

Implementation of Health Education to Improve Adolescent Girls' Knowledge of the Importance of Iron Supplement Tablet Consumption at SMP Negeri 2 Gorontalo City

Sitti Rahmadiva Resita¹, Ani Retni², Inne Ariane Gobel³

^{1,2,3}Program Studi Ilmu Keperawatan, Jurusan Keperawatan, Fakultas Ilmu Kesehatan, Universitas Muhammadiyah Gorontalo

*Corresponding Author: E-mail: dipdippul@gmail.com

Article Info

Article history:

Received 12 Dec, 2025

Revised 21 Jan, 2026

Accepted 14 Feb, 2026

Keywords:

Anemia, Knowledge, Health education, Adolescent girls, Iron tablets

ABSTRACT

Adolescent girls are a vulnerable group for anemia, particularly iron deficiency anemia, due to menstrual blood loss, an unbalanced diet, and low compliance with iron supplementation. Anemia in adolescent girls can lead to decreased concentration, fatigue, and long-term health problems. This study aimed to determine the effect of health education on increasing adolescent girls' knowledge about the importance of iron supplementation at SMP Negeri 2 Gorontalo City. This study used the following method: almost experimental with design pretest–posttest. The research population was all female adolescents at SMP Negeri 2, Gorontalo City, with a sample of 74 respondents selected using the technique purposive sampling. Data analysis was carried out using the paired t-test. The results of the study showed that before the health education, most respondents had a low level of knowledge (45.9%), whereas after the health education, the majority of respondents had a good level of knowledge (62.2%). The test results paired t-test showed a p-value of 0.000 ($p < 0.05$). This study concluded that health education significantly impacted the knowledge of adolescent girls. Schools and health workers are advised to continuously improve health education programs to prevent anemia in adolescent girls.

INTRODUCTION

Adolescence is a critical stage of human growth and development characterized by rapid physical, psychological, emotional, and cognitive changes. According to Husna and Saputri (2022), adolescence spans the age of 10–24 years for unmarried individuals and represents the transitional period from childhood to adulthood. This phase is marked by a significant growth spurt, the development of primary and secondary sexual characteristics, the attainment of reproductive maturity, and substantial physiological, psychological, and emotional changes.

Adolescent girls constitute one of the population groups most vulnerable to anemia, particularly iron deficiency anemia, which primarily results from inadequate iron intake, menstrual blood loss, unhealthy dietary habits, and poor adherence to iron supplementation programs (Ministry of Health of the Republic of Indonesia [Kemenkes RI], 2022). Physiological maturation during adolescence includes the onset of menstruation, and the monthly menstrual cycle increases the risk of iron depletion, making adolescent girls more susceptible to anemia (Kharismawati et al., 2023).

According to the *World Health Statistics 2021* published by the World Health Organization (WHO), the global prevalence of anemia among women of reproductive age (15–49 years) reached 29.9% in 2019, while the prevalence among non-pregnant women aged 15–49 years was 29.6%, a population that includes older adolescents (World Health Organization, 2021). In Indonesia, the 2018 Basic Health Research (Riskesdas) reported that anemia affected approximately 27.2% of females aged 15–24 years, compared with 20.3% among males of the same age group, indicating that anemia remains a major public health problem among Indonesian adolescents, particularly adolescent girls (Auliya et al., 2022).

At the provincial level, the Gorontalo Provincial Health Office (2023) reported that 29.5% of adolescent girls in Gorontalo Province were diagnosed with anemia. Specifically, 1,960 adolescent girls were identified as having anemia out of a total population of 66,494 adolescent girls, indicating that anemia remains a significant public health concern requiring immediate preventive intervention.

Anemia is defined as a condition in which the hemoglobin (Hb) concentration in the blood is lower than the normal reference value according to age and sex. The normal hemoglobin concentration ranges from 12–15 g/dL in adolescent females and 13–17 g/dL in adolescent males. Decreased hemoglobin, hematocrit, and erythrocyte counts remain the principal laboratory indicators for diagnosing anemia (Marfiah et al., 2023).

The consequences of anemia extend beyond hematological disorders and may impair overall body function. Among adolescents, anemia can lead to nutritional deficiencies, decreased immune function, impaired concentration, poor academic performance, reduced physical fitness, fatigue, and lower productivity, thereby affecting both educational achievement and long-term health outcomes (Ernawati et al., 2021).

Low adherence to iron supplementation among adolescent girls is closely associated with inadequate knowledge and negative perceptions regarding the benefits of iron tablets. Knowledge is one of the primary determinants influencing health-related behavior. Individuals with adequate knowledge are more likely to understand health information, adopt healthy practices, and maintain positive behavioral changes. Therefore, educational interventions such as structured health education are essential to improve adolescents' understanding of the importance of routinely consuming iron supplementation tablets (Notoatmodjo, 2020).

Previous studies have consistently demonstrated the effectiveness of health education in improving knowledge regarding anemia prevention. Putri and Lestari (2021) reported that audiovisual-based health education significantly increased adolescent girls' knowledge about anemia by approximately 70%, with statistically significant differences between pre-intervention and post-intervention scores.

Similarly, Rahmawati (2022) found that compliance with weekly iron supplementation increased from 42% to 76% following a three-week health education program. These findings suggest that improving knowledge through health education contributes directly to behavioral changes and increases adherence to iron supplementation among adolescent girls.

