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Hello,

Lina Handayani has submitted the manuscript, "Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention" to Media Publikasi Promosi Kesehatan Indonesia (MPPKI).

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

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Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention

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ABSTRACT

Introduction: Adolescence is a critical phase marked by rapid physical and mental development, which necessitates increased nutritional intake to promote long-term health. Adolescent girls are especially vulnerable to iron deficiency, which can result in anemia and heighten the risk of stunting in future generations.

Method: This study employs a quantitative, quasi-experimental design. The study population consisted of 541 adolescent girls aged 12-18 years, with a purposive sample of 91 participants divided into two groups: the experimental group, which received flip chart-based education, and the control group, which did not receive the intervention. The study was conducted in Kalurahan Triharjo, Sleman, DI Yogyakarta (intervention location), and Kalurahan Pandowoharjo, Sleman, DI Yogyakarta (control location). Data were collected using pre- and post-intervention questionnaires, which were tested for validity and reliability. The data were analyzed using the Wilcoxon test and paired t-test

Result: Statistical analysis showed significant improvements in knowledge and attitudes in the intervention group. The average knowledge score in the intervention group increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest, with a mean difference of 4.94 ($p = 0.000$). In the control group, knowledge increased moderately from 15.70 ± 1.051 to 16.43 ± 1.068, with a mean difference of 0.73 ($p = 0.000$). Similarly, attitude scores in the intervention group significantly increased from 59.04 ± 8.512 to 75.31 ± 2.410, with a mean difference of 16.27 ($p = 0.000$). In contrast, attitude scores in the control group increased from 53.59 ± 4.893 to 57.72 ± 3.607, with a mean difference of 4.13 ($p = 0.036$).

Conclusion: The flip chart intervention was found to be effective in significantly improving adolescents' knowledge and attitudes toward stunting prevention. In the intervention group, knowledge increased by a mean difference of 4.94 (Wilcoxon test, $p = 0.000$), and attitudes improved by a mean difference of 16.27 (Wilcoxon test, $p = 0.000$). In contrast, the control group showed smaller improvements in both knowledge (mean difference of 0.73, Wilcoxon test, $p = 0.000$) and attitudes (mean difference of 4.13, paired t-test, $p = 0.036$). However, the study had limitations due to external exposure to nutrition information for the control group. Future research should control external factors by providing basic information to the control group without in-depth exposure to the flip chart intervention.

Keywords: *Health promotion media, Flip Chart, Nutrition, Stunting*

INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls, especially during menstruation, require additional iron intake to support hemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues. Adolescence can be a key moment to address malnutrition conditions such as stunting or anemia. Micronutrient deficiencies, especially iron, can hinder linear growth (2).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (3). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (4). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anemia, most of which is caused by iron deficiency (iron deficiency anemia). Anemia is more prevalent among female adolescents than male adolescents (5).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (3). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future. Therefore, optimal nutritional intake, both in terms of quantity and quality, is crucial for healthy growth and development in adolescents, as well as for preventing stunting that can have long-term impacts on the next generation (6). Sustained good nutrition in adolescent girls will not only support their health today but also break the intergenerational cycle of poor nutrition that has persisted for generations.

Stunting is a growth and development disorder in children caused by malnutrition, recurrent infections, and a lack of psychosocial stimulation. A child is categorized as stunted if their height is more than two standard deviations below the WHO standards (7). Occurring primarily during the first 1,000 days of life, stunting impacts cognition, education, and future productivity. In 2022, the WHO reported that 149 million children under five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread consequences for health, the economy, and social development (8).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (9). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (9). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (10).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counseling, iron supplementation, and reproductive health education to prevent anemia, which negatively impacts pregnancy and future child growth (11). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential. A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (12). In the context of stunting prevention, this motivation can encourage adolescents to take an active role in breaking the intergenerational cycle of stunting, both through adopting healthy lifestyles and ensuring adequate nutrition in the future. Breaking the cycle of stunting can be achieved through education that provides deeper understanding and changes in attitudes about the importance of nutrition, reproductive health, and early stunting prevention.

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (11). Health education is a continuous, dynamic, and complex learning process that takes place

throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (13). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting.

One strategy that can be implemented is through the use of health promotion media. These media include various tools used to convey health messages with the aim of improving the health status of the target population. In general, media can be divided into three categories: print media, electronic media, and billboards. Print media includes various types, such as flip charts, leaflets, booklets, flyers, posters, and photos. Meanwhile, electronic media includes television, radio, video, slides, and film strips (14).

The process of delivering information to adolescents requires engaging techniques to ensure they receive and understand the information effectively. Visualizing information in an engaging and easily understandable way helps adolescents absorb crucial details about proper nutrition intake, the importance of nutritional balance, and the prevention of anemia and stunting. According to research by Alviani and Dwianggitamawati, the effectiveness of health education largely depends on the use of media that aligns with the educational goals being implemented. Media plays an important role in delivering information in a more attractive and easily understood manner, so the message can be well received by the audience and encourage positive behavior changes. The use of flipchart media has been proven effective in improving attitudes and knowledge regarding stunting prevention (15).

A flip chart, or flipbook media, is a visual aid consisting of sheets of paper that resemble an album or calendar. Each flip chart sheet typically displays an image on the front intended for the audience to view, while the back contains written explanations that assist the facilitator in providing additional information (16). As an educational tool, flip charts are considered effective for public health outreach because they enhance the audience's understanding of the topic being presented.

According to a study, flipchart media is an effective tool for use in outreach on public health issues. Its use can improve the audience's knowledge after the presentation with this media. Flip charts help present information visually and in an easily understandable manner, thereby strengthening the target audience's comprehension of the material being delivered (17). ith increased understanding, adolescents are more likely to adopt positive nutritional behaviors, which are crucial in preventing stunting in their generation and in the children they will have in the future.

METHOD

This study employs a quantitative approach with a quasi-experimental design to evaluate the effectiveness of a flip chart-based educational intervention in enhancing adolescent girls' knowledge and attitudes toward nutrition for stunting prevention. The study population comprises all adolescent girls aged 12-18 years, totaling 541 individuals. Using purposive sampling, a sample of 91 participants was selected, divided into an experimental group, which received the flip chart intervention, and a control group, which did not. The intervention was conducted in Kalurahan Triharjo, Sleman, DI Yogyakarta, while Kalurahan Pandowoharjo, Sleman, DI Yogyakarta, served as the control site.

The instrument used in this study was an open-ended questionnaire, where the researcher provided answers aligned with the educational material that had been presented to the respondents. The content of the educational flip chart media includes information on topics such as balanced nutrition for adolescent girls, the impact of stunting, the causes of stunting, and efforts to prevent stunting. The knowledge questionnaire was adapted from the study by Anisah (2023) titled "Pengaruh Pemberian Penyuluhan dan Buku Saku Tentang Gizi Terhadap Tingkat Pengetahuan dan Sikap Pada Remaja Putri Dalam Upaya Pencegahan Stunting di Madrasah Aliyah Madania Bantul." This questionnaire was tested for reliability and was found to be reliable based on the results of the reliability test (Cronbach's Alpha <0.06), with a Cronbach's Alpha value of 0.676 for the knowledge questionnaire and 0.753 for the attitude questionnaire. The data collection procedure began with a pretest for both groups to measure their initial knowledge and attitudes. The experimental group then received an educational intervention using flip charts for 1 hour, while the control group did not receive any intervention. Three days after the intervention, a posttest using the same questionnaire was administered to measure changes in the adolescents' knowledge and attitudes regarding stunting prevention.

T The collected data were analyzed using descriptive statistics to examine the frequency distribution of respondents' knowledge and attitudes before and after the intervention. Additionally, normality tests were conducted to assess data distribution, as presented in Table 1. The results indicated that the knowledge and attitude variables in the intervention group, as well as the knowledge variable in the control group, did not follow a normal distribution and were therefore analyzed using the Wilcoxon test. Conversely, the attitude variable in the control group met the normality assumption, allowing it to be analyzed using the Paired T-Test (18). This statistical analysis aimed to compare the differences in knowledge and attitudes between the intervention and control groups, with a significance threshold of $p = 0.05$.

Ethical review for this study was conducted by the Health Research Ethics Committee of the Banyuwangi School of Health Sciences to protect the rights and welfare of human research participants. The researcher obtained ethical approval (No: 332/04/KEPK-STIKESBWI/VIII/2024) issued in Banyuwangi on August 15, 2024.

RESULTS

The characteristics of the respondents in this study include variables such as age, education level, and occupation. The youngest age of respondents is 12 years while the oldest is 18 years. A detailed description of the respondent characteristics is provided in Table 1.

Table 1. Respondent Characteristics

Intervention Group			Control Group		
Variable	**n**	**%**	**Variable**	**n**	**%**
Age			**Age**		
12 years	6	13.3	12 years	5	10.9
13 years	11	24.4	13 years	4	8.7
14 years	3	6.7	14 years	5	10.9
15 years	5	11.1	15 years	10	21.7
16 years	5	11.1	16 years	7	15.2
17 years	6	13.3	17 years	11	23.9
18 years	9	20.0	18 years	4	8.7
Father's Last Education			**Father's Last Education**		
Middle School	9	20	Middle School	7	15.2
High School	23	51.1	High School	31	67.4
Bachelor's Degree	13	28.9	Bachelor's Degree	8	17.4
Mother's Last Education			**Mother's Last Education**		
Elementary School	3	6.7	Elementary School	3	6.5
Middle School	9	20	Middle School	10	21.7
High School	23	51.1	High School	26	56.7
Bachelor's Degree	10	22.2	Bachelor's Degree	7	15.2
Father's Occupation			**Father's Occupation**		
Laborer	17	37.8	Laborer	21	45.7
Entrepreneur	11	24.4	Entrepreneur	12	26.1
Merchant	4	8.9	Teacher	4	8.7
Civil Servant	9	20	Millitary	4	8.7
Police Officer	2	4.4	Civil Servant	5	10.9
Millitary	2	4.4			
Mother's Occupation			**Mother's Occupation**		
Housewife	28	62.2	Housewife	28	60.9
Entrepreneur	3	6.7	Entrepreneur	7	15.2
Merchant	9	20	Merchant	3	6.5
Teacher	2	4.4	Teacher	7	15.2
Nurse	1	2.2	Civil Servant	1	2.2
Midwife	1	2.2			
Civil Servant	1	2.2			

Table 1 shows that in the intervention group, respondents ranged from 12 to 18 years old, with the highest distribution at ages 13 (24.4%) and 18 (20%). The majority of fathers had a high school education (51.1%), as did most mothers (51.1%). Regarding parental occupations, most fathers were employed as laborers (37.8%), and the majority of mothers were housewives (62.2%).

Hence, in the control group, respondents also ranged from 12 to 18 years old, with the largest distribution at age 17 (23.9%). Fathers' education in this group was primarily high school (67.6%), and mothers' education was similarly concentrated at the high school level (56.6%). Most fathers in the control group worked as laborers (45.7%), and most mothers were housewives (60.9%). This data indicates a family background with predominantly secondary education, fathers employed in the informal sector, and mothers as primary homemakers. These characteristics are crucial for designing practical and relevant nutrition education interventions, taking into account the socioeconomic and cultural context of the respondents' families.

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.000, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption. However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 2. Normality Test Results of Pretest and Posttest Differences

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Knowledge Difference (Intervention)	0.205	45	0.000	0.911	45	0.002
Attitude Difference (Intervention)	0.225	45	0.000	0.843	45	0.000
Knowledge Difference (Control)	0.210	46	0.000	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the posttest with a standard deviation of 0.883. The mean difference between the pretest and posttest was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.000 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the posttest with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the posttest with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the posttest with a standard deviation of 3.607. The mean difference between the pretest and posttest was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

Table 3. Differences Between Variables

Variable	Kelompok	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.000
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.000
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.000
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

DISCUSSION

To support a deeper understanding, engaging and effective health promotion media or tools are necessary. Health promotion media can be classified into three types: visual media (such as posters, leaflets, flip charts, PowerPoint presentations), audio media (radio), and audiovisual media (films and videos) (19). To enhance deeper understanding, it is important to use engaging and effective health promotion tools or media. Health promotion media

are categorized into three types: visual media (such as posters, leaflets, flip charts, PowerPoint presentations, etc.), audio media (such as radio), and audiovisual media (such as films and videos) (20). These media act as supportive tools in the educational process. The greater the number of senses involved, the more information can be absorbed, resulting in a clearer and more thorough understanding of the subject matter (21).

According to the Ministry of Health, efforts to improve health knowledge are part of a health strategy aimed at preparing adolescents to grow into healthy, intelligent, high-quality, productive individuals who actively contribute to maintaining and enhancing their own health. A particular focus on adolescent girls is essential to help them navigate the physical, emotional, and social changes that occur during adolescence, as well as to prepare them for future reproductive health roles (22). Therefore, nutrition education plays a crucial role in enhancing knowledge and shaping mindsets and behaviors that support adolescent health in the future.

This study found a significant difference in the level of knowledge about nutrition for stunting prevention before and after the intervention using flip chart media in the intervention group, with a p-value of 0.000 ($p < 0.05$). These results indicate that health education using flip chart media has a significant impact on improving knowledge about nutrition in efforts to prevent stunting. This finding is consistent with research conducted by Alviani and Dwianggitamawati, which showed a p-value of 0.020 ($p < 0.05$), further supporting the conclusion that health education through flip chart media is effective in enhancing understanding of stunting prevention. The provision of health education plays a crucial role in improving health quality, both through increased knowledge and more targeted changes in attitudes (15).

In the control group, which did not receive the intervention, statistical analysis also revealed a significant difference in the knowledge of adolescent girls about nutrition for stunting prevention, with a p-value of 0.000 ($p < 0.05$). Previous research suggests that the increase in knowledge in the control group may have occurred due to exposure to nutrition information from sources other than the intervention in this study (2). A comparison of the mean score improvement in knowledge shows a more significant difference in the intervention group, with an increase of 4.94 (pretest 14.42 ± 2.388 to posttest 19.36 ± 0.883), compared to the control group, which only experienced an increase of 0.73 (pretest 15.70 ± 1.051 to posttest 16.43 ± 1.068). This further reinforces the effectiveness of using flip chart media in delivering nutrition education. Therefore, it can be concluded that the flip chart as an educational media not only improved understanding of the importance of nutrition in stunting prevention but also proved to be more effective compared to the method applied in the control group.

A study in Ketapang District found that the use of flip charts in nutrition education increased respondents' knowledge of nutrition by 8.923%. Providing nutrition education is expected to enhance respondents' understanding of balanced nutrition and stunting prevention, which could potentially lead to positive behavior changes. This increase in knowledge was achieved because the nutrition education materials presented using flip chart media were found to be easily understood by the respondents (16).

Knowledge plays a crucial role in influencing an individual's attitudes and actions toward stunting prevention. As found in a study in Jambi City, a deeper understanding of nutrition can drive attitude changes, so individuals with higher knowledge about the importance of nutrition are more likely to exhibit positive and proactive attitudes toward stunting prevention (23). Attitude is defined as an individual's response or reaction to a particular stimulus or object, involving cognitive, affective, and attentional aspects. Attitude is not merely an immediate reaction but reflects various aspects of mental and emotional experiences that are integrated. These experiences, whether direct or indirect, shape an individual's perspective toward a specific object (19).

The results of this study indicate that the educational intervention using flip charts significantly improved respondents' attitudes toward nutrition in efforts to address stunting, with a p-value of 0.000 ($p < 0.05$). The flip chart proved to be an effective educational tool, not only conveying information but also changing perspectives and raising awareness among adolescent girls about the importance of nutrition. This finding is consistent with a study conducted in Surabaya, which showed an improvement in both knowledge and attitudes among respondents after receiving education through health promotion media using flip charts. Therefore, health promotion using flip chart media is considered suitable and effective for providing information on stunting prevention (21).

In the control group, statistical analysis also showed a significant difference in adolescent girls' attitudes toward nutrition for stunting prevention, with a p-value of 0.000 ($p < 0.05$). This result diverges from the findings of Fauziatin et al., who observed no significant change in mean attitude scores between pretest and posttest on stunting prevention within the control group. This difference may stem from the absence of targeted stunting prevention knowledge provided to the control group, unlike the intervention group, which received specific educational content on the topic (24).

According to a study in Semarang, the improvement in attitudes in the control group may have occurred because adolescents experienced an increase in knowledge, even without receiving specific information about stunting from other sources. This external information could indirectly influence their knowledge and attitude changes, despite the lack of a targeted educational intervention in the study (2). This external information can have

an indirect impact on improving knowledge and changing attitudes in the control group, even without specific educational intervention in the study. The improvement in attitude in the intervention group was seen from the mean difference in pretest and posttest scores of 16.27 (pretest 59.04 ± 8.512 to posttest 75.31 ± 2.410), compared to only 4.13 in the control group (pretest 53.59 ± 4.893 to posttest 57.72 ± 3.607). These results reinforce that the flip chart has a stronger and more tangible educational impact. The significant difference further supports the effectiveness of the flip chart in generating better behavioral changes compared to other educational methods applied in the control group.

According to Notoatmodjo, behaviors and attitudes toward prevention that are based on knowledge tend to be more enduring than those not grounded in knowledge. Individuals with increased knowledge are more likely to adopt supportive attitudes, which are reflected in better actions or behaviors. This increase in knowledge is influenced by factors such as the methods, content, and media or tools used to deliver the message. These factors must work together in a supportive manner to achieve optimal outcomes (19). In this context, health promotion methods, the material on nutrition for stunting prevention, and the use of flip chart media collectively play an effective role in enhancing the knowledge and attitudes of adolescent girls.

CONCLUSION

In conclusion, flip charts have proven to be an effective educational tool in improving adolescents' knowledge and attitudes towards stunting prevention. The intervention group showed significant improvements in knowledge, with the average score increasing from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest, with a mean difference of 4.94 (Wilcoxon test, p = 0.000). Attitudes also significantly improved, with the average score increasing from 59.04 ± 8.512 at pretest to 75.31 ± 2.410 at posttest, with a mean difference of 16.27 (Wilcoxon test, p = 0.000). In contrast, the control group showed smaller improvements in knowledge, with the average score increasing from 15.70 ± 1.051 at pretest to 16.43 ± 1.068 at posttest, with a mean difference of 0.73 (Wilcoxon test, p = 0.000). Attitudes in the control group also showed improvement, with the average score increasing from 53.59 ± 4.893 at pretest to 57.72 ± 3.607 at posttest, with a mean difference of 4.13 (paired t-test, p = 0.036). These findings confirm that flip charts are effective in delivering nutrition information in an engaging and easy-to-understand way, thus enhancing understanding and commitment to stunting prevention.

SUGGESTION

This study has limitations, as the control group was not completely shielded from external information regarding nutrition, which may have influenced their knowledge and attitude improvements. To minimize the influence of external information on the control group, it is suggested that future studies provide basic information similar to that given to the intervention group, but without in-depth exposure through the flip chart. This approach is expected to provide a more valid comparison regarding the effectiveness of the flip chart as a nutrition education medium.

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3. Email pemberitahuan hasil penyaringan awal editorial (*Editorial decision: Revisions Required*) (19 November 2024)

UNIVERSITAS
AHMAD DAHLAN

LINA HANDAYANI <lina.handayani@ikm.uad.ac.id>

[MPPKI] Editor Decision

1 message

MPPKI_Editorial <jurnal@unismuhpalu.ac.id> Tue, Nov 19, 2024 at 8:29 AM
To: Lina Handayani <lina.handayani@ikm.uad.ac.id>, Melly Eka Saputri <2208053039@webmail.uad.ac.id>, Heni Trisnowati <heni.trisnowati@pascakesmas.uad.ac.id>, Tria Nisa Novianti <2308053037@webmail.uad.ac.id>, Isah Fitriani <2307053018@webmail.uad.ac.id>, Aufatcha Ayutya Suryana <aufatcha2100029101@webmail.uad.ac.id>, Tania Vergawita <2200029308@webmail.uad.ac.id>, Ardiansyah Jumaedi Nasir <ardiansyahjnasir@gmail.com>, Asa Ismia Bunga Aisyahrani <ilovebunga@gmail.com>

Lina Handayani, Melly Eka Saputri , Heni Trisnowati, Tria Nisa Novianti, Isah Fitriani, Aufatcha Ayutya Suryana, Tania Vergawita , Ardiansyah Jumaedi Nasir, Asa Ismia Bunga Aisyahrani :

We have reached a decision regarding your submission to Media Publikasi Promosi Kesehatan Indonesia (MPPKI), "Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention".

Our decision is: **Revisions Required**

MPPKI_Editorial
Media Publikasi Promosi Kesehatan Indonesia (MPPKI)
mppki@unismuhpalu.ac.id

Reviewer A:
Recommendation: Revisions Required

Reviewer B:
Recommendation: Revisions Required

Media Publikasi Promosi Kesehatan Indonesia (MPPKI)
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4. Dokumen permintaan revisi dari *Reviewer* A

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Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention

ABSTRACT

Introduction: Adolescence is a critical phase marked by rapid physical and mental development, which necessitates increased nutritional intake to promote long-term health. Adolescent girls are especially vulnerable to iron deficiency, which can result in anemia and heighten the risk of stunting in future generations.

Method: This study employs a quantitative, quasi-experimental design. The study population consisted of 541 adolescent girls aged 12-18 years, with a purposive sample of 91 participants divided into two groups: the experimental group, which received flip chart-based education, and the control group, which did not receive the intervention. The study was conducted in Kalurahan Triharjo, Sleman, DI Yogyakarta (intervention location), and Kalurahan Pandowoharjo, Sleman, DI Yogyakarta (control location). Data were collected using pre- and post-intervention questionnaires, which were tested for validity and reliability. The data were analyzed using the Wilcoxon test and paired t-test

Result: Statistical analysis showed significant improvements in knowledge and attitudes in the intervention group. The average knowledge score in the intervention group increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest, with a mean difference of 4.94 ($p = 0.000$). In the control group, knowledge increased moderately from 15.70 ± 1.051 to 16.43 ± 1.068, with a mean difference of 0.73 ($p = 0.000$). Similarly, attitude scores in the intervention group significantly increased from 59.04 ± 8.512 to 75.31 ± 2.410, with a mean difference of 16.27 ($p = 0.000$). In contrast, attitude scores in the control group increased from 53.59 ± 4.893 to 57.72 ± 3.607, with a mean difference of 4.13 ($p = 0.036$).

Conclusion: The flip chart intervention was found to be effective in significantly improving adolescents' knowledge and attitudes toward stunting prevention. In the intervention group, knowledge increased by a mean difference of 4.94 (Wilcoxon test, $p = 0.000$), and attitudes improved by a mean difference of 16.27 (Wilcoxon test, $p = 0.000$). In contrast, the control group showed smaller improvements in both knowledge (mean difference of 0.73, Wilcoxon test, $p = 0.000$) and attitudes (mean difference of 4.13, paired t-test, $p = 0.036$). However, the study had limitations due to external exposure to nutrition information for the control group. Future research should control external factors by providing basic information to the control group without in-depth exposure to the flip chart intervention.

Keywords: *Health promotion media, Flip Chart, Nutrition, Stunting*

INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls,

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especially during menstruation, require additional iron intake to support hemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues. Adolescence can be a key moment to address malnutrition conditions such as stunting or anemia. Micronutrient deficiencies, especially iron, can hinder linear growth (2).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (3). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (4). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anemia, most of which is caused by iron deficiency (iron deficiency anemia). Anemia is more prevalent among female adolescents than male adolescents (5).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (3). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future. Therefore, optimal nutritional intake, both in terms of quantity and quality, is crucial for healthy growth and development in adolescents, as well as for preventing stunting that can have long-term impacts on the next generation (6). Sustained good nutrition in adolescent girls will not only support their health today but also break the intergenerational cycle of poor nutrition that has persisted for generations.

Stunting is a growth and development disorder in children caused by malnutrition, recurrent infections, and a lack of psychosocial stimulation. A child is categorized as stunted if their height is more than two standard deviations below the WHO standards (7). Occurring primarily during the first 1,000 days of life, stunting impacts cognition, education, and future productivity. In 2022, the WHO reported that 149 million children under five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread consequences for health, the economy, and social development (8).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (9). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (9). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (10).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counseling, iron supplementation, and reproductive health education to prevent anemia, which negatively impacts pregnancy and future child growth (11). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential. A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (12). In the context of stunting prevention, this motivation can encourage adolescents to take an active role in breaking the intergenerational cycle of stunting, both through adopting healthy lifestyles and ensuring adequate nutrition in the future. Breaking the cycle of stunting can be achieved through education that provides deeper understanding and changes in attitudes about the importance of nutrition, reproductive health, and early stunting prevention.

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (11). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (13). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting.

One strategy that can be implemented is through the use of health promotion media. These media include various tools used to convey health messages with the aim of improving the health status of the target population. In

general, media can be divided into three categories: print media, electronic media, and billboards. Print media includes various types, such as flip charts, leaflets, booklets, flyers, posters, and photos. Meanwhile, electronic media includes television, radio, video, slides, and film strips (14).

The process of delivering information to adolescents requires engaging techniques to ensure they receive and understand the information effectively. Visualizing information in an engaging and easily understandable way helps adolescents absorb crucial details about proper nutrition intake, the importance of nutritional balance, and the prevention of anemia and stunting. According to research by Alviani and Dwianggitamawati, the effectiveness of health education largely depends on the use of media that aligns with the educational goals being implemented. Media plays an important role in delivering information in a more attractive and easily understood manner, so the message can be well received by the audience and encourage positive behavior changes. The use of flipchart media has been proven effective in improving attitudes and knowledge regarding stunting prevention (15).

A flip chart, or flipbook media, is a visual aid consisting of sheets of paper that resemble an album or calendar. Each flip chart sheet typically displays an image on the front intended for the audience to view, while the back contains written explanations that assist the facilitator in providing additional information (16). As an educational tool, flip charts are considered effective for public health outreach because they enhance the audience's understanding of the topic being presented.

According to a study, flipchart media is an effective tool for use in outreach on public health issues. Its use can improve the audience's knowledge after the presentation with this media. Flip charts help present information visually and in an easily understandable manner, thereby strengthening the target audience's comprehension of the material being delivered (17). ith increased understanding, adolescents are more likely to adopt positive nutritional behaviors, which are crucial in preventing stunting in their generation and in the children they will have in the future.

METHOD

This study employs a quantitative approach with a quasi-experimental design to evaluate the effectiveness of a flip chart-based educational intervention in enhancing adolescent girls' knowledge and attitudes toward nutrition for stunting prevention. The study population comprises all adolescent girls aged 12-18 years, totaling 541 individuals. Using purposive sampling, a sample of 91 participants was selected, divided into an experimental group, which received the flip chart intervention, and a control group, which did not. The intervention was conducted in Kalurahan Triharjo, Sleman, DI Yogyakarta, while Kalurahan Pandowoharjo, Sleman, DI Yogyakarta, served as the control site.

The instrument used in this study was an open-ended questionnaire, where the researcher provided answers aligned with the educational material that had been presented to the respondents. The content of the educational flip chart media includes information on topics such as balanced nutrition for adolescent girls, the impact of stunting, the causes of stunting, and efforts to prevent stunting. The knowledge questionnaire was adapted from the study by Anisah (2023) titled "Pengaruh Pemberian Penyuluhan dan Buku Saku Tentang Gizi Terhadap Tingkat Pengetahuan dan Sikap Pada Remaja Putri Dalam Upaya Pencegahan Stunting di Madrasah Aliyah Madania Bantul." This questionnaire was tested for reliability and was found to be reliable based on the results of the reliability test (Cronbach's Alpha <0.06), with a Cronbach's Alpha value of 0.676 for the knowledge questionnaire and 0.753 for the attitude questionnaire. The data collection procedure began with a pretest for both groups to measure their initial knowledge and attitudes. The experimental group then received an educational intervention using flip charts for 1 hour, while the control group did not receive any intervention. Three days after the intervention, a posttest using the same questionnaire was administered to measure changes in the adolescents' knowledge and attitudes regarding stunting prevention.

T The collected data were analyzed using descriptive statistics to examine the frequency distribution of respondents' knowledge and attitudes before and after the intervention. Additionally, normality tests were conducted to assess data distribution, as presented in Table 1. The results indicated that the knowledge and attitude variables in the intervention group, as well as the knowledge variable in the control group, did not follow a normal distribution and were therefore analyzed using the Wilcoxon test. Conversely, the attitude variable in the control group met the normality assumption, allowing it to be analyzed using the Paired T-Test (18). This statistical analysis aimed to compare the differences in knowledge and attitudes between the intervention and control groups, with a significance threshold of $p = 0.05$.

Ethical review for this study was conducted by the Health Research Ethics Committee of the Banyuwangi School of Health Sciences to protect the rights and welfare of human research participants. The researcher obtained ethical approval (No: 332/04/KEPK-STIKESBWI/VIII/2024) issued in Banyuwangi on August 15, 2024.

RESULTS

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The characteristics of the respondents in this study include variables such as age, education level, and occupation. The youngest age of respondents is 12 years while the oldest is 18 years. A detailed description of the respondent characteristics is provided in Table 1.

Table 1. Respondent Characteristics

Intervention Group			Control Group		
Variable	**n**	**%**	**Variable**	**n**	**%**
Age			**Age**		
12 years	6	13.3	12 years	5	10.9
13 years	11	24.4	13 years	4	8.7
14 years	3	6.7	14 years	5	10.9
15 years	5	11.1	15 years	10	21.7
16 years	5	11.1	16 years	7	15.2
17 years	6	13.3	17 years	11	23.9
18 years	9	20.0	18 years	4	8.7
Father's Last Education			**Father's Last Education**		
Middle School	9	20	Middle School	7	15.2
High School	23	51.1	High School	31	67.4
Bachelor's Degree	13	28.9	Bachelor's Degree	8	17.4
Mother's Last Education			**Mother's Last Education**		
Elementary School	3	6.7	Elementary School	3	6.5
Middle School	9	20	Middle School	10	21.7
High School	23	51.1	High School	26	56.7
Bachelor's Degree	10	22.2	Bachelor's Degree	7	15.2
Father's Occupation			**Father's Occupation**		
Laborer	17	37.8	Laborer	21	45.7
Entrepreneur	11	24.4	Entrepreneur	12	26.1
Merchant	4	8.9	Teacher	4	8.7
Civil Servant	9	20	Millitary	4	8.7
Police Officer	2	4.4	Civil Servant	5	10.9
Millitary	2	4.4			
Mother's Occupation			**Mother's Occupation**		
Housewife	28	62.2	Housewife	28	60.9
Entrepreneur	3	6.7	Entrepreneur	7	15.2
Merchant	9	20	Merchant	3	6.5
Teacher	2	4.4	Teacher	7	15.2
Nurse	1	2.2	Civil Servant	1	2.2
Midwife	1	2.2			
Civil Servant	1	2.2			

Table 1 shows that in the intervention group, respondents ranged from 12 to 18 years old, with the highest distribution at ages 13 (24.4%) and 18 (20%). The majority of fathers had a high school education (51.1%), as did most mothers (51.1%). Regarding parental occupations, most fathers were employed as laborers (37.8%), and the majority of mothers were housewives (62.2%).

Hence, in the control group, respondents also ranged from 12 to 18 years old, with the largest distribution at age 17 (23.9%). Fathers' education in this group was primarily high school (67.6%), and mothers' education was similarly concentrated at the high school level (56.6%). Most fathers in the control group worked as laborers (45.7%), and most mothers were housewives (60.9%). This data indicates a family background with predominantly secondary education, fathers employed in the informal sector, and mothers as primary homemakers. These characteristics are crucial for designing practical and relevant nutrition education interventions, taking into account the socioeconomic and cultural context of the respondents' families.

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.000, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption.

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However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 2. Normality Test Results of Pretest and Posttest Differences

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Knowledge Difference (Intervention)	0.205	45	0.000	0.911	45	0.002
Attitude Difference (Intervention)	0.225	45	0.000	0.843	45	0.000
Knowledge Difference (Control)	0.210	46	0.000	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the posttest with a standard deviation of 0.883. The mean difference between the pretest and posttest was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.000 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the posttest with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the posttest with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the posttest with a standard deviation of 3.607. The mean difference between the pretest and posttest was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

Table 3. Differences Between Variables

Variable	Kelompok	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.000
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.000
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.000
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

DISCUSSION

To support a deeper understanding, engaging and effective health promotion media or tools are necessary. Health promotion media can be classified into three types: visual media (such as posters, leaflets, flip charts, PowerPoint presentations), audio media (radio), and audiovisual media (films and videos) (19). To enhance deeper understanding, it is important to use engaging and effective health promotion tools or media. Health promotion media are categorized into three types: visual media (such as posters, leaflets, flip charts, PowerPoint presentations, etc.), audio media (such as radio), and audiovisual media (such as films and videos) (20). These media act as supportive tools in the educational process. The greater the number of senses involved, the more information can be absorbed, resulting in a clearer and more thorough understanding of the subject matter (21).

According to the Ministry of Health, efforts to improve health knowledge are part of a health strategy aimed

at preparing adolescents to grow into healthy, intelligent, high-quality, productive individuals who actively contribute to maintaining and enhancing their own health. A particular focus on adolescent girls is essential to help them navigate the physical, emotional, and social changes that occur during adolescence, as well as to prepare them for future reproductive health roles (22). Therefore, nutrition education plays a crucial role in enhancing knowledge and shaping mindsets and behaviors that support adolescent health in the future.

This study found a significant difference in the level of knowledge about nutrition for stunting prevention before and after the intervention using flip chart media in the intervention group, with a p-value of 0.000 ($p < 0.05$). These results indicate that health education using flip chart media has a significant impact on improving knowledge about nutrition in efforts to prevent stunting. This finding is consistent with research conducted by Alviani and Dwianggitamawati, which showed a p-value of 0.020 ($p < 0.05$), further supporting the conclusion that health education through flip chart media is effective in enhancing understanding of stunting prevention. The provision of health education plays a crucial role in improving health quality, both through increased knowledge and more targeted changes in attitudes (15).

In the control group, which did not receive the intervention, statistical analysis also revealed a significant difference in the knowledge of adolescent girls about nutrition for stunting prevention, with a p-value of 0.000 ($p < 0.05$). Previous research suggests that the increase in knowledge in the control group may have occurred due to exposure to nutrition information from sources other than the intervention in this study (2). A comparison of the mean score improvement in knowledge shows a more significant difference in the intervention group, with an increase of 4.94 (pretest 14.42 ± 2.388 to posttest 19.36 ± 0.883), compared to the control group, which only experienced an increase of 0.73 (pretest 15.70 ± 1.051 to posttest 16.43 ± 1.068). This further reinforces the effectiveness of using flip chart media in delivering nutrition education. Therefore, it can be concluded that the flip chart as an educational media not only improved understanding of the importance of nutrition in stunting prevention but also proved to be more effective compared to the method applied in the control group.

A study in Ketapang District found that the use of flip charts in nutrition education increased respondents' knowledge of nutrition by 8.923%. Providing nutrition education is expected to enhance respondents' understanding of balanced nutrition and stunting prevention, which could potentially lead to positive behavior changes. This increase in knowledge was achieved because the nutrition education materials presented using flip chart media were found to be easily understood by the respondents (16).

Knowledge plays a crucial role in influencing an individual's attitudes and actions toward stunting prevention. As found in a study in Jambi City, a deeper understanding of nutrition can drive attitude changes, so individuals with higher knowledge about the importance of nutrition are more likely to exhibit positive and proactive attitudes toward stunting prevention (23). Attitude is defined as an individual's response or reaction to a particular stimulus or object, involving cognitive, affective, and attentional aspects. Attitude is not merely an immediate reaction but reflects various aspects of mental and emotional experiences that are integrated. These experiences, whether direct or indirect, shape an individual's perspective toward a specific object (19).

The results of this study indicate that the educational intervention using flip charts significantly improved respondents' attitudes toward nutrition in efforts to address stunting, with a p-value of 0.000 ($p < 0.05$). The flip chart proved to be an effective educational tool, not only conveying information but also changing perspectives and raising awareness among adolescent girls about the importance of nutrition. This finding is consistent with a study conducted in Surabaya, which showed an improvement in both knowledge and attitudes among respondents after receiving education through health promotion media using flip charts. Therefore, health promotion using flip chart media is considered suitable and effective for providing information on stunting prevention (21).

In the control group, statistical analysis also showed a significant difference in adolescent girls' attitudes toward nutrition for stunting prevention, with a p-value of 0.000 ($p < 0.05$). This result diverges from the findings of Fauziatin et al., who observed no significant change in mean attitude scores between pretest and posttest on stunting prevention within the control group. This difference may stem from the absence of targeted stunting prevention knowledge provided to the control group, unlike the intervention group, which received specific educational content on the topic (24).

According to a study in Semarang, the improvement in attitudes in the control group may have occurred because adolescents experienced an increase in knowledge, even without receiving specific information about stunting from other sources. This external information could indirectly influence their knowledge and attitude changes, despite the lack of a targeted educational intervention in the study (2). This external information can have an indirect impact on improving knowledge and changing attitudes in the control group, even without specific educational intervention in the study. The improvement in attitude in the intervention group was seen from the mean difference in pretest and posttest scores of 16.27 (pretest 59.04 ± 8.512 to posttest 75.31 ± 2.410), compared to only 4.13 in the control group (pretest 53.59 ± 4.893 to posttest 57.72 ± 3.607). These results reinforce that the flip chart has a stronger and more tangible educational impact. The significant difference further supports the effectiveness of

the flip chart in generating better behavioral changes compared to other educational methods applied in the control group.

According to Notoatmodjo, behaviors and attitudes toward prevention that are based on knowledge tend to be more enduring than those not grounded in knowledge. Individuals with increased knowledge are more likely to adopt supportive attitudes, which are reflected in better actions or behaviors. This increase in knowledge is influenced by factors such as the methods, content, and media or tools used to deliver the message. These factors must work together in a supportive manner to achieve optimal outcomes (19). In this context, health promotion methods, the material on nutrition for stunting prevention, and the use of flip chart media collectively play an effective role in enhancing the knowledge and attitudes of adolescent girls.

CONCLUSION

In conclusion, flip charts have proven to be an effective educational tool in improving adolescents' knowledge and attitudes towards stunting prevention. The intervention group showed significant improvements in knowledge, with the average score increasing from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest, with a mean difference of 4.94 (Wilcoxon test, p = 0.000). Attitudes also significantly improved, with the average score increasing from 59.04 ± 8.512 at pretest to 75.31 ± 2.410 at posttest, with a mean difference of 16.27 (Wilcoxon test, p = 0.000). In contrast, the control group showed smaller improvements in knowledge, with the average score increasing from 15.70 ± 1.051 at pretest to 16.43 ± 1.068 at posttest, with a mean difference of 0.73 (Wilcoxon test, p = 0.000). Attitudes in the control group also showed improvement, with the average score increasing from 53.59 ± 4.893 at pretest to 57.72 ± 3.607 at posttest, with a mean difference of 4.13 (paired t-test, p = 0.036). These findings confirm that flip charts are effective in delivering nutrition information in an engaging and easy-to-understand way, thus enhancing understanding and commitment to stunting prevention.

SUGGESTION

This study has limitations, as the control group was not completely shielded from external information regarding nutrition, which may have influenced their knowledge and attitude improvements. To minimize the influence of external information on the control group, it is suggested that future studies provide basic information similar to that given to the intervention group, but without in-depth exposure through the flip chart. This approach is expected to provide a more valid comparison regarding the effectiveness of the flip chart as a nutrition education medium.

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Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention

ABSTRACT

Introduction: Adolescence is a critical phase marked by rapid physical and mental development, which necessitates increased nutritional intake to promote long-term health. Adolescent girls are especially vulnerable to iron deficiency, which can result in anemia and heighten the risk of stunting in future generations.

Method: This study employs a quantitative, quasi-experimental design. The study population consisted of 541 adolescent girls aged 12-18 years, with a purposive sample of 91 participants divided into two groups: the experimental group, which received flip chart-based education, and the control group, which did not receive the intervention. The study was conducted in Kalurahan Triharjo, Sleman, DI Yogyakarta (intervention location), and Kalurahan Pandowoharjo, Sleman, DI Yogyakarta (control location). Data were collected using pre- and post-intervention questionnaires, which were tested for validity and reliability. The data were analyzed using the Wilcoxon test and paired t-test

Result: Statistical analysis showed significant improvements in knowledge and attitudes in the intervention group. The average knowledge score in the intervention group increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest, with a mean difference of 4.94 (p = 0.000). In the control group, knowledge increased moderately from 15.70 ± 1.051 to 16.43 ± 1.068, with a mean difference of 0.73 (p = 0.000). Similarly, attitude scores in the intervention group significantly increased from 59.04 ± 8.512 to 75.31 ± 2.410, with a mean difference of 16.27 (p = 0.000). In contrast, attitude scores in the control group increased from 53.59 ± 4.893 to 57.72 ± 3.607, with a mean difference of 4.13 (p = 0.036).

Conclusion: The flip chart intervention was found to be effective in significantly improving adolescents' knowledge and attitudes toward stunting prevention. In the intervention group, knowledge increased by a mean difference of 4.94 (Wilcoxon test, p = 0.000), and attitudes improved by a mean difference of 16.27 (Wilcoxon test, p = 0.000). In contrast, the control group showed smaller improvements in both knowledge (mean difference of 0.73, Wilcoxon test, p = 0.000) and attitudes (mean difference of 4.13, paired t-test, p = 0.036). However, the study had limitations due to external exposure to nutrition information for the control group. Future research should control external factors by providing basic information to the control group without in-depth exposure to the flip chart intervention.

Keywords: *Health promotion media, Flip Chart, Nutrition, Stunting*

Commented [Au1]: The abstract effectively summarizes the research objective, methodology, key findings, and conclusions. However, it could be further improved by explicitly stating the significance of the study and its practical implications for public health strategies. The abstract currently omits a clear emphasis on how the intervention could be scaled or applied in broader contexts, which could make it more impactful.

INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls,

Commented [Au2]: The introduction is comprehensive and well-researched, providing a strong foundation for the study by contextualizing stunting as a critical public health issue. However, it could benefit from a sharper focus on the unique contribution of the study. While it outlines global and national statistics, it could emphasize the research gap this study aims to address, particularly the efficacy of specific educational tools like flip charts in the Indonesian context.

especially during menstruation, require additional iron intake to support hemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues. Adolescence can be a key moment to address malnutrition conditions such as stunting or anemia. Micronutrient deficiencies, especially iron, can hinder linear growth (2).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (3). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (4). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anemia, most of which is caused by iron deficiency (iron deficiency anemia). Anemia is more prevalent among female adolescents than male adolescents (5).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (3). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future. Therefore, optimal nutritional intake, both in terms of quantity and quality, is crucial for healthy growth and development in adolescents, as well as for preventing stunting that can have long-term impacts on the next generation (6). Sustained good nutrition in adolescent girls will not only support their health today but also break the intergenerational cycle of poor nutrition that has persisted for generations.

Stunting is a growth and development disorder in children caused by malnutrition, recurrent infections, and a lack of psychosocial stimulation. A child is categorized as stunted if their height is more than two standard deviations below the WHO standards (7). Occurring primarily during the first 1,000 days of life, stunting impacts cognition, education, and future productivity. In 2022, the WHO reported that 149 million children under five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread consequences for health, the economy, and social development (8).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (9). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (9). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (10).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counseling, iron supplementation, and reproductive health education to prevent anemia, which negatively impacts pregnancy and future child growth (11). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential. A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (12). In the context of stunting prevention, this motivation can encourage adolescents to take an active role in breaking the intergenerational cycle of stunting, both through adopting healthy lifestyles and ensuring adequate nutrition in the future. Breaking the cycle of stunting can be achieved through education that provides deeper understanding and changes in attitudes about the importance of nutrition, reproductive health, and early stunting prevention.

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (11). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (13). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting.

One strategy that can be implemented is through the use of health promotion media. These media include various tools used to convey health messages with the aim of improving the health status of the target population. In

general, media can be divided into three categories: print media, electronic media, and billboards. Print media includes various types, such as flip charts, leaflets, booklets, flyers, posters, and photos. Meanwhile, electronic media includes television, radio, video, slides, and film strips (14).

The process of delivering information to adolescents requires engaging techniques to ensure they receive and understand the information effectively. Visualizing information in an engaging and easily understandable way helps adolescents absorb crucial details about proper nutrition intake, the importance of nutritional balance, and the prevention of anemia and stunting. According to research by Alviani and Dwianggitamawati, the effectiveness of health education largely depends on the use of media that aligns with the educational goals being implemented. Media plays an important role in delivering information in a more attractive and easily understood manner, so the message can be well received by the audience and encourage positive behavior changes. The use of flipchart media has been proven effective in improving attitudes and knowledge regarding stunting prevention (15).

A flip chart, or flipbook media, is a visual aid consisting of sheets of paper that resemble an album or calendar. Each flip chart sheet typically displays an image on the front intended for the audience to view, while the back contains written explanations that assist the facilitator in providing additional information (16). As an educational tool, flip charts are considered effective for public health outreach because they enhance the audience's understanding of the topic being presented.

According to a study, flipchart media is an effective tool for use in outreach on public health issues. Its use can improve the audience's knowledge after the presentation with this media. Flip charts help present information visually and in an easily understandable manner, thereby strengthening the target audience's comprehension of the material being delivered (17). ith increased understanding, adolescents are more likely to adopt positive nutritional behaviors, which are crucial in preventing stunting in their generation and in the children they will have in the future.

METHOD

This study employs a quantitative approach with a quasi-experimental design to evaluate the effectiveness of a flip chart-based educational intervention in enhancing adolescent girls' knowledge and attitudes toward nutrition for stunting prevention. The study population comprises all adolescent girls aged 12-18 years, totaling 541 individuals. Using purposive sampling, a sample of 91 participants was selected, divided into an experimental group, which received the flip chart intervention, and a control group, which did not. The intervention was conducted in Kalurahan Triharjo, Sleman, DI Yogyakarta, while Kalurahan Pandowoharjo, Sleman, DI Yogyakarta, served as the control site.

The instrument used in this study was an open-ended questionnaire, where the researcher provided answers aligned with the educational material that had been presented to the respondents. The content of the educational flip chart media includes information on topics such as balanced nutrition for adolescent girls, the impact of stunting, the causes of stunting, and efforts to prevent stunting. The knowledge questionnaire was adapted from the study by Anisah (2023) titled "Pengaruh Pemberian Penyuluhan dan Buku Saku Tentang Gizi Terhadap Tingkat Pengetahuan dan Sikap Pada Remaja Putri Dalam Upaya Pencegahan Stunting di Madrasah Aliyah Madania Bantul." This questionnaire was tested for reliability and was found to be reliable based on the results of the reliability test (Cronbach's Alpha <0.06), with a Cronbach's Alpha value of 0.676 for the knowledge questionnaire and 0.753 for the attitude questionnaire. The data collection procedure began with a pretest for both groups to measure their initial knowledge and attitudes. The experimental group then received an educational intervention using flip charts for 1 hour, while the control group did not receive any intervention. Three days after the intervention, a posttest using the same questionnaire was administered to measure changes in the adolescents' knowledge and attitudes regarding stunting prevention.

T The collected data were analyzed using descriptive statistics to examine the frequency distribution of respondents' knowledge and attitudes before and after the intervention. Additionally, normality tests were conducted to assess data distribution, as presented in Table 1. The results indicated that the knowledge and attitude variables in the intervention group, as well as the knowledge variable in the control group, did not follow a normal distribution and were therefore analyzed using the Wilcoxon test. Conversely, the attitude variable in the control group met the normality assumption, allowing it to be analyzed using the Paired T-Test (18). This statistical analysis aimed to compare the differences in knowledge and attitudes between the intervention and control groups, with a significance threshold of $p = 0.05$.

Ethical review for this study was conducted by the Health Research Ethics Committee of the Banyuwangi School of Health Sciences to protect the rights and welfare of human research participants. The researcher obtained ethical approval (No: 332/04/KEPK-STIKESBWI/VIII/2024) issued in Banyuwangi on August 15, 2024.

RESULTS

Commented [Au3]: The methods section is clear and appropriately detailed, describing the study design, population, sampling, intervention, and data analysis methods. The inclusion of ethical approval enhances its credibility. However, it would benefit from a more robust discussion on how potential confounding variables, such as external sources of nutrition information, were managed. Additionally, specifying the duration of the intervention and follow-up periods could provide greater clarity.

Commented [Au4]: The results are well-presented with appropriate statistical analysis and tables to support the findings. However, the section could be improved by providing more in-depth interpretations of the data. For example, while it highlights the statistical significance of the intervention, it could explore why certain subgroups might have responded differently. Additionally, linking the results back to the broader implications for stunting prevention strategies would make this section more impactful.

The characteristics of the respondents in this study include variables such as age, education level, and occupation. The youngest age of respondents is 12 years while the oldest is 18 years. A detailed description of the respondent characteristics is provided in Table 1.

Table 1. Respondent Characteristics

Intervention Group			Control Group		
Variable	**n**	**%**	**Variable**	**n**	**%**
Age			**Age**		
12 years	6	13.3	12 years	5	10.9
13 years	11	24.4	13 years	4	8.7
14 years	3	6.7	14 years	5	10.9
15 years	5	11.1	15 years	10	21.7
16 years	5	11.1	16 years	7	15.2
17 years	6	13.3	17 years	11	23.9
18 years	9	20.0	18 years	4	8.7
Father's Last Education			**Father's Last Education**		
Middle School	9	20	Middle School	7	15.2
High School	23	51.1	High School	31	67.4
Bachelor's Degree	13	28.9	Bachelor's Degree	8	17.4
Mother's Last Education			**Mother's Last Education**		
Elementary School	3	6.7	Elementary School	3	6.5
Middle School	9	20	Middle School	10	21.7
High School	23	51.1	High School	26	56.7
Bachelor's Degree	10	22.2	Bachelor's Degree	7	15.2
Father's Occupation			**Father's Occupation**		
Laborer	17	37.8	Laborer	21	45.7
Entrepreneur	11	24.4	Entrepreneur	12	26.1
Merchant	4	8.9	Teacher	4	8.7
Civil Servant	9	20	Millitary	4	8.7
Police Officer	2	4.4	Civil Servant	5	10.9
Millitary	2	4.4			
Mother's Occupation			**Mother's Occupation**		
Housewife	28	62.2	Housewife	28	60.9
Entrepreneur	3	6.7	Entrepreneur	7	15.2
Merchant	9	20	Merchant	3	6.5
Teacher	2	4.4	Teacher	7	15.2
Nurse	1	2.2	Civil Servant	1	2.2
Midwife	1	2.2			
Civil Servant	1	2.2			

Table 1 shows that in the intervention group, respondents ranged from 12 to 18 years old, with the highest distribution at ages 13 (24.4%) and 18 (20%). The majority of fathers had a high school education (51.1%), as did most mothers (51.1%). Regarding parental occupations, most fathers were employed as laborers (37.8%), and the majority of mothers were housewives (62.2%).

Hence, in the control group, respondents also ranged from 12 to 18 years old, with the largest distribution at age 17 (23.9%). Fathers' education in this group was primarily high school (67.6%), and mothers' education was similarly concentrated at the high school level (56.6%). Most fathers in the control group worked as laborers (45.7%), and most mothers were housewives (60.9%). This data indicates a family background with predominantly secondary education, fathers employed in the informal sector, and mothers as primary homemakers. These characteristics are crucial for designing practical and relevant nutrition education interventions, taking into account the socioeconomic and cultural context of the respondents' families.

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.000, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption.

However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 2. Normality Test Results of Pretest and Posttest Differences

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Knowledge Difference (Intervention)	0.205	45	0.000	0.911	45	0.002
Attitude Difference (Intervention)	0.225	45	0.000	0.843	45	0.000
Knowledge Difference (Control)	0.210	46	0.000	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the posttest with a standard deviation of 0.883. The mean difference between the pretest and posttest was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.000 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the posttest with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the posttest with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the posttest with a standard deviation of 3.607. The mean difference between the pretest and posttest was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

Table 3. Differences Between Variables

Variable	Kelompok	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.000
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.000
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.000
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

DISCUSSION

To support a deeper understanding, engaging and effective health promotion media or tools are necessary. Health promotion media can be classified into three types: visual media (such as posters, leaflets, flip charts, PowerPoint presentations), audio media (radio), and audiovisual media (films and videos) (19). To enhance deeper understanding, it is important to use engaging and effective health promotion tools or media. Health promotion media are categorized into three types: visual media (such as posters, leaflets, flip charts, PowerPoint presentations, etc.), audio media (such as radio), and audiovisual media (such as films and videos) (20). These media act as supportive tools in the educational process. The greater the number of senses involved, the more information can be absorbed, resulting in a clearer and more thorough understanding of the subject matter (21).

According to the Ministry of Health, efforts to improve health knowledge are part of a health strategy aimed

Commented [Au5]: The discussion effectively contextualizes the findings within existing literature and highlights the effectiveness of flip chart media for health education. However, it tends to reiterate results rather than delve into their broader implications. A more critical analysis of the intervention's limitations, such as the potential influence of external information on the control group, and suggestions for mitigating these issues in future research would strengthen this section. Additionally, discussing how the intervention aligns with or challenges existing health promotion frameworks would enhance its theoretical contribution.

at preparing adolescents to grow into healthy, intelligent, high-quality, productive individuals who actively contribute to maintaining and enhancing their own health. A particular focus on adolescent girls is essential to help them navigate the physical, emotional, and social changes that occur during adolescence, as well as to prepare them for future reproductive health roles (22). Therefore, nutrition education plays a crucial role in enhancing knowledge and shaping mindsets and behaviors that support adolescent health in the future.

This study found a significant difference in the level of knowledge about nutrition for stunting prevention before and after the intervention using flip chart media in the intervention group, with a p-value of 0.000 ($p < 0.05$). These results indicate that health education using flip chart media has a significant impact on improving knowledge about nutrition in efforts to prevent stunting. This finding is consistent with research conducted by Alviani and Dwianggitamawati, which showed a p-value of 0.020 ($p < 0.05$), further supporting the conclusion that health education through flip chart media is effective in enhancing understanding of stunting prevention. The provision of health education plays a crucial role in improving health quality, both through increased knowledge and more targeted changes in attitudes (15).

In the control group, which did not receive the intervention, statistical analysis also revealed a significant difference in the knowledge of adolescent girls about nutrition for stunting prevention, with a p-value of 0.000 ($p < 0.05$). Previous research suggests that the increase in knowledge in the control group may have occurred due to exposure to nutrition information from sources other than the intervention in this study (2). A comparison of the mean score improvement in knowledge shows a more significant difference in the intervention group, with an increase of 4.94 (pretest 14.42 ± 2.388 to posttest 19.36 ± 0.883), compared to the control group, which only experienced an increase of 0.73 (pretest 15.70 ± 1.051 to posttest 16.43 ± 1.068). This further reinforces the effectiveness of using flip chart media in delivering nutrition education. Therefore, it can be concluded that the flip chart as an educational media not only improved understanding of the importance of nutrition in stunting prevention but also proved to be more effective compared to the method applied in the control group.

A study in Ketapang District found that the use of flip charts in nutrition education increased respondents' knowledge of nutrition by 8.923%. Providing nutrition education is expected to enhance respondents' understanding of balanced nutrition and stunting prevention, which could potentially lead to positive behavior changes. This increase in knowledge was achieved because the nutrition education materials presented using flip chart media were found to be easily understood by the respondents (16).

Knowledge plays a crucial role in influencing an individual's attitudes and actions toward stunting prevention. As found in a study in Jambi City, a deeper understanding of nutrition can drive attitude changes, so individuals with higher knowledge about the importance of nutrition are more likely to exhibit positive and proactive attitudes toward stunting prevention (23). Attitude is defined as an individual's response or reaction to a particular stimulus or object, involving cognitive, affective, and attentional aspects. Attitude is not merely an immediate reaction but reflects various aspects of mental and emotional experiences that are integrated. These experiences, whether direct or indirect, shape an individual's perspective toward a specific object (19).

The results of this study indicate that the educational intervention using flip charts significantly improved respondents' attitudes toward nutrition in efforts to address stunting, with a p-value of 0.000 ($p < 0.05$). The flip chart proved to be an effective educational tool, not only conveying information but also changing perspectives and raising awareness among adolescent girls about the importance of nutrition. This finding is consistent with a study conducted in Surabaya, which showed an improvement in both knowledge and attitudes among respondents after receiving education through health promotion media using flip charts. Therefore, health promotion using flip chart media is considered suitable and effective for providing information on stunting prevention (21).

In the control group, statistical analysis also showed a significant difference in adolescent girls' attitudes toward nutrition for stunting prevention, with a p-value of 0.000 ($p < 0.05$). This result diverges from the findings of Fauziatin et al., who observed no significant change in mean attitude scores between pretest and posttest on stunting prevention within the control group. This difference may stem from the absence of targeted stunting prevention knowledge provided to the control group, unlike the intervention group, which received specific educational content on the topic (24).

According to a study in Semarang, the improvement in attitudes in the control group may have occurred because adolescents experienced an increase in knowledge, even without receiving specific information about stunting from other sources. This external information could indirectly influence their knowledge and attitude changes, despite the lack of a targeted educational intervention in the study (2). This external information can have an indirect impact on improving knowledge and changing attitudes in the control group, even without specific educational intervention in the study. The improvement in attitude in the intervention group was seen from the mean difference in pretest and posttest scores of 16.27 (pretest 59.04 ± 8.512 to posttest 75.31 ± 2.410), compared to only 4.13 in the control group (pretest 53.59 ± 4.893 to posttest 57.72 ± 3.607). These results reinforce that the flip chart has a stronger and more tangible educational impact. The significant difference further supports the effectiveness of

the flip chart in generating better behavioral changes compared to other educational methods applied in the control group.

According to Notoatmodjo, behaviors and attitudes toward prevention that are based on knowledge tend to be more enduring than those not grounded in knowledge. Individuals with increased knowledge are more likely to adopt supportive attitudes, which are reflected in better actions or behaviors. This increase in knowledge is influenced by factors such as the methods, content, and media or tools used to deliver the message. These factors must work together in a supportive manner to achieve optimal outcomes (19). In this context, health promotion methods, the material on nutrition for stunting prevention, and the use of flip chart media collectively play an effective role in enhancing the knowledge and attitudes of adolescent girls.

CONCLUSION

In conclusion, flip charts have proven to be an effective educational tool in improving adolescents' knowledge and attitudes towards stunting prevention. The intervention group showed significant improvements in knowledge, with the average score increasing from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest, with a mean difference of 4.94 (Wilcoxon test, p = 0.000). Attitudes also significantly improved, with the average score increasing from 59.04 ± 8.512 at pretest to 75.31 ± 2.410 at posttest, with a mean difference of 16.27 (Wilcoxon test, p = 0.000). In contrast, the control group showed smaller improvements in knowledge, with the average score increasing from 15.70 ± 1.051 at pretest to 16.43 ± 1.068 at posttest, with a mean difference of 0.73 (Wilcoxon test, p = 0.000). Attitudes in the control group also showed improvement, with the average score increasing from 53.59 ± 4.893 at pretest to 57.72 ± 3.607 at posttest, with a mean difference of 4.13 (paired t-test, p = 0.036). These findings confirm that flip charts are effective in delivering nutrition information in an engaging and easy-to-understand way, thus enhancing understanding and commitment to stunting prevention.

SUGGESTION

This study has limitations, as the control group was not completely shielded from external information regarding nutrition, which may have influenced their knowledge and attitude improvements. To minimize the influence of external information on the control group, it is suggested that future studies provide basic information similar to that given to the intervention group, but without in-depth exposure through the flip chart. This approach is expected to provide a more valid comparison regarding the effectiveness of the flip chart as a nutrition education medium.

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Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency

ABSTRACT

Introduction: Adolescence is a critical stage requiring adequate nutrition for long-term health. Adolescent girls are particularly vulnerable to iron deficiency, which increases the risk of anemia and stunting. Enhancing adolescent girls' knowledge of nutrition through health education, which can be delivered using tools such as flipcharts, can prevent and address stunting.
Method: This quasi-experimental study involved 541 adolescent girls aged 12–18 years, with a purposive sample of 91 participants divided into an intervention group and a control group. The intervention group received flip chart-based education, while the control group did not. The study was conducted in Kalurahan Triharjo and Pandowoharjo, Sleman, DI Yogyakarta. Data were collected using validated pre- and post-intervention questionnaires and analyzed with Wilcoxon and paired t-tests.
Result: The intervention group showed significant improvements in knowledge and attitudes about nutrition. Knowledge scores increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest (mean difference: 4.94, p = 0.001). Attitude scores rose from 59.04 ± 8.512 to 75.31 ± 2.410 (mean difference: 16.27, p = 0.001). In the control group, smaller increases were observed for both knowledge (mean difference: 0.73, p = 0.001) and attitudes (mean difference: 4.13, p = 0.036).
Conclusion: Flip chart-based education effectively improves adolescents' knowledge and attitudes about nutrition for stunting prevention. However, external exposure to nutrition information in the control group was a limitation. Future research should minimize such exposure by limiting information to basic content for control groups.
Keywords: *Health promotion media, Flip Chart, Nutrition, Stunting*

INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls, especially during menstruation, require additional iron intake to support hemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues. Adolescence can be a key moment to address malnutrition conditions such as stunting or anemia. Micronutrient deficiencies, especially iron, can hinder linear growth (2).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (3). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and

6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (4). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anemia, most of which is caused by iron deficiency (iron deficiency anemia). Anemia is more prevalent among female adolescents than male adolescents (5).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (3). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future (6). In 2022, the WHO reported that 149 million children under the age of five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread impacts on health, the economy, and social development (7).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (8). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (8). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (9).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counseling, iron supplementation, and reproductive health education to prevent anemia, which negatively impacts pregnancy and future child growth (10). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential. A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (11).

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (10). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (12). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting. In its implementation, several factors must be considered to ensure the success of the desired behavior modification, such as a targeted approach, motivated change agents, and appropriate educational strategies in the use of media and the messages conveyed (13).

One of the key strategies implemented in stunting prevention is education through health promotion media. Promotional media, such as flip charts, leaflets, and posters, have proven effective in delivering information in an engaging and easily understood manner (14). Flip charts, in particular, are visual aids consisting of sheets of paper with images and supporting information that facilitate audience comprehension (15). Previous studies have shown that the use of flip charts can enhance audience knowledge and attitudes regarding specific health issues, including stunting prevention. Flip charts present information visually and in a comprehensible way, thereby strengthening the audience's understanding of the material delivered (16).

In this study, flipcharts were used as a nutrition education medium for adolescent girls to prevent stunting. This medium serves as a visual aid consisting of sheets of paper with images and supporting information that facilitates audience comprehension (14). Nugraheni (2024) emphasized the urgency of investing in nutrition education as one of the strategies to support sustainable health development (18). Similarly, Lestari (2023) revealed that future nutrition intervention programs should ideally begin during the preconception phase or before pregnancy, including providing education on nutrition to enhance cognitive understanding among prospective mothers in preventing stunting (19). These two recommendations form the foundation for the researcher to implement nutrition education using flipcharts to improve the knowledge and attitudes of adolescent girls regarding stunting prevention.

METHOD

This study employed a quantitative approach with a quasi-experimental two-group design (pre-test and post-test) to examine the effect of nutrition education on improving adolescents' knowledge and attitudes regarding stunting prevention. The study population consisted of 541 adolescent girls, 91 of whom were selected as respondents through purposive sampling with a 1:1 ratio. The intervention group received flipchart-based education after the pre-test, while the control group did not.The inclusion criteria were adolescent girls aged 12–18 years, residing in Triharjo Village, Sleman, Yogyakarta (intervention group) or Pandowoharjo Village, Sleman, Yogyakarta (control group), and willing to participate in the study. The exclusion criterion was the refusal of adolescents to participate. Data collection was conducted from late August 2024 to September 2024. To minimize the effect of confounding variables such as economic status, the intervention and control groups were matched in terms of occupational distribution, ensuring similar economic conditions.

A closed-ended questionnaire with the Guttman scale was used in this study. Knowledge was assessed through questions evaluating participants' understanding of the importance of balanced nutrition, the impacts, causes, and preventive measures of stunting. Attitudes were measured using a Likert scale, focusing on respondents' perceptions, beliefs, and readiness to support healthy eating practices in stunting prevention. The educational material covered topics such as balanced nutrition, the impacts and causes of stunting, and strategies to prevent stunting through proper nutrition.

The study began with a 10-minute pre-test, followed by a one-hour intervention session and discussion for the intervention group. The post-test was conducted on the third day after the intervention. Before analysis, the data were tested for normality, as shown in Table 2. Statistical tests included the Wilcoxon test for non-normally distributed data and the Paired T-test for normally distributed data. These analyses aimed to compare differences in knowledge and attitudes between the intervention and control groups (P-value < 0.05). This study obtained ethical approval from the Health Research Ethics Committee of the Banyuwangi Public Health School with reference number 332/04/KEPK-STIKESBWI/VIII/2024, dated August 15, 2024.

RESULTS

The characteristics of the respondents in this study include variables such as age, parental education level, and occupation. The youngest respondent is 12 years old, while the oldest is 18 years old. A detailed description of the respondents' characteristics is presented in Table 1.

Table 1. Respondent Characteristics

Variable	n	%
Age		
12 years	11	12.1
13 years	15	16.5
14 years	8	8.8
15 years	15	16.5
16 years	12	13.2
17 years	17	18.7
18 years	13	14.3
Father's Last Education		
Middle School	16	17.6
High School	54	59.3
Bachelor's Degree	21	23.1
Mother's Last Education		
Elementary School	6	6.6
Middle School	19	20.9
High School	49	53.8
Bachelor's Degree	17	18.7
Father's Occupation		
Laborer	38	41.8
Entrepreneur	22	24.2
Merchant	5	5.5
Civil Servant	14	15.4
Police Officer	2	2.2
Teacher	4	4.4
Millitary	6	6.6
Mother's Occupation		

Laborer	7	7.7
Entrepreneur	3	3.3
Merchant	12	13.2
Civil Servant	2	2.2
Nurse	1	1.1
Teacher	9	9.9
Midwife	6	1.1
Housewife	56	61.5

Table 1 indicates that most respondents were aged between 12 and 18 years, with the highest proportion at age 17 (18.7%) and the lowest at age 14 (8.8%). The majority of fathers had a high school education (59.3%), and similarly, most mothers also completed high school as their highest level of education (53.8%). Regarding parental occupations, the largest proportion of fathers worked as laborers (41.8%), while most mothers were housewives (61.5%).

Table 2. Normality Test Results of Pretest and Posttest Differences

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Knowledge Difference (Intervention)	0.205	45	0.001	0.911	45	0.001
Attitude Difference (Intervention)	0.225	45	0.001	0.843	45	0.001
Knowledge Difference (Control)	0.210	46	0.001	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.001, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption. However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 3. Differences Between Variables

Variable	Kelompok	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.001
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.001
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.001
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the posttest with a standard deviation of 0.883. The mean difference between the pretest and posttest was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.001 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the posttest with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the posttest with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the posttest with a standard deviation of 3.607. The mean difference between the pretest and posttest was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

DISCUSSION

Knowledge and attitude are the most important domains of health behavior because they originate from the individual themselves. The sensory process that occurs from what happens around a person will make them more "aware," allowing them to respond with agreement or disagreement. In other words, the attitude someone has is a representation of the knowledge they previously possessed. These two domains are in the phase of educational diagnosis and ecology as predispositional factors in the Precede-Proceed model of behavior change theory by Lawrence Green in 1980. This theory suggests that health education is an effort made to identify the interrelated domains of behavior change, namely predisposition, enabling, and reinforcing factors. (17).

In order to optimize the effectiveness of health education, an efficient tool or medium is required to convey information more clearly, with one such tool being a flip chart. A 2022 review of 10 articles found that flip charts are a valuable resource in health intervention programs addressing public health concerns. When used, they have been shown to enhance the audience's knowledge following the intervention. The flip chart facilitates the visual presentation of information in an easily digestible format, which in turn helps reinforce the target audience's comprehension of the content provided (18).

Adolescence is a phase where individuals begin to develop their identity, knowledge, attitudes, and habits, which will shape their future behavior. Health education for adolescents, particularly in the context of stunting prevention, is crucial for shaping their understanding and attitudes toward health issues, such as nutrition. Proper health interventions can significantly influence their knowledge and attitudes (19). Special focus on adolescent girls is important to support them in facing the physical, emotional, and social changes that occur during adolescence, as well as preparing them for reproductive health roles in the future (20). Therefore, nutrition education is a critical step in enhancing knowledge, shaping attitudes, and encouraging actions that support adolescent health in preventing stunting.

This study indicates that education using flip chart media significantly increased knowledge about nutrition for stunting prevention in the intervention group ($p = 0.001$; $p < 0.05$). The control group also experienced a significant increase ($p = 0.001$; $p < 0.05$), although the average improvement score was smaller, 0.73 compared to 4.94 in the intervention group (see Table 3). These results affirm the effectiveness of flip charts in enhancing adolescent girls' knowledge and strengthen the role of nutrition education in stunting prevention efforts. These findings suggest that health education through flip charts has a significant impact on improving knowledge about nutrition in the context of stunting prevention. Better knowledge of nutrition among adolescents plays a crucial role in reducing stunting rates.

The study by Alviani and Dwianggitamawati aligns with this research, showing that health education is effective in improving understanding related to stunting prevention. Health education plays a strategic role in enhancing health quality, both through increasing knowledge and fostering more constructive attitude changes (21). Similarly, according to the research by Juhari and Suan, individuals with high nutrition knowledge tend to meet both micro and macro nutritional needs and ensure that their children's nutritional status is adequate (22). This understanding encourages proactive behavior in maintaining and improving adolescent nutritional status, which directly supports stunting prevention efforts.

Knowledge plays a crucial role in influencing an individual's attitude and actions toward stunting prevention. As found in a study in Jambi City, a deep understanding of nutrition can drive attitude changes, so individuals with higher knowledge of the importance of nutrition are more likely to demonstrate positive and proactive attitudes toward stunting prevention (23). Attitude is defined as an individual's response or reaction to a specific stimulus or object, involving cognitive, affective, and attentional aspects toward that stimulus. Attitude is not merely an instant reaction but reflects various aspects of integrated mental and emotional experiences (24).

The results of this study show that education using flip chart media significantly improved adolescent girls' attitudes toward nutrition in stunting prevention, with a p-value of 0.010 ($p < 0.05$). The control group also experienced a significant increase (p-value 0.001), but the difference was smaller compared to the intervention group. The average difference in pretest and posttest scores in the intervention group reached 16.27, much higher than the 4.13 observed in the control group (see Table 3). These results confirm that flip charts are effective as an educational medium that not only delivers information but also changes perspectives and enhances attitudes regarding the importance of nutrition. These findings align with research in Surabaya, which showed an improvement in knowledge

and attitudes following health education using flip charts. This health education also supports the community empowerment process to maintain and improve health, while demonstrating that flip charts are an effective tool for strengthening individuals' cognitive aspects in stunting prevention (25).

However, these results contrast with the study by Fauziatin et al., which found no difference in attitude scores between the pretest and posttest in the control group regarding stunting prevention, as they did not receive education like the intervention group (26). In contrast, a study in Semarang showed that attitude improvement in the control group could occur even without direct intervention, as adolescents tend to acquire information from other sources such as social media, their environment, or discussions with peers, which also influences attitude changes (2). This discrepancy suggests that external factors, such as access to information through technology or exposure to community activities, can play a role in shaping adolescent attitudes, even in the absence of structured education.

Effective nutrition education not only increases knowledge about nutrition but also encourages attitude changes among adolescents toward health, including stunting prevention. Better knowledge enables adolescents to make wiser decisions regarding eating habits and lifestyle choices that support optimal growth and development. A positive attitude toward the importance of proper nutrition, if maintained in the long term, becomes a key factor in preventing stunting and supporting their future health (27).

Although the flip chart-based approach shows effectiveness, this study also faces several limitations that need to be considered. One of these is the possibility that the control group may have gained knowledge related to stunting from other sources, such as family, peers, or mass media. These external factors could influence their knowledge and attitudes, making the observed results potentially not fully reflect the effects of the educational intervention provided. Therefore, for future research, it is important to consider strategies that can control or mitigate the influence of these external factors to ensure that the obtained results are more accurate.

CONCLUSION

Nutrition education using flip charts is effective in improving knowledge and attitudes among adolescent girls regarding stunting prevention (p-value 0.001). The intervention group showed a significant improvement compared to the control group. Flip charts help convey information visually and in an easily understandable manner, which strengthens understanding and fosters a positive attitude toward nutrition. Although there are external factors that may influence the results, this approach has proven effective in encouraging behavioral changes that support stunting prevention.

SUGGESTION

It is important to consider local factors such as the availability of resources, accessibility, and the educational level of parents to ensure that the educational material is effectively received by the target audience. For future researchers, strategies for mitigation can be considered, such as providing general education not directly related to the research topic to the control group, to maintain their involvement without affecting the main variables. Another alternative is to use blinding methods to minimize exposure to external information during the study.

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8. Email pemberitahuan artikel diterima untuk diterbitkan dan permintaan pembayaran

(21 November 2024)

UNIVERSITAS
AHMAD DAHLAN

LINA HANDAYANI <lina.handayani@ikm.uad.ac.id>

[MPPKI] Editor Decision

6 messages

Dr. Ahmad Yani, S.K.M, M.Kes <jurnal@unismuhpalu.ac.id> Thu, Nov 21, 2024 at 11:15 AM
To: Lina Handayani <lina.handayani@ikm.uad.ac.id>, Melly Eka Saputri <2208053039@webmail.uad.ac.id>, Heni Trisnowati <heni.trisnowati@pascakesmas.uad.ac.id>, Tria Nisa Novianti <2308053037@webmail.uad.ac.id>, Isah Fitriani <2307053018@webmail.uad.ac.id>, Aufatcha Ayutya Suryana <aufatcha2100029101@webmail.uad.ac.id>, Tania Vergawita <2200029308@webmail.uad.ac.id>, Ardiansyah Jumaedi Nasir <ardiansyahjnasir@gmail.com>, Asa Ismia Bunga Aisyahrani <ilovebunga@gmail.com>

Dear Lina Handayani, Melly Eka Saputri , Heni Trisnowati, Tria Nisa Novianti, Isah Fitriani, Aufatcha Ayutya Suryana, Tania Vergawita , Ardiansyah Jumaedi Nasir, Asa Ismia Bunga Aisyahrani :

We have reached a decision regarding your submission to Media Publikasi Promosi Kesehatan Indonesia (MPPKI), "**Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention**".

Our decision is to: **Accept Submission**

Following the acceptance of your submission, we are now progressing to the next phase of the publication process. Attached to this letter, you will find the invoice for the Article Processing Charges (APC) associated with the publication of your work in the Media Publikasi Promosi Kesehatan Indonesia (MPPKI).

The timely settlement of this invoice is crucial to proceed with the final steps of publication, including the issuance of your Letter of Acceptance (LOA), which will be provided upon receipt of payment.

Should you have any questions regarding the invoice or any further aspects of the publication process, please feel free to contact me directly.

We greatly appreciate your valuable contribution to Media Publikasi Promosi Kesehatan Indonesia (MPPKI) and look forward to further collaboration in the future.

Dr. Ahmad Yani, S.K.M, M.Kes
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Dr. Ahmad Yani, S.K.M, M.Kes <jurnal@unismuhpalu.ac.id> Thu, Nov 21, 2024 at 11:16 AM
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Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency

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ABSTRACT

Introduction: Adolescence is a critical stage requiring adequate nutrition for long-term health. Adolescent girls are particularly vulnerable to iron deficiency, which increases the risk of anemia and stunting. Enhancing adolescent girls' knowledge of nutrition through health education, which can be delivered using tools such as flipcharts, can prevent and address stunting.

Method: This quasi-experimental study involved 541 adolescent girls aged 12–18 years, with a purposive sample of 91 participants divided into an intervention group and a control group. The intervention group received flip chart-based education, while the control group did not. The study was conducted in Kalurahan Triharjo and Pandowoharjo, Sleman, DI Yogyakarta. Data were collected using validated pre- and post-intervention questionnaires and analyzed with Wilcoxon and paired t-tests.

Result: The intervention group showed significant improvements in knowledge and attitudes about nutrition. Knowledge scores increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest (mean difference: 4.94, p = 0.001). Attitude scores rose from 59.04 ± 8.512 to 75.31 ± 2.410 (mean difference: 16.27, p = 0.001). In the control group, smaller increases were observed for both knowledge (mean difference: 0.73, p = 0.001) and attitudes (mean difference: 4.13, p = 0.036).

Conclusion: Flip chart-based education effectively improves adolescents' knowledge and attitudes about nutrition for stunting prevention. However, external exposure to nutrition information in the control group was a limitation. Future research should minimize such exposure by limiting information to basic content for control groups.

Keywords: *Health promotion media, Flip Chart, Nutrition, Stunting*

INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls, especially during menstruation, require additional iron intake to support hemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues. Adolescence can be a key moment to address

malnutrition conditions such as stunting or anemia. Micronutrient deficiencies, especially iron, can hinder linear growth (2).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (3). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (4). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anemia, most of which is caused by iron deficiency (iron deficiency anemia). Anemia is more prevalent among female adolescents than male adolescents (5).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (3). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future (6). In 2022, the WHO reported that 149 million children under the age of five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread impacts on health, the economy, and social development (7).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (8). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (8). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (9).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counseling, iron supplementation, and reproductive health education to prevent anemia, which negatively impacts pregnancy and future child growth (10). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential. A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (11).

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (10). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (12). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting. In its implementation, several factors must be considered to ensure the success of the desired behavior modification, such as a targeted approach, motivated change agents, and appropriate educational strategies in the use of media and the messages conveyed (13).

One of the key strategies implemented in stunting prevention is education through health promotion media. Promotional media, such as flip charts, leaflets, and posters, have proven effective in delivering information in an engaging and easily understood manner (14). Flip charts, in particular, are visual aids consisting of sheets of paper with images and supporting information that facilitate audience comprehension (15). Previous studies have shown that the use of flip charts can enhance audience knowledge and attitudes regarding specific health issues, including stunting prevention. Flip charts present information visually and in a comprehensible way, thereby strengthening the audience's understanding of the material delivered (16).

In this study, flipcharts were used as a nutrition education medium for adolescent girls to prevent stunting. This medium serves as a visual aid consisting of sheets of paper with images and supporting information that facilitates audience comprehension (14). Nugraheni (2024) emphasized the urgency of investing in nutrition education as one of the strategies to support sustainable health development (18). Similarly, Lestari (2023) revealed that future nutrition intervention programs should ideally begin during the preconception phase or before pregnancy, including providing education on nutrition to enhance cognitive understanding among prospective mothers in

preventing stunting (19). These two recommendations form the foundation for the researcher to implement nutrition education using flipcharts to improve the knowledge and attitudes of adolescent girls regarding stunting prevention.

METHOD

This study employed a quantitative approach with a quasi-experimental two-group design (pre-test and post-test) to examine the effect of nutrition education on improving adolescents' knowledge and attitudes regarding stunting prevention. The study population consisted of 541 adolescent girls, 91 of whom were selected as respondents through purposive sampling with a 1:1 ratio. The intervention group received flipchart-based education after the pre-test, while the control group did not.The inclusion criteria were adolescent girls aged 12–18 years, residing in Triharjo Village, Sleman, Yogyakarta (intervention group) or Pandowoharjo Village, Sleman, Yogyakarta (control group), and willing to participate in the study. The exclusion criterion was the refusal of adolescents to participate. Data collection was conducted from late August 2024 to September 2024. To minimize the effect of confounding variables such as economic status, the intervention and control groups were matched in terms of occupational distribution, ensuring similar economic conditions.

A closed-ended questionnaire with the Guttman scale was used in this study. Knowledge was assessed through questions evaluating participants' understanding of the importance of balanced nutrition, the impacts, causes, and preventive measures of stunting. Attitudes were measured using a Likert scale, focusing on respondents' perceptions, beliefs, and readiness to support healthy eating practices in stunting prevention. The educational material covered topics such as balanced nutrition, the impacts and causes of stunting, and strategies to prevent stunting through proper nutrition.

The study began with a 10-minute pre-test, followed by a one-hour intervention session and discussion for the intervention group. The post-test was conducted on the third day after the intervention. Before analysis, the data were tested for normality, as shown in Table 2. Statistical tests included the Wilcoxon test for non-normally distributed data and the Paired T-test for normally distributed data. These analyses aimed to compare differences in knowledge and attitudes between the intervention and control groups (P-value < 0.05). This study obtained ethical approval from the Health Research Ethics Committee of the Banyuwangi Public Health School with reference number 332/04/KEPK-STIKESBWI/VIII/2024, dated August 15, 2024.

RESULTS

The characteristics of the respondents in this study include variables such as age, parental education level, and occupation. The youngest respondent is 12 years old, while the oldest is 18 years old. A detailed description of the respondents' characteristics is presented in Table 1.

Table 1. Respondent Characteristics

Variable	n	%
Age		
12 years	11	12.1
13 years	15	16.5
14 years	8	8.8
15 years	15	16.5
16 years	12	13.2
17 years	17	18.7
18 years	13	14.3
Father's Last Education		
Middle School	16	17.6
High School	54	59.3
Bachelor's Degree	21	23.1
Mother's Last Education		
Elementary School	6	6.6
Middle School	19	20.9
High School	49	53.8
Bachelor's Degree	17	18.7
Father's Occupation		
Laborer	38	41.8
Entrepreneur	22	24.2

Merchant	5	5.5
Civil Servant	14	15.4
Police Officer	2	2.2
Teacher	4	4.4
Millitary	6	6.6
Mother's Occupation		
Laborer	7	7.7
Entrepreneur	3	3.3
Merchant	12	13.2
Civil Servant	2	2.2
Nurse	1	1.1
Teacher	9	9.9
Midwife	6	6.6
Housewife	56	61.5

Table 1 indicates that most respondents were aged between 12 and 18 years, with the highest proportion at age 17 (18.7%) and the lowest at age 14 (8.8%). The majority of fathers had a high school education (59.3%), and similarly, most mothers also completed high school as their highest level of education (53.8%). Regarding parental occupations, the largest proportion of fathers worked as laborers (41.8%), while most mothers were housewives (61.5%).

Table 2. Normality Test Results of Pretest and Posttest Differences

Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Knowledge Difference (Intervention)	0.205	45	0.001	0.911	45	0.001
Attitude Difference (Intervention)	0.225	45	0.001	0.843	45	0.001
Knowledge Difference (Control)	0.210	46	0.001	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.001, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption. However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 3. Differences Between Variables

Variable	Kelompok	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	**Posttest**			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.001
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.001
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.001
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the posttest with a standard deviation of 0.883. The mean difference between the pretest and posttest was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.001 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the posttest with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on

improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the posttest with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the posttest with a standard deviation of 3.607. The mean difference between the pretest and posttest was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

DISCUSSION

Knowledge and attitude are the most important domains of health behavior because they originate from the individual themselves. The sensory process that occurs from what happens around a person will make them more "aware," allowing them to respond with agreement or disagreement. In other words, the attitude someone has is a representation of the knowledge they previously possessed. These two domains are in the phase of educational diagnosis and ecology as predispositional factors in the Precede-Proceed model of behavior change theory by Lawrence Green in 1980. This theory suggests that health education is an effort made to identify the interrelated domains of behavior change, namely predisposition, enabling, and reinforcing factors (17).

In order to optimize the effectiveness of health education, an efficient tool or medium is required to convey information more clearly, with one such tool being a flip chart. A 2022 review of 10 articles found that flip charts are a valuable resource in health intervention programs addressing public health concerns. When used, they have been shown to enhance the audience's knowledge following the intervention. The flip chart facilitates the visual presentation of information in an easily digestible format, which in turn helps reinforce the target audience's comprehension of the content provided (18).

Adolescence is a phase where individuals begin to develop their identity, knowledge, attitudes, and habits, which will shape their future behavior. Health education for adolescents, particularly in the context of stunting prevention, is crucial for shaping their understanding and attitudes toward health issues, such as nutrition. Proper health interventions can significantly influence their knowledge and attitudes (19). Special focus on adolescent girls is important to support them in facing the physical, emotional, and social changes that occur during adolescence, as well as preparing them for reproductive health roles in the future (20). Therefore, nutrition education is a critical step in enhancing knowledge, shaping attitudes, and encouraging actions that support adolescent health in preventing stunting.

This study indicates that education using flip chart media significantly increased knowledge about nutrition for stunting prevention in the intervention group ($p = 0.001$; $p < 0.05$). The control group also experienced a significant increase ($p = 0.001$; $p < 0.05$), although the average improvement score was smaller, 0.73 compared to 4.94 in the intervention group (see Table 3). These results affirm the effectiveness of flip charts in enhancing adolescent girls' knowledge and strengthen the role of nutrition education in stunting prevention efforts. These findings suggest that health education through flip charts has a significant impact on improving knowledge about nutrition in the context of stunting prevention. Better knowledge of nutrition among adolescents plays a crucial role in reducing stunting rates.

The study by Alviani and Dwianggitamawati aligns with this research, showing that health education is effective in improving understanding related to stunting prevention. Health education plays a strategic role in enhancing health quality, both through increasing knowledge and fostering more constructive attitude changes (21). Similarly, according to the research by Juhari and Suan, individuals with high nutrition knowledge tend to meet both micro and macro nutritional needs and ensure that their children's nutritional status is adequate (22). This understanding encourages proactive behavior in maintaining and improving adolescent nutritional status, which directly supports stunting prevention efforts.

Knowledge plays a crucial role in influencing an individual's attitude and actions toward stunting prevention. As found in a study in Jambi City, a deep understanding of nutrition can drive attitude changes, so individuals with higher knowledge of the importance of nutrition are more likely to demonstrate positive and proactive attitudes toward stunting prevention (23). Attitude is defined as an individual's response or reaction to a specific stimulus or object, involving cognitive, affective, and attentional aspects toward that stimulus. Attitude is not merely an instant reaction but reflects various aspects of integrated mental and emotional experiences (24).

The results of this study show that education using flip chart media significantly improved adolescent girls'

attitudes toward nutrition in stunting prevention, with a p-value of 0.010 ($p < 0.05$). The control group also experienced a significant increase (p-value 0.001), but the difference was smaller compared to the intervention group. The average difference in pretest and posttest scores in the intervention group reached 16.27, much higher than the 4.13 observed in the control group (see Table 3). These results confirm that flip charts are effective as an educational medium that not only delivers information but also changes perspectives and enhances attitudes regarding the importance of nutrition. These findings align with research in Surabaya, which showed an improvement in knowledge and attitudes following health education using flip charts. This health education also supports the community empowerment process to maintain and improve health, while demonstrating that flip charts are an effective tool for strengthening individuals' cognitive aspects in stunting prevention (25).

However, these results contrast with the study by Fauziatin et al., which found no difference in attitude scores between the pretest and posttest in the control group regarding stunting prevention, as they did not receive education like the intervention group (26). In contrast, a study in Semarang showed that attitude improvement in the control group could occur even without direct intervention, as adolescents tend to acquire information from other sources such as social media, their environment, or discussions with peers, which also influences attitude changes (2). This discrepancy suggests that external factors, such as access to information through technology or exposure to community activities, can play a role in shaping adolescent attitudes, even in the absence of structured education.

Effective nutrition education not only increases knowledge about nutrition but also encourages attitude changes among adolescents toward health, including stunting prevention. Better knowledge enables adolescents to make wiser decisions regarding eating habits and lifestyle choices that support optimal growth and development. A positive attitude toward the importance of proper nutrition, if maintained in the long term, becomes a key factor in preventing stunting and supporting their future health (27).

Although the flip chart-based approach shows effectiveness, this study also faces several limitations that need to be considered. One of these is the possibility that the control group may have gained knowledge related to stunting from other sources, such as family, peers, or mass media. These external factors could influence their knowledge and attitudes, making the observed results potentially not fully reflect the effects of the educational intervention provided. Therefore, for future research, it is important to consider strategies that can control or mitigate the influence of these external factors to ensure that the obtained results are more accurate.

CONCLUSION

Nutrition education using flip charts is effective in improving knowledge and attitudes among adolescent girls regarding stunting prevention (p-value 0.000). The intervention group showed a significant improvement compared to the control group. Flip charts help convey information visually and in an easily understandable manner, which strengthens understanding and fosters a positive attitude toward nutrition. Although there are external factors that may influence the results, this approach has proven effective in encouraging behavioral changes that support stunting prevention.

SUGGESTION

It is important to consider local factors such as the availability of resources, accessibility, and the educational level of parents to ensure that the educational material is effectively received by the target audience. For future researchers, strategies for mitigation can be considered, such as providing general education not directly related to the research topic to the control group, to maintain their involvement without affecting the main variables. Another alternative is to use blinding methods to minimize exposure to external information during the study.

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You have been added to a discussion titled "Letter of Acceptance (LoA)" regarding the submission "Nutrition Education to Improve Adolescent Girls' Knowledge and Attitudes towards Stunting: An Effort to Early Stunting Prevention".

Link: https://jurnal.unismuhpalu.ac.id/index.php/MPPKI/authorDashboard/submission/6381

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Letter of Acceptance (LoA)

Participants

Lina Handayani (linafkm)

MPPKI_Editorial (mppkieditorial)

Messages

Note	From
Dear Author We are thrilled to inform you that your manuscript has been officially accepted for publication in the Media Publikasi Promosi Kesehatan Indonesia (MPPKI). Congratulations on this significant achievement! Attached to this email, you will find your formal Letter of Acceptance. We are proud to include your work in our journal and look forward to sharing it with the wider community. Your contribution is valuable in advancing research and knowledge in Health Science. Should you have any questions or need further assistance, please do not hesitate to contact us. Thank you for choosing to publish your work with the Media Publikasi Promosi Kesehatan Indonesia (MPPKI). We are excited to move forward with the publication of your article. **Best regards,** **JPHP Editorial Team** mppkieditorial, LoA MPPKI_6381.pdf	mppkieditorial 2024-11-21 11:31 AM

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13. Surat resmi *Letter of Acceptance* (LoA)

(21 November 2024)

e-ISSN : 2597-6052

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Letter of Acceptance

6381/MPPKI-FKMUMPAL/XI/2024

After a meticulous review process, we are pleased to inform you that your manuscript has been accepted for publication in Media Publikasi Promosi Kesehatan Indonesia (MPPKI). The essential details for your accepted manuscript are as follows:

Date		21 Nov 2024
Manuscript ID	:	6381
Title	:	**Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency**
Author	:	**Lina Handayani[1]*, Melly Eka Saputri[2], Heni Trisnowati[3], Tria Nisa Novianti[4], Isah Fitriani[5], Aufatcha Ayutya Suryana[6], Tania Vergawita[7], Ardiansyah Jumaedi Nasir[8], Asa Ismia Bunga Aisyahrani[9]**
Corresponding*	:	lina.handayani@ikm.uad.ac.id

Your article is scheduled for publication in **Vol. 7 No. 12 (2024) of Media Publikasi Promosi Kesehatan Indonesia (MPPKI)**, providing you with a glimpse of the anticipated publication timeline. Should you have any inquiries or require further assistance, please do not hesitate to contact
our editorial team at ahmadyani@unismuhpalu.ac.id or mppki@unismuhpalu.ac.id

Once again, thank you for choosing Media Publikasi Promosi Kesehatan Indonesia (MPPKI). We eagerly anticipate the successful publication of your valuable contribution

With regards
Yours sincerely

Dr. Ahmad Yani, S.K.M.,M.Kes
Editor in Chief

14. Email dan notifikasi dari OJS terkait permintaan koreksi *Galley Proof* (5 December 2024)

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Team Production <jurnal@unismuhpalu.ac.id> Thu, Dec 5, 2024 at 10:30 AM
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Link: https://jurnal.unismuhpalu.ac.id/index.php/MPPKI/authorDashboard/submission/6381

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Galley Proof Correction

Participants

Dr. Ahmad Yani (ayanix)

Editorial Production (tproduction)

Lina Handayani (linafkm)

Messages

Note	From
Dear [**Lina Handayani**], Greetings, We are delighted to inform you that your article titled ***"Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency"***has successfully undergone the editing process and is now in the galley proof stage. Attached, you will find the galley proof of your article for your review. We kindly request you to thoroughly review all aspects of your article, including but not limited to: • Title and abstract • Author names and affiliations • Main content (text, tables, figures) • References Please pay particular attention to any typographical errors, grammatical issues, or formatting inconsistencies that may have been overlooked. **Additionally, we kindly ask you to review and address the changes or additions marked in the Galley Proof document.** Should any revisions be necessary, please indicate the desired changes directly on the galley proof using the commenting or markup tools available in the Word or PDF document. We kindly ask that you return the revised galley proof to us no later than [**Two Days after this message is sent**] to ensure your article is published on schedule. If you have any questions or require further clarification, please do not hesitate to contact us. Thank you for your cooperation and valuable contribution. Best regards, Dirwan Production Editor tproduction, Galley Proof.pdf	tproduction 2024-12-05 10:28 AM

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15. Naskah revisi *Galley Proof*, disertai dengan *highlight* (5 December 2024)

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MPPKI MEDIA PUBLIKASI PROMOSI KESEHATAN INDONESIA

Research Articles Open Access

Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency

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Health Promotion Media;
Flip Chart;
Nutrition;
Stunting

ABSTRACT

Background: Adolescence is a critical stage requiring adequate nutrition for long-term health. Adolescent girls are particularly vulnerable to iron deficiency, which increases the risk of anemia and stunting. Enhancing adolescent girls' knowledge of nutrition through health education, which can be delivered using tools such as flipcharts, can prevent and address stunting.

Method: This quasi-experimental study involved 541 adolescent girls aged 12–18 years, with a purposive sample of 91 participants divided into an intervention group and a control group. The intervention group received flip chart-based education, while the control group did not. The study was conducted in Kalurahan Triharjo and Pandowoharjo, Sleman, DI Yogyakarta. Data were collected using validated pre- and post-intervention questionnaires and analyzed with Wilcoxon and paired t-tests.

Result: The intervention group showed significant improvements in knowledge and attitudes about nutrition. Knowledge scores increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest (mean difference: 4.94, p = 0.001). Attitude scores rose from 59.04 ± 8.512 to 75.31 ± 2.410 (mean difference: 16.27, p = 0.001). In the control group, smaller increases were observed for both knowledge (mean difference: 0.73, p = 0.001) and attitudes (mean difference: 4.13, p = 0.036).

Conclusion: Flip chart-based education effectively improves adolescents' knowledge and attitudes about nutrition for stunting prevention. However, external exposure to nutrition information in the control group was a limitation. Future research should minimize such exposure by limiting information to basic content for control groups.

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INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental

development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anaemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls, especially during menstruation, require additional iron intake to support haemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues (2–5). Adolescence can be a key moment to address malnutrition conditions such as stunting or anaemia. Micronutrient deficiencies, especially iron, can hinder linear growth (6).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anaemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (7). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (8). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anaemia, most of which is caused by iron deficiency (iron deficiency anaemia). Anaemia is more prevalent among female adolescents than male adolescents (9).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (7). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future (10). In 2022, the WHO reported that 149 million children under the age of five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread impacts on health, the economy, and social development (11).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (12). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (12). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (13).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counselling, iron supplementation, and reproductive health education to prevent anaemia, which negatively impacts pregnancy and future child growth (14). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential (15). A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (16).

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (14). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (17). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting. In its implementation, several factors must be considered to ensure the success of the desired behavior modification, such as a targeted approach, motivated change agents, and appropriate educational strategies in the use of media and the messages conveyed (18).

One of the key strategies implemented in stunting prevention is education through health promotion media. Promotional media, such as flip charts, leaflets, and posters, have proven effective in delivering information in an engaging and easily understood manner (19). Flip charts, in particular, are visual aids consisting of sheets of paper

with images and supporting information that facilitate audience comprehension (20). Previous studies have shown that the use of flip charts can enhance audience knowledge and attitudes regarding specific health issues, including stunting prevention. Flip charts present information visually and in a comprehensible way, thereby strengthening the audience's understanding of the material delivered (16).

In this study, flipcharts were used as a nutrition education medium for adolescent girls to prevent stunting. This medium serves as a visual aid consisting of sheets of paper with images and supporting information that facilitates audience comprehension (14). Nugraheni (2024) emphasized the urgency of investing in nutrition education as one of the strategies to support sustainable health development (23). Similarly, Lestari (2023) revealed that future nutrition intervention programs should ideally begin during the preconception phase or before pregnancy, including providing education on nutrition to enhance cognitive understanding among prospective mothers in preventing stunting (24). These two recommendations form the foundation for the researcher to implement nutrition education using flipcharts to improve the knowledge and attitudes of adolescent girls regarding stunting prevention.

METHOD

This study employed a quantitative approach with a quasi-experimental two-group design (pre-test and post-test) to examine the effect of nutrition education on improving adolescents' knowledge and attitudes regarding stunting prevention. The study population consisted of 541 adolescent girls, 91 of whom were selected as respondents through purposive sampling with a 1:1 ratio. The intervention group received flipchart-based education after the pre-test, while the control group did not.The inclusion criteria were adolescent girls aged 12–18 years, residing in Triharjo Village, Sleman, Yogyakarta (intervention group) or Pandowoharjo Village, Sleman, Yogyakarta (control group), and willing to participate in the study. The exclusion criterion was the refusal of adolescents to participate. Data collection was conducted from late August 2024 to September 2024. To minimize the effect of confounding variables such as economic status, the intervention and control groups were matched in terms of occupational distribution, ensuring similar economic conditions.

A closed-ended questionnaire with the Guttman scale was used in this study. Knowledge was assessed through questions evaluating participants' understanding of the importance of balanced nutrition, the impacts, causes, and preventive measures of stunting. Attitudes were measured using a Likert scale, focusing on respondents' perceptions, beliefs, and readiness to support healthy eating practices in stunting prevention. The educational material covered topics such as balanced nutrition, the impacts and causes of stunting, and strategies to prevent stunting through proper nutrition.

The study began with a 10-minute pre-test, followed by a one-hour intervention session and discussion for the intervention group. The post-test was conducted on the third day after the intervention. Before analysis, the data were tested for normality, as shown in Table 2. Statistical tests included the Wilcoxon test for non-normally distributed data and the Paired T-test for normally distributed data. These analyses aimed to compare differences in knowledge and attitudes between the intervention and control groups (P-value < 0.05). This study obtained ethical approval from the Health Research Ethics Committee of the Banyuwangi Public Health School with reference number 332/04/KEPK-STIKESBWI/VIII/2024, dated August 15, 2024.

Ethical Approval

This study was approved by the Health Research Ethics Committee of X University (Approval Number: 123/KEPK/2024). All participants, including parents or guardians for participants under 18, provided informed consent prior to participating in the study. The confidentiality of all participants was strictly maintained throughout the research process.

RESULTS

The characteristics of the respondents in this study include variables such as age, parental education level, and occupation. The youngest respondent is 12 years old, while the oldest is 18 years old. A detailed description of the respondents' characteristics is presented in Table 1.

Table 1. Respondent Characteristics

Variable	n	%
Age		
12 years	11	12.1
13 years	15	16.5
14 years	8	8.8
15 years	15	16.5
16 years	12	13.2
17 years	17	18.7
18 years	13	14.3
Father's Last Education		
Middle School	16	17.6
High School	54	59.3
Bachelor's Degree	21	23.1
Mother's Last Education		
Elementary School	6	6.6
Middle School	19	20.9
High School	49	53.8
Bachelor's Degree	17	18.7
Father's Occupation		
Laborer	38	41.8
Entrepreneur	22	24.2
Merchant	5	5.5
Civil Servant	14	15.4
Police Officer	2	2.2
Teacher	4	4.4
Millitary	6	6.6
Mother's Occupation		
Laborer	7	7.7
Entrepreneur	3	3.3
Merchant	12	13.2
Civil Servant	2	2.2
Nurse	1	1.1
Teacher	9	9.9
Midwife	6	1.1
Housewife	56	61.5

Table 1 indicates that most respondents were aged between 12 and 18 years, with the highest proportion at age 17 (18.7%) and the lowest at age 14 (8.8%). The majority of fathers had a high school education (59.3%), and similarly, most mothers also completed high school as their highest level of education (53.8%). Regarding parental occupations, the largest proportion of fathers worked as labourers (41.8%), while most mothers were housewives (61.5%).

Table 2. Normality Test Results of Pretest and Posttest Differences

	Tests of Normality					
	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Knowledge Difference (Intervention)	0.205	45	0.001	0.911	45	0.001
Attitude Difference (Intervention)	0.225	45	0.001	0.843	45	0.001
Knowledge Difference (Control)	0.210	46	0.001	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.001, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption. However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 3. Differences Between Variables

Variable	Group	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.001
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.001
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.001
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the post-test with a standard deviation of 0.883. The mean difference between the pretest and post-test was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.001 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the post-test with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the post-test with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the post-test with a standard deviation of 3.607. The mean difference between the pretest and post-test was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

DISCUSSION

Knowledge and attitude are the most important domains of health behavior because they originate from the individual themselves (3,25,26). The sensory process that occurs from what happens around a person will make them more "aware," allowing them to respond with agreement or disagreement. In other words, the attitude someone has is a representation of the knowledge they previously possessed. These two domains are in the phase of educational diagnosis and ecology as predispositional factors in the Precede-Proceed model of behavior change theory by Lawrence Green in 1980. This theory suggests that health education is an effort made to identify the interrelated

domains of behavior change, namely predisposition, enabling, and reinforcing factors (27).

In order to optimize the effectiveness of health education, an efficient tool or medium is required to convey information more clearly, with one such tool being a flip chart. A 2022 review of 10 articles found that flip charts are a valuable resource in health intervention programs addressing public health concerns. When used, they have been shown to enhance the audience's knowledge following the intervention. The flip chart facilitates the visual presentation of information in an easily digestible format, which in turn helps reinforce the target audience's comprehension of the content provided (21).

Adolescence is a phase where individuals begin to develop their identity, knowledge, attitudes, and habits, which will shape their future behavior. Health education for adolescents, particularly in the context of stunting prevention, is crucial for shaping their understanding and attitudes toward health issues, such as nutrition. Proper health interventions can significantly influence their knowledge and attitudes (28). Special focus on adolescent girls is important to support them in facing the physical, emotional, and social changes that occur during adolescence, as well as preparing them for reproductive health roles in the future (29). Therefore, nutrition education is a critical step in enhancing knowledge, shaping attitudes, and encouraging actions that support adolescent health in preventing stunting.

This study indicates that education using flip chart media significantly increased knowledge about nutrition for stunting prevention in the intervention group ($p = 0.001$; $p < 0.05$). The control group also experienced a significant increase ($p = 0.001$; $p < 0.05$), although the average improvement score was smaller, 0.73 compared to 4.94 in the intervention group (see Table 3). These results affirm the effectiveness of flip charts in enhancing adolescent girls' knowledge and strengthen the role of nutrition education in stunting prevention efforts. These findings suggest that health education through flip charts has a significant impact on improving knowledge about nutrition in the context of stunting prevention. Better knowledge of nutrition among adolescents plays a crucial role in reducing stunting rates.

The study by Alviani and Dwianggitamawati aligns with this research, showing that health education is effective in improving understanding related to stunting prevention. Health education plays a strategic role in enhancing health quality, both through increasing knowledge and fostering more constructive attitude changes (22). Similarly, according to the research by Juhari and Suan, individuals with high nutrition knowledge tend to meet both micro and macro nutritional needs and ensure that their children's nutritional status is adequate (30). This understanding encourages proactive behavior in maintaining and improving adolescent nutritional status, which directly supports stunting prevention efforts.

Knowledge plays a crucial role in influencing an individual's attitude and actions toward stunting prevention. As found in a study in Jambi City, a deep understanding of nutrition can drive attitude changes, so individuals with higher knowledge of the importance of nutrition are more likely to demonstrate positive and proactive attitudes toward stunting prevention (31). Attitude is defined as an individual's response or reaction to a specific stimulus or object, involving cognitive, affective, and attentional aspects toward that stimulus. Attitude is not merely an instant reaction but reflects various aspects of integrated mental and emotional experiences (32).

The results of this study show that education using flip chