidenced by a paired t-test result ($p=0.000$).[15,16] This confirms that a targeted, simple educational tool is effective. The implication is clear: integrating structured digital health promotion into the curriculum for health professional students is a viable strategy. It can simultaneously improve their personal health literacy and equip them with practical experience for future community education, contributing to national anemia prevention efforts.

METHODS

Design. This study utilized a quantitative approach with a quasi-experimental design, specifically the one-group pretest-posttest model, to evaluate the effect of a singular health promotion intervention on knowledge levels.[17] The research was conducted at the Midwifery Department in Manado, Indonesia. The subjects were first-year female midwifery students. Using purposive sampling, a final sample of 115 respondents was obtained from a population of 133. The inclusion criteria required participants to be active students willing to participate, while the exclusion criteria excluded those unwilling to engage with the health promotion.

Instrument. The primary instruments used for data collection were: Questionnaire (Pre-test and Post-test): A structured e-questionnaire consisting of 25 questions, adapted and modified from previous research[18], was used to measure knowledge about Blood Supplement Tablets (TTD). The knowledge was categorized as Good (68-100), Fair (34-67), and Poor (0-33). Intervention Material: An e-flyer containing educational information about the benefits, use, and importance of TTD was developed and distributed digitally to the participants. Hemoglobin (Hb) Measurement Tool: A hemoglobinometer was used to measure the Hb levels of participants as a supporting physiological data point, before and after the intervention period.

Data Collection. Data collection followed a structured sequence. It commenced with an online pre-test questionnaire and an initial Hb check. Subsequently, the educational e-flyer was distributed digitally. Pre-test and Initial Hb Check (August 2023): Respondents first completed the pre-test knowledge questionnaire online. Subsequently, their Hb levels were measured. Intervention (Week after Pre-test): The researcher distributed the educational e-flyer about TTD to all participants via digital platforms. Post-test and Follow-up Hb Check (September 2023): After a four-week period during which students were expected to apply the knowledge independently, they completed the post-test knowledge questionnaire. A follow-up Hb measurement was also conducted.

Data analysis. The collected data were analyzed quantitatively using IBM SPSS Statistics software. The analysis consisted of two stages. Univariate Analysis was used to describe and summarize the characteristics of the respondents (age, origin, menarche, menstrual duration, Hb level, and knowledge scores) presented in frequency distributions, percentages, and medians. Bivariate Analysis was employed to determine the effect of the

intervention. The Paired Sample T-Test was used to compare the mean knowledge scores before (pre-test) and after (post-test) the health promotion intervention. A p-value of less than 0.05 ($\alpha \leq 0.05$) was considered statistically significant.

Ethical Consideration. This study was conducted in accordance with established ethical guidelines for research involving human subjects.[19] Prior to commencement, the research protocol, including the use of questionnaires and Hb measurement procedures, received Ethical Approval from the Health Research Ethics Committee of the Manado Health Polytechnic, Ministry of Health. The approval was granted under the official letter number KEPK.01/10/377/2023, confirming that the study adhered to ethical standards concerning social and scientific value, equitable burden and benefit, risk minimization, prevention of exploitation, and confidentiality. Informed consent was obtained from all participants before their involvement in the study. They were clearly informed about the study's purpose, procedures, their right to withdraw at any time without penalty, and the measures taken to ensure the confidentiality of their data. All collected information was anonymized and used solely for the purposes of this research.

RESULTS

Demographic data

Table 1: Demographic characteristics of research participants (n = 115)

Demographic Characteristic	Frequency n (%)
Age (Years)	
17	28 (24.3%)
18	48 (41.7%)
19	28 (24.3%)
20	7 (6.1%)
21 and above	4 (3.5%)
Region of Origin	
Manado City	25 (21.7%)
Minahasa	14 (12.2%)
Talaud Islands	13 (11.3%)
South Minahasa	8 (7.0%)
Bitung City	8 (7.0%)
Southeast Minahasa	7 (6.1%)
Sangihe Islands	7 (6.1%)
Siau Tagulandang Biaro	7 (6.1%)
Outside North Sulawesi	7 (6.1%)
Kotamobagu City	6 (5.2%)
North Minahasa	5 (4.3%)
East Bolaang Mongondow	3 (2.6%)
Tomohon City	2 (1.7%)
Bolaang Mongondow	2 (1.7%)
Gorontalo	1 (0.9%)
Age at Menarche (Years)	
11	1 (0.9%)
12	16 (13.9%)
13	23 (20.0%)
14	59 (51.3%)