A preliminary survey conducted by the researchers at SMP Negeri 2 Gorontalo City revealed that the school had a total enrollment of 523 students, including 279 adolescent girls. Interviews were conducted with 15 female students from grades VII to IX. The findings indicated that 13 participants had limited knowledge regarding the benefits of iron supplementation, while none of the interviewed students reported consuming iron tablets regularly. Interviews with the School Health Unit (UKS) teacher further revealed that although iron tablets were periodically distributed by the local community health center (Puskesmas), monitoring of tablet consumption remained inadequate. These findings indicate that adolescent girls at SMP Negeri 2 Gorontalo City have not received sufficient health education regarding the importance of regular iron supplementation. Consequently, there is a clear need for educational interventions to improve their knowledge and encourage adherence to iron tablet consumption. Based on these findings, this study aims to evaluate the implementation of a health education program to improve adolescent girls' knowledge regarding the importance of routine iron supplementation at SMP Negeri 2 Gorontalo City.

RESEARCH METHODS

This study was conducted at SMP Negeri 2 Gorontalo City in December 2025. According to Nursalam (2020), research methodology refers to a systematic strategy for identifying research problems and organizing data collection to answer research objectives. This study employed a quasi-experimental research design using a one-group pretest–posttest approach. Participants received a structured health education intervention, and changes in knowledge before and after the intervention were analyzed using a paired t-test. This design was selected to determine the effect of the educational intervention on participants' knowledge regarding the importance of consuming iron supplementation tablets.

Population and Sample

The study population comprised all adolescent girls enrolled at SMP Negeri 2 Gorontalo City, totaling 279 students. The sample size was determined using the Slovin formula, resulting in a minimum sample requirement of 73.6 participants, which was rounded up to 74 respondents. Participants meeting the inclusion criteria were recruited to receive the health education intervention and participate in both the pretest and posttest assessments.

Data Analysis

Univariate Analysis

Univariate analysis was performed to describe the characteristics of each study variable independently. This analysis focused on a single variable without examining relationships between dependent and independent variables. Descriptive statistical methods were employed to summarize the frequency distribution and percentage

of respondents' characteristics and knowledge levels regarding the importance of consuming iron supplementation tablets.

Bivariate Analysis

Bivariate analysis was conducted to determine the effect of the health education intervention on adolescent girls' knowledge regarding the importance of consuming iron supplementation tablets at SMP Negeri 2 Gorontalo City. Differences between pre-intervention (pretest) and post-intervention (posttest) knowledge scores were analyzed using the paired samples t-test with a 95% confidence level.

Prior to hypothesis testing, the normality of the pretest and posttest data was assessed using the Kolmogorov–Smirnov test in IBM SPSS. Data were considered normally distributed when the Asymp. Sig. (2-tailed) value was greater than 0.05. Statistical significance was determined at $p < 0.05$. A p -value less than or equal to 0.05 indicated a statistically significant effect of the intervention, whereas a p -value greater than 0.05 indicated no statistically significant difference.

RESULTS

Univariate Analysis

Knowledge Level Before the Health Education Intervention

Table 1. Distribution of Respondents According to Knowledge Level Before the Health Education Intervention

Knowledge Level	Frequency (n)	Percentage (%)
Good	12	16.2
Moderate	28	37.8
Poor	34	45.9
Total	74	100.0

Source: Primary Data, 2025.

Table 1 shows that, prior to the health education intervention, most respondents demonstrated inadequate knowledge regarding the importance of consuming iron supplementation tablets. Of the 74 participants, 34 respondents (45.9%) had poor knowledge, 28 respondents (37.8%) had moderate knowledge, and only 12 respondents (16.2%) demonstrated good knowledge.

Knowledge Level After the Health Education Intervention

Table 2. Distribution of Respondents According to Knowledge Level After the Health Education Intervention

Knowledge Level	Frequency (n)	Percentage (%)
Good	46	62.2
Moderate	22	29.7
Poor	6	8.1
Total	74	100.0

Source: Primary Data, 2025.

As presented in Table 2, respondents' knowledge improved considerably following the health education intervention. Of the 74 participants, 46 respondents (62.2%) achieved a good level of knowledge, 22 respondents (29.7%) demonstrated moderate knowledge, while only 6 respondents (8.1%) remained in the poor knowledge category.

Bivariate Analysis

Effect of the Health Education Intervention on Adolescent Girls' Knowledge

Table 3. Comparison of Knowledge Scores Before and After the Health Education Intervention

Health Education	n	Mean	Standard Deviation	p -value
Before intervention	74	2.30	0.735	
After intervention	74	1.46	0.645	0.000

Source: Primary Data, 2025.

Table 3 demonstrates that the mean knowledge score before the health education intervention was 2.30 ± 0.735 , whereas the mean score after the intervention decreased to 1.46 ± 0.645 . Because lower scores represented

higher levels of knowledge according to the study scoring system, this reduction indicates a substantial improvement in participants' knowledge following the intervention.

The paired samples *t*-test revealed a statistically significant difference between pretest and posttest knowledge scores ($p = 0.000$; $p < 0.05$). Therefore, the null hypothesis was rejected, indicating that the health education intervention significantly improved adolescent girls' knowledge regarding the importance of consuming iron supplementation tablets at SMP Negeri 2 Gorontalo City.

DISCUSSION

Analysis of Adolescent Girls' Knowledge Before Receiving Health Education at SMP Negeri 2 Gorontalo City

The findings of this study revealed that, prior to the health education intervention, only 12 respondents (16.2%) were categorized as having good knowledge regarding the importance of consuming iron supplementation tablets. This finding indicates that the majority of respondents had not yet acquired an adequate understanding of the importance of routine iron tablet consumption. The low proportion of respondents with good knowledge reflects a considerable gap in health-related information among adolescent girls before the educational intervention was implemented. These findings emphasize the need for structured and comprehensive health education programs within the school setting.

Further analysis demonstrated that respondents classified as having good knowledge were still unable to answer several questions correctly, particularly those related to the recommended dosage, appropriate timing of iron tablet consumption, potential side effects, and strategies for managing these side effects. Several respondents also held misconceptions, such as believing that iron tablets should be taken together with tea or on an empty stomach when experiencing nausea. These findings indicate that the technical and practical aspects of iron supplementation had not been fully understood by most respondents before receiving health education.

According to Notoatmodjo (2018), health knowledge is influenced by individual experiences, access to information, and exposure to health education. Adolescents who have not received systematic health information tend to possess inadequate knowledge, particularly regarding practical aspects such as dosage, timing of consumption, and management of side effects. This perspective supports the concept that health knowledge encompasses not only factual understanding but also practical competencies that can be applied in everyday life.

These findings are consistent with the study conducted by Susanti, Rahmawati, and Putri (2025), entitled "*Knowledge Improvement of Adolescent Girls with Weekly Iron Folic Acid Supplementation (WIFAS) Education*," which reported that most respondents experienced difficulties in answering questions related to the dosage and side effects of iron supplementation before receiving educational intervention. Similarly, Sari and Handayani (2024), in their study entitled "*Factors Influencing Adolescent Girls' Knowledge Regarding Iron Tablet Consumption*," concluded that inadequate information provided by healthcare professionals was one of the primary factors contributing to poor baseline knowledge among adolescent girls.

The researchers assume that the low proportion of respondents categorized as having good knowledge prior to the intervention was primarily attributable to insufficient practical understanding regarding the correct dosage, timing of consumption, and possible side effects of iron supplementation. Most adolescent girls appeared to recognize the general purpose of iron tablets but lacked sufficient knowledge about their appropriate use. Therefore, health education emphasizing practical and applicable information is expected to substantially improve adolescents' knowledge regarding appropriate iron supplementation practices.

The results also showed that 28 respondents (37.8%) were categorized as having moderate knowledge before receiving health education. This finding suggests that a considerable proportion of respondents had already acquired basic knowledge regarding iron supplementation; however, their understanding remained incomplete. Their knowledge was largely limited to general concepts and did not encompass all essential aspects of proper iron tablet consumption. These findings indicate that although respondents had previously been exposed to health information, their understanding still required further improvement through structured educational interventions.

Further analysis revealed that respondents with moderate knowledge were generally able to answer questions correctly concerning the definition and function of iron supplementation tablets as well as the consequences of iron deficiency. Nevertheless, many respondents continued to demonstrate misconceptions regarding the recommended dosage, appropriate timing of consumption, perceptions toward iron supplementation, and habitual tablet intake. Some respondents were also unable to identify reliable sources of information concerning iron supplementation. These findings suggest that while respondents understood the benefits of iron tablets, they had not yet developed comprehensive knowledge regarding their correct and consistent use.

According to Notoatmodjo (2018), knowledge develops through several hierarchical stages, ranging from awareness and comprehension to application. Respondents classified as having moderate knowledge generally reached the stages of knowing and understanding but had not yet achieved the ability to apply that

knowledge in daily practice. Within the context of this study, respondents understood the benefits of iron supplementation but were not yet able to implement this knowledge appropriately in their routine health behaviors.

These findings are consistent with the study conducted by Rahmawati, Sari, and Anwar (2023), entitled *"Adolescent Girls' Knowledge of Iron Supplementation Based on Knowledge Score Categories,"* which found that adolescents with moderate knowledge generally understood the definition and benefits of iron tablets but remained uncertain about technical aspects such as dosage and timing of consumption. Likewise, Handayani and Putri (2024), in their study entitled *"The Relationship Between Knowledge and Adherence to Iron Tablet Consumption Among Adolescent Girls,"* concluded that inadequate knowledge contributes to poor compliance with iron supplementation programs.

The researchers assume that respondents classified as having moderate knowledge had previously been exposed to basic information regarding iron supplementation but had not received comprehensive and practice-oriented health education. Insufficient emphasis on appropriate dosage, timing, and regular consumption appears to be the primary reason why these respondents had not yet achieved a good level of knowledge. Consequently, health education focusing on practical aspects of iron tablet consumption is expected to improve respondents' knowledge from a moderate to a good level.

The findings further demonstrated that 34 respondents (45.9%) were categorized as having poor knowledge before receiving health education. This result indicates that nearly half of the respondents lacked adequate understanding regarding iron supplementation. The high proportion of respondents with poor knowledge reflects limited exposure to health information before the educational intervention and highlights the importance of implementing structured health education programs to improve adolescent girls' knowledge.

Detailed analysis showed that respondents classified as having poor knowledge were unable to answer most questionnaire items correctly. The greatest difficulties were observed in questions concerning the appropriate dosage and timing of iron tablet consumption, potential side effects and their management, as well as attitudes and habitual consumption practices. In addition, many respondents were unable to identify reliable sources of information regarding iron supplementation. These findings suggest that respondents lacked not only technical knowledge but also positive attitudes toward the routine consumption of iron tablets.

According to Notoatmodjo (2018), poor health knowledge is often associated with limited access to health information, insufficient experience, and the absence of continuous health education. Adolescents who do not receive adequate health education are more likely to develop misconceptions and incomplete understanding of health-related issues. In the present study, the respondents' limited knowledge regarding iron supplementation reflects inadequate dissemination of health information within the school environment.

These findings are supported by the study conducted by Lestari, Wijaya, and Pratama (2023), entitled *"Description of Adolescent Girls' Knowledge Regarding Anemia and Iron Supplementation,"* which reported that most respondents with poor knowledge were unable to identify the correct dosage, timing of consumption, and possible side effects of iron tablets. Similarly, Putri and Handayani (2024), in their study entitled *"Factors Contributing to Poor Knowledge of Iron Tablet Consumption Among Adolescent Girls,"* identified the lack of health education as the dominant factor contributing to inadequate knowledge regarding iron supplementation.

The researchers assume that the high proportion of respondents with poor knowledge was primarily caused by limited exposure to comprehensive health information concerning iron supplementation. Most respondents had not yet fully understood the benefits, proper methods of consumption, and the importance of routinely taking iron tablets. Without structured and continuous health education, adolescent girls are likely to maintain inadequate knowledge, which may negatively affect their compliance with iron supplementation programs and increase their risk of developing iron deficiency anemia.

Further analysis revealed that respondents classified as having poor knowledge were unable to answer most of the questionnaire items correctly. The greatest difficulties were observed in questions related to the appropriate dosage and timing of iron tablet consumption, potential side effects and their management, as well as attitudes and habitual practices regarding iron supplementation. In addition, many respondents were unable to identify reliable sources of information concerning iron tablets. These findings indicate that respondents lacked not only technical knowledge regarding iron supplementation but also a positive attitude toward the routine consumption of iron tablets.

According to Notoatmodjo (2018), poor health knowledge may result from limited access to health information, insufficient personal experience, and the absence of continuous health education. Adolescents who have not received adequate health information are more likely to develop misconceptions and incomplete understanding of health-related issues. In the context of this study, the respondents' limited knowledge regarding iron supplementation reflects inadequate dissemination of health information within the school environment.

These findings are consistent with the study conducted by Lestari, Wijaya, and Pratama (2023), entitled *"Description of Adolescent Girls' Knowledge Regarding Anemia and Iron Supplementation,"* which reported that the majority of adolescent girls with poor knowledge were unable to identify the correct dosage, appropriate timing of consumption, and possible side effects of iron tablets. Likewise, Putri and Handayani

(2024), in their study entitled *"Factors Contributing to Poor Knowledge of Iron Tablet Consumption Among Adolescent Girls,"* identified the lack of health education as the dominant factor associated with inadequate knowledge regarding iron supplementation.

The researchers assume that the high proportion of respondents with poor knowledge was primarily attributable to limited exposure to comprehensive health information concerning iron supplementation. Most respondents had not yet fully understood the benefits, proper methods of consumption, and the importance of taking iron tablets regularly. The researchers believe that without structured and continuous health education, adolescent girls are likely to maintain inadequate knowledge, which may subsequently hinder adherence to iron supplementation programs and increase the risk of iron deficiency anemia.

Analysis of Adolescent Girls' Knowledge After Receiving Health Education at SMP Negeri 2 Gorontalo City

The findings of this study demonstrated that, following the health education intervention, **46 respondents (62.2%)** were categorized as having good knowledge regarding the importance of iron tablet consumption. This result represents a substantial improvement compared with the pre-intervention findings, indicating that the majority of respondents had developed a comprehensive understanding of iron supplementation. The considerable increase in the proportion of respondents with good knowledge suggests that the health education program was effective in improving adolescent girls' knowledge. These findings indicate that educational interventions can significantly enhance adolescents' understanding of the importance of routine iron supplementation.

Further analysis showed that respondents classified as having good knowledge after the intervention were able to answer almost all questionnaire items correctly. They demonstrated a comprehensive understanding of the definition and function of iron tablets, the recommended dosage and timing of consumption, the benefits of iron supplementation and the consequences of iron deficiency, as well as the potential side effects and appropriate strategies for managing them. Furthermore, respondents exhibited improved perceptions, greater awareness of reliable sources of health information, and more positive attitudes toward routine iron tablet consumption. These findings indicate that the health education intervention successfully addressed the misconceptions previously identified among respondents. Consequently, participants not only acquired conceptual knowledge but also developed practical understanding and positive attitudes that support regular iron tablet consumption.

According to Notoatmodjo (2018), improvements in health knowledge can be achieved through well-planned, systematic, and target-oriented health education programs. Health education plays an essential role in enhancing individuals' ability to understand health-related information comprehensively, beginning with basic knowledge and extending to its practical application in everyday life.

These findings are consistent with the study conducted by Putri, Lestari, and Yuliana (2023), entitled *"The Effectiveness of Health Education in Improving Adolescent Girls' Knowledge of Iron Tablet Consumption,"* which reported that the majority of respondents achieved a good level of knowledge following the educational intervention. Similarly, Sari and Handayani (2024), in their study entitled *"The Effect of Health Education on Adolescent Girls' Knowledge and Attitudes Toward Iron Tablet Consumption,"* concluded that health education contributes significantly to improving both knowledge and positive attitudes toward routine iron supplementation among adolescent girls.

The researchers assume that the increase in the number of respondents classified as having **good knowledge** after the health education intervention was attributable to the effectiveness of the educational materials, which were specifically designed to meet the needs of adolescent girls. The health education emphasized the definition, benefits, appropriate dosage, timing of consumption, and management of side effects of iron supplementation tablets, enabling respondents to develop a comprehensive understanding of the topic. The researchers believe that interactive and practical health education is more easily understood by adolescents because it facilitates active participation and improves information retention.

The findings also showed that **22 respondents (29.7%)** remained in the **moderate knowledge** category after receiving health education. Although the majority of respondents demonstrated improved knowledge, some participants had not yet achieved the good knowledge category. This finding indicates that knowledge improvement did not occur uniformly among all respondents. Individual differences in learning ability, educational background, and cognitive capacity may have contributed to these variations in learning outcomes.

The analysis revealed that respondents classified as having moderate knowledge after the intervention were able to answer most questions correctly regarding the definition, function, and benefits of iron supplementation tablets. However, they continued to experience difficulties with questions related to habitual tablet consumption, attitudes toward routine supplementation, and the identification of reliable information sources. These findings suggest that although health education successfully improved cognitive understanding, it had not yet fully established positive attitudes and consistent behavioral practices regarding regular iron tablet consumption.

According to Notoatmodjo (2018), individuals with a moderate level of knowledge have generally reached the stage of understanding but have not yet progressed to the stages of application and internalization of knowledge into behavior. In the context of this study, respondents understood the fundamental concepts of iron supplementation but had not yet consistently translated this knowledge into positive attitudes and routine consumption practices. This finding indicates that increased knowledge does not necessarily lead immediately to behavioral change.

These findings are consistent with the study conducted by Handayani, Putri, and Lestari (2024), entitled *"Changes in Knowledge and Attitudes of Adolescent Girls Following Iron Supplementation Education,"* which reported that some respondents remained in the moderate knowledge category despite receiving health education. The authors suggested that individual motivation and environmental influences contributed to these outcomes. Similarly, Sari and Rahmawati (2023), in their study *"The Relationship Between Knowledge and Attitudes Toward Iron Supplementation Consumption Among Adolescent Girls,"* concluded that changes in attitudes require continuous reinforcement and repeated educational exposure.

The researchers assume that respondents who remained in the moderate knowledge category after the intervention require repeated and continuous reinforcement of educational materials. A single health education session may not be sufficient to establish optimal attitudes and habitual iron tablet consumption among all participants. Therefore, follow-up interventions in the form of repeated educational sessions or continuous mentoring by teachers and healthcare professionals are recommended.

The study further demonstrated that **6 respondents (8.1%)** remained in the **poor knowledge** category after receiving health education. Although this proportion decreased substantially compared with the pre-intervention assessment, a small number of respondents still failed to achieve the expected level of knowledge. These findings indicate that while health education was generally effective, improvements in knowledge were not evenly distributed across all participants.

The analysis showed that respondents in the poor knowledge category continued to experience difficulties answering questions related to the appropriate dosage and timing of iron tablet consumption, as well as attitudes and habitual behaviors regarding regular supplementation. In addition, several respondents still lacked adequate understanding of potential side effects and their management. These findings suggest that each adolescent possesses different capacities for processing and retaining health information, meaning that not all participants are able to comprehend educational materials at the same pace or through the same learning approach. Differences in learning styles, attention span, readiness to learn, and individual cognitive abilities may have influenced the effectiveness of the health education intervention.

According to Notoatmodjo (2018), the success of health education is influenced by individual characteristics, including comprehension ability, motivation, and the capacity to receive and process information. Furthermore, theories of individual differences in learning propose that each person processes newly acquired information differently and at varying speeds. Consequently, some individuals require additional time, repeated reinforcement, and more intensive educational support before achieving the expected level of knowledge regarding health-related behaviors such as regular iron supplementation.

These findings are consistent with the study conducted by Handayani, Putri, and Lestari (2024), entitled *"Individual Factors Influencing the Success of Health Education Among Adolescent Girls,"* which reported that differences in cognitive ability and learning styles significantly influenced the effectiveness of health education interventions. Similarly, Sari and Wahyuni (2023), in their study *"Variations in Adolescents' Responses to Iron Supplementation Education,"* found that not all respondents experienced the same degree of knowledge improvement despite receiving identical educational materials.

The researchers assume that respondents who remained in the poor knowledge category after the intervention were influenced by individual differences in their ability to absorb health education. A single educational session may not be sufficient for some adolescents to fully understand the material. Therefore, more varied and repeated educational approaches are recommended, including the use of visual media, small-group discussions, and individualized mentoring to accommodate different learning needs and improve educational outcomes.

Analysis of the Effect of Health Education on Improving Female Adolescents' Knowledge Regarding the Importance of Iron Supplementation at SMP Negeri 2 Gorontalo City

The analysis showed that the **mean knowledge score before the health education intervention was 2.30**, with a **standard deviation of 0.735**. This average score indicates that respondents generally possessed relatively low levels of knowledge prior to the intervention. The relatively large standard deviation suggests considerable variability in baseline knowledge among respondents, indicating that their initial understanding was heterogeneous and influenced by differences in individual backgrounds and previous exposure to health information.

Following the health education intervention, the **mean knowledge score decreased to 1.46**, with a **standard deviation of 0.645**. Because lower scores represented higher levels of knowledge in the scoring system used in this study, this decrease indicates a substantial improvement in respondents' knowledge after

the intervention. Furthermore, the smaller standard deviation demonstrates that respondents' knowledge became more homogeneous following health education. These findings suggest that the intervention not only improved knowledge but also reduced disparities in understanding among participants.

According to Notoatmodjo (2018), health education represents one of the primary strategies for improving individual knowledge through a structured process of cognitive change. Systematic delivery of health information enhances understanding while simultaneously reducing knowledge disparities among individuals. This concept is reflected in the observed reduction in both the mean score and the standard deviation following the intervention, indicating overall improvement and greater uniformity in respondents' knowledge.

The findings of the present study are consistent with those reported by Putri, Lestari, and Yuliana (2023) in their study entitled *"The Effect of Health Education on Changes in the Mean Knowledge Level of Adolescent Girls Regarding Iron Supplementation Tablets,"* which similarly demonstrated significant differences in mean knowledge scores before and after health education.

The researchers therefore assume that health education plays an important role in improving and equalizing adolescent girls' knowledge regarding the importance of regular iron supplementation. The observed changes in the mean score and reduction in the standard deviation reflect the effectiveness of the intervention in transferring health information comprehensively to all respondents. Structured educational sessions enabled participants with initially low knowledge to improve their understanding, thereby narrowing the knowledge gap among respondents. These findings support the use of health education as an effective strategy for improving health literacy among adolescent girls within the school environment.

The results of the paired-samples **t-test** demonstrated a **p-value of 0.000 ($p < 0.05$)**, indicating a statistically significant difference between respondents' knowledge levels before and after receiving health education. This finding confirms that the educational intervention had a significant positive effect on increasing adolescent girls' knowledge regarding the importance of consuming iron supplementation tablets. Statistically, the p-value below the significance threshold indicates that the observed improvement was unlikely to have occurred by chance. Therefore, the health education intervention was proven to be effective in enhancing respondents' knowledge.

These findings are consistent with the study by Putri, Lestari, and Yuliana (2023), entitled *"The Effect of Health Education on Adolescent Girls' Knowledge Regarding Iron Supplementation Consumption,"* which reported a **p-value of 0.001**, demonstrating a significant improvement in knowledge following health education. Similarly, Sari and Handayani (2024), in their study *"The Effectiveness of Health Education in Improving Knowledge of Anemia Among Adolescent Girls,"* also reported statistically significant results using a paired-samples t-test (**$p < 0.05$**), indicating that health education effectively increased respondents' knowledge. Furthermore, Rahmawati et al. (2023), in their study *"The Effect of School-Based Health Education on Knowledge of Anemia Prevention Among Adolescent Girls,"* concluded that school-based educational interventions significantly improved students' knowledge following repeated assessment.

Based on the statistical findings and their consistency with previous studies, the researchers assume that health education was the primary factor responsible for improving adolescent girls' knowledge regarding the importance of iron supplementation. The researchers believe that structured educational materials specifically designed to meet adolescents' needs can substantially improve knowledge within a relatively short period. The school environment also appears to provide a conducive setting for learning, thereby enhancing the effectiveness of health education interventions. Consequently, school-based health education can be considered an effective strategy for increasing knowledge and supporting anemia prevention among adolescent girls.

This study was conducted over **three consecutive days** and involved **74 female adolescent respondents** from SMP Negeri 2 Gorontalo City. The intervention consisted of structured health education sessions focusing on the importance of regular iron supplementation tablet consumption. The findings demonstrated a statistically significant improvement in respondents' knowledge following the intervention. These results indicate that even a relatively short-term health education program can produce meaningful improvements in adolescents' understanding, highlighting the value of educational interventions as an effective approach to promoting healthy behaviors and preventing iron-deficiency anemia among school-aged girls.

This finding is consistent with the study conducted by Sari et al. (2020), which employed a **one-group pretest–posttest design** with a health education intervention delivered over three consecutive days. The study demonstrated a significant improvement in adolescent girls' knowledge following the health education program, as evidenced by higher posttest mean scores compared to pretest scores (**$p < 0.05$**). These findings indicate that even a short-term health education intervention can effectively enhance adolescent girls' knowledge regarding anemia prevention.

CONCLUSION

Based on the analysis of respondents' characteristics at **SMP Negeri 2 Kota Gorontalo**, the majority of adolescent girls were **12–13 years old**, accounting for **40 respondents (54.1%)**. In terms of grade level, most participants were from **Grade VII**, comprising **26 respondents (35.1%)**.

The analysis of adolescent girls' knowledge **before** receiving health education revealed that **12 respondents (16.2%)** had good knowledge, **28 respondents (37.8%)** had moderate knowledge, and **34 respondents (45.9%)** had poor knowledge regarding the importance of consuming iron supplementation tablets.

Following the implementation of the health education intervention, the level of knowledge increased substantially. A total of **46 respondents (62.2%)** achieved a good level of knowledge, while **22 respondents (29.7%)** had moderate knowledge and only **6 respondents (8.1%)** remained in the poor knowledge category.

The results of the **paired-samples t-test** comparing pretest and posttest knowledge scores showed a statistically significant difference (**p = 0.000; p < 0.05**). These findings indicate that the implementation of health education had a significant positive effect on improving adolescent girls' knowledge regarding the importance of consuming iron supplementation tablets at **SMP Negeri 2 Kota Gorontalo**.

RECOMMENDATIONS

Adolescent girls are encouraged to continuously improve their knowledge and awareness regarding the importance of regularly consuming iron supplementation tablets as an effective strategy for preventing anemia. Improved understanding is expected to promote sustainable and independent adherence to iron supplementation practices.

Schools, particularly the **School Health Unit (UKS)** and teachers, are encouraged to utilize the findings of this study as a basis for strengthening school-based health promotion activities. Regular and continuous health education programs focusing on adolescent health, anemia prevention, and appropriate iron supplementation should be integrated into routine school health services.

Future researchers are encouraged to use the findings of this study as a reference for further investigations. Subsequent studies should consider employing more rigorous research designs, such as including a control group, increasing the sample size, extending the intervention period, and examining additional variables that may influence adolescents' knowledge and adherence to iron supplementation programs.

REFERENCES

- Auliya, N., Sari, D. P., & Lestari, R. (2022). Hubungan pengetahuan dengan kepatuhan konsumsi tablet tambah darah pada remaja putri di SMA Negeri 1 Padang. *Jurnal Kesehatan Masyarakat Indonesia*, 17(2), 115–123.
- Biahimo, N. U., Lasanuddin, H. V., Gobel, I. A., & Asnawati, R. (2025). Membangun ketahanan mental remaja melalui edukasi jiwa sehat di SMP Widyakrama Telaga Biru Kabupaten Gorontalo. *Mohuyula: Jurnal Pengabdian Kepada Masyarakat*, 4(1), 22–28.
- Dewi, A. P., & Sudaryanto, A. (2020). Hubungan pengetahuan dengan sikap remaja terhadap pencegahan anemia di SMP Negeri 1 Surakarta. *Jurnal Ilmiah Kesehatan*, 12(1), 33–42.
- Dinas Kesehatan Kota Bandung. (2023). Manfaat tablet tambah darah bagi remaja putri. Dinas Kesehatan Kota Bandung.
- Dinas Kesehatan Provinsi Gorontalo. (2023). Profil Kesehatan Provinsi Gorontalo Tahun 2023. Dinas Kesehatan Provinsi Gorontalo.
- Elleman, J. (2021). Health education as a core nursing intervention: Concepts and applications. *Journal of Nursing Practice*, 15(3), 112–119.
- Ernawati, H., Dewi, N. L., & Wulandari, A. (2021). Dampak anemia terhadap prestasi belajar dan kebugaran remaja putri. *Jurnal Gizi dan Kesehatan Reproduksi*, 5(1), 33–40.
- Handayani, T., & Putri, A. R. (2024). Hubungan pengetahuan dan kepatuhan konsumsi tablet tambah darah pada remaja putri. *Jurnal Gizi dan Kesehatan Remaja*, 7(1), 40–48.
- Handayani, T., Putri, A. R., & Lestari, S. (2024). Perubahan tingkat pengetahuan dan sikap remaja putri setelah edukasi tablet tambah darah. *Jurnal Promosi Kesehatan Indonesia*, 12(1), 60–68.
- Helmyati, S., Syarifa, C. A., Rizana, N. A., Sitorus, N. L., & Pratiwi, D. (2023). Acceptance of iron supplementation program among adolescent girls in Indonesia: A literature review. *Amerta Nutrition*, 7(3), 50–61.
- Husna, A., & Saputri, M. (2022). Perkembangan fisik dan psikologis pada masa remaja. *Jurnal Ilmu Kesehatan Masyarakat*, 11(2), 72–81.
- Kementerian Kesehatan Republik Indonesia. (2022). Pedoman pencegahan dan penanggulangan anemia pada remaja putri dan wanita usia subur. Kementerian Kesehatan RI.
- Kharismawati, D., Hidayat, T., & Nurbaya, S. (2023). Menstruasi dan risiko anemia pada remaja putri. *Jurnal Kesehatan Reproduksi Remaja*, 9(1), 45–53.
- Khomsan, A., Riyadi, H., Ekawidyani, K. R., Dina, R. A., Nurhidayati, V. A., & Prasetya, G. (2025). A formative study of weekly iron-folic acid (WIFA) supplementation for adolescent school girls in West Java, Indonesia. *Nutrición Clínica y Dietética Hospitalaria*, 45(1), 438–444.

- Lestari, N., Wijaya, A., & Pratama, R. (2023). Gambaran tingkat pengetahuan remaja putri tentang anemia dan tablet tambah darah. *Jurnal Kesehatan Masyarakat*, 18(3), 210–218.
- Lestari, S., Handayani, T., & Putri, A. R. (2024). Faktor individu yang mempengaruhi keberhasilan edukasi kesehatan pada remaja putri. *Jurnal Promosi Kesehatan Indonesia*, 12(2), 145–153.
- Lestari, Y. D., Herawati, Permatasari, L., & Hamidah, N. (2021). Pengaruh pendidikan kesehatan reproduksi remaja melalui media animasi terhadap perubahan pengetahuan dan sikap pada siswi SMP di Pondok Pesantren Nurul Jadid. *Midwifery Journal*, 3(1), 1–9.
- Lisdiyanti Usman, M. A. K., & Mohammad, F. (2023). Peran konsumsi tablet tambah darah terhadap kesehatan reproduksi remaja putri. *Gorontalo Journal of Health Science*, 2(1), 55–63.
- Marfiah, S., Andini, Y., & Setyaningsih, D. (2023). Pemeriksaan hemoglobin dan faktor risiko anemia pada remaja putri. *Jurnal Laboratorium Medis Indonesia*, 7(2), 122–131.
- Na, Y., & Hiperteinsiva, E. (2021). Pentingnya pendidikan kesehatan gizi pada remaja: Kajian sistematis. *Indonesian Journal of Public Health*, 10(4), 245–254.
- Ningsih, A. (2021). Pengaruh edukasi kesehatan terhadap pengetahuan dan sikap remaja putri tentang anemia di SMP Negeri 5 Surakarta. *Jurnal Promosi Kesehatan Indonesia*, 16(3), 241–248.
- Notoatmodjo, S. (2020). Promosi kesehatan dan ilmu perilaku. Rineka Cipta.
- Nursalam. (2019). Metodologi penelitian ilmu keperawatan: Pendekatan praktis (Edisi ke-4). Salemba Medika.
- Putra, M., Lestari, E., & Wijaya, D. (2020). Peran pendidikan kesehatan terhadap perubahan perilaku hidup sehat pada remaja. *Journal of Health Promotion*, 5(1), 58–67.
- Putri, A. D., Lestari, S., & Yuliana, R. (2023). Pengaruh penyuluhan kesehatan terhadap perubahan rata-rata tingkat pengetahuan remaja putri tentang tablet tambah darah. *Jurnal Promosi Kesehatan Indonesia*, 11(3), 225–233.
- Putri, A. P., & Lestari, N. (2021). Pengaruh penyuluhan kesehatan terhadap pengetahuan remaja putri tentang anemia di SMA Negeri 1 Medan. *Jurnal Ilmiah Keperawatan*, 9(2), 101–108.
- Rahayu, D., Sulastri, H., & Nuraini, A. (2021). Perubahan psikososial pada masa remaja dan dampaknya terhadap kesehatan mental. *Jurnal Psikologi Perkembangan*, 9(2), 77–86.
- Rahmawati, D. (2022). Efektivitas penyuluhan kesehatan terhadap kepatuhan konsumsi tablet tambah darah pada remaja putri di Kabupaten Bantul. *Jurnal Keperawatan Komunitas*, 5(1), 56–64.
- Rahmawati, D., Anwar, K., & Putri, A. R. (2023). Hubungan tingkat pendidikan dengan pengetahuan konsumsi tablet tambah darah pada remaja putri. *Jurnal Kesehatan Masyarakat Indonesia*, 19(1), 45–52.
- Retni, A., & Lihu, F. (2021). Faktor-faktor yang berhubungan dengan terjadinya kehamilan tidak diinginkan pada remaja di wilayah Kecamatan Bolangitang Barat.
- Sari, N., & Handayani, T. (2024). Faktor-faktor yang mempengaruhi pengetahuan remaja putri tentang konsumsi tablet tambah darah. *Jurnal Gizi dan Kesehatan Remaja*, 6(1), 30–38.
- Sari, N., & Rahmawati, D. (2023). Hubungan pengetahuan dengan sikap konsumsi tablet tambah darah pada remaja putri. *Jurnal Gizi dan Kesehatan Remaja*, 6(1), 15–23.
- Susanti, D., Rahmawati, N., & Fadillah, R. (2025). Knowledge improvement of adolescent girls with weekly iron folic acid supplementation (WIFAS) education. *Journal of Public Health Research*, 14(2), 101–109. <https://doi.org/10.4081/jphr.2025.2849>
- Theodoridis, X., & Kraemer, L. (2020). Iron supplementation and adolescent health: A review. *Journal of Nutrition and Health Sciences*, 7(3), 122–131.
- Utami, S., Wulandari, A., & Kurniawan, I. (2021). Efektivitas tablet tambah darah terhadap peningkatan hemoglobin pada remaja putri. *Jurnal Gizi dan Dietetik Indonesia*, 9(1), 40–49.
- Utari, D., & Novayelinda, R. (2024). Efek samping konsumsi tablet tambah darah pada remaja putri di Pekanbaru. *Jurnal Kebidanan Nusantara*, 15(1), 23–31.
- Wahyuni, S., & Sulastri, E. (2022). Pengaruh tingkat kelas terhadap pengetahuan kesehatan reproduksi remaja putri. *Jurnal Pendidikan dan Kesehatan*, 10(2), 134–141.
- Wardani. (2024). Factors related to iron tablets consumption compliance among adolescent girls in Indonesia: Literature review. *Media Gizi Kesmas*, 13(2), 878–897.
- Warmansyah, J. (2020). Metode penelitian dan pengolahan data untuk pengambilan keputusan pada perusahaan.
- World Health Organization. (2021). World health statistics 2021: Monitoring health for the SDGs. WHO.
- World Health Organization. (2022). Adolescent health and development: A framework for country action. WHO.