15	14 (12.2%)
16	2 (1.7%)
Duration of Menstruation (Days)	
4	1 (0.9%)
5	18 (15.7%)
6	50 (43.5%)
7	32 (27.8%)
8	11 (9.6%)
9 - 10	3 (2.6%)

The demographic profile of the 115 respondents indicates a sample predominantly consisting of young adolescent females, with the highest concentration (41.7%) being 18 years old, aligning with the typical age of first-year university students. Geographically, respondents originated from diverse regions across North Sulawesi, with the largest proportion (21.7%) coming from Manado City, the provincial capital and the study's location. This distribution suggests the institution attracts students from both urban and rural areas within and occasionally outside the province. A key biological characteristic, the age at menarche, shows that the majority (51.3%) experienced their first menstruation at age 14. This finding is consistent with national data and falls within the normal physiological range reported in the literature. Furthermore, the duration of menstruation for most respondents was between 5 to 7 days, with 43.5% reporting a 6-day cycle. This is within the clinically accepted normal range of 2 to 7 days. These characteristics confirm that the study sample represents a typical group of adolescent girls who are at risk for iron loss due to menstruation and are therefore the appropriate target population for interventions related to iron deficiency anemia and Blood Supplement Tablets (TTD). The data establishes a baseline for understanding the population in which the health promotion intervention was tested.

Univariate Analysis

Table 2. Univariate Analysis of Knowledge Level and Hemoglobin (Hb) Before and After Health Promotion Intervention

Variable	Category	Before Intervention n (%)	After Intervention n (%)
Knowledge Level	Good (68-100)	16 (13.9%)	107 (93.0%)
	Fair (34-67)	68 (59.1%)	8 (7.0%)
	Poor (0-33)	31 (27.0%)	0 (0%)
	Total	115 (100%)	115 (100%)
Hemoglobin (Hb) Level	> 11 g/dL	25 (21.7%)	112 (97.4%)
	10.0 – 10.9 g/dL	87 (75.7%)	3 (2.6%)
	7.0 – 9.9 g/dL	3 (2.6%)	0 (0%)
	Total	115 (100%)	115 (100%)

The univariate analysis reveals a profound shift in both knowledge and physiological status following the health promotion intervention. Prior to the intervention, the majority of respondents (59.1%) possessed only a fair level of knowledge regarding Blood Supplement Tablets (TTD), with a significant portion (27.0%) categorized as having poor knowledge. Post-intervention, this distribution inverted dramatically, with 93.0% of respondents achieving a good knowledge level, and no respondents remaining in the poor category. Similarly, baseline Hemoglobin (Hb) levels indicated a critical public health concern, with 78.3% of participants (n=90) presenting with Hb levels at or below 10.9 g/dL, which is indicative of anemia. Following the four-week intervention period that included education and encouraged independent TTD consumption, this proportion drastically reversed. Post-intervention results show that 97.4% of respondents (n=112) achieved Hb levels above 11 g/dL, a range considered non-anemic, demonstrating a substantial improvement in the cohort's iron status.

Bivariate Analysis

Table 3. Bivariate Analysis of Knowledge Level Before and After Health Promotion Intervention (Paired Sample T-Test)

Knowledge Level	Pre-Test n (%)	Post-Test n (%)	p-value
Good	16 (13.9%)	107 (93.1%)	0.000
Fair	68 (59.1%)	8 (6.9%)	
Poor	31 (27.0%)	0 (0%)	
Total	115 (100%)	115 (100%)	

Notes: Statistical Test: Paired Sample T-Test. Mean Difference (Post-Pre): -33.730. t-statistic: -21.513. Significance Level (α): 0.05.

The bivariate analysis employing the Paired Sample T-Test yielded statistically significant results, demonstrating a powerful effect of the health promotion intervention. The test compared the mean knowledge scores before and after the distribution of the educational e-flyer on Blood Supplement Tablets (TTD). The analysis revealed a substantial mean difference of -33.730, with a highly significant t-statistic of -21.513. The corresponding p-value was 0.000, which is decisively less than the predetermined alpha level of 0.05. This statistical outcome provides strong evidence to reject the null hypothesis, confirming that there is a significant difference in knowledge levels following the intervention. In practical terms, this quantifies the dramatic shift observed in the univariate analysis, where the proportion of respondents with 'Good' knowledge increased from 13.9% to 93.1%, directly attributable to the health promotion activity.

DISCUSSION

This study provides clear evidence that a targeted digital health promotion intervention significantly enhances knowledge about Blood Supplement Tablets (TTD) among first-year midwifery students. The findings align with the theoretical framework of Social Cognitive Theory, which posits that learning through observation and access to information can build knowledge and influence self-efficacy, a precursor to behavioral change.[10] The substantial increase from 'Fair' and 'Poor' to predominantly 'Good' knowledge levels post-intervention mirrors the effectiveness of educational tools documented in prior research. Studies by Madestria et al. (2021) and Shaban et al. (2024) similarly found that video-based and digital educational interventions, respectively, were effective in improving knowledge domains in health contexts.[11,20] Our results extend this understanding by demonstrating the specific efficacy of a simple, distributable e-flyer within a professional health education setting. Furthermore, the corresponding marked improvement in hemoglobin levels from a baseline where 78.3% of participants were anemic to a post-intervention status where 97.4% achieved non-anemic levels suggests a potential translation of knowledge into preliminary health-seeking behavior, such as independent TTD consumption. This echoes findings from Utami et al. (2022), where education intervention alongside supplementation improved both knowledge and compliance.[2] Thus, this research underscores that even concise, digitally delivered health information can serve as a potent catalyst for improving health literacy and related physiological outcomes among adolescent health professional students.

This study possesses distinct strengths that bolster the validity of its findings. A primary strength is the application of a quasi-experimental pretest-posttest design, which provides a robust structure for establishing a temporal relationship between the intervention and the observed change in knowledge.[17] The use of a standardized, adapted questionnaire and physiological Hb measurement adds methodological rigor by combining subjective knowledge assessment with an objective health outcome. Furthermore, focusing on midwifery students is a strategic strength; this group represents a high-priority demographic for anemia prevention and acts as future multipliers of health information, aligning with the need for sustainable health promotion strategies.[21] However, several limitations must be acknowledged. The one-group design lacks a control group, making it difficult to definitively rule out the influence of external factors or historical trends on the observed improvements.[22] The relatively short duration of the study and the reliance on self-reported knowledge and Hb levels measured at only two points in time limit the ability to assess the long-term retention of knowledge and

the sustained effect on hemoglobin status.[23] Future research would benefit from a controlled, longitudinal design to confirm causality and evaluate the durability of the intervention's impact, as well as incorporating direct measures of behavioral compliance with TTD intake.

This study's primary limitation lies in its quasi-experimental, one-group pretest-posttest design, which lacks a control group. This absence limits the ability to definitively attribute the significant improvements in knowledge and Hb levels solely to the e-flyer intervention, as external factors like concurrent campus health campaigns or general maturation could have influenced the outcomes.[17] Additionally, the short follow-up period restricts understanding of the long-term retention of knowledge and sustainability of improved hemoglobin status.[24,25] Despite these constraints, the findings carry significant implications. They provide preliminary, evidence-based support for the practical integration of simple digital health promotion tools, like e-flyers, into the curriculum of health professional schools. This strategy offers a cost-effective method to simultaneously address personal student health (anemia prevention) and pedagogically equip future healthcare workers with experience in patient education techniques. Consequently, the study implies that educational institutions have a direct role in advancing national anemia reduction goals by embedding targeted health literacy interventions within their programs.

CONCLUSION

This study successfully achieved its objective of analyzing the effect of health promotion on knowledge about Blood Supplement Tablets (TTD) among first-year midwifery students. The results conclusively demonstrate that a targeted intervention using a digital e-flyer led to a statistically significant and substantial improvement in knowledge levels, as evidenced by the paired t-test result ($p=0.000$). The findings align with the research aim and confirm the hypothesis that structured health education is effective in enhancing health literacy within this specific demographic. Furthermore, the concurrent notable improvement in hemoglobin levels among participants suggests a positive behavioral or compliance response, reinforcing the practical value of the intervention. Based on these conclusions, several recommendations for future research are proposed. First, subsequent studies should employ a randomized controlled trial (RCT) design with a control group to strengthen causal inference and isolate the specific effect of the intervention from other variables. Second, investigations should incorporate longitudinal follow-ups to assess the durability of knowledge retention and its sustained impact on hemoglobin levels and consistent TTD consumption behavior over several months. Finally, research could explore comparative effectiveness by testing different digital delivery formats (e.g., interactive apps, short videos) or combining educational tools with direct supplementation programs to identify the most impactful strategies for preventing anemia among adolescent and young adult populations.

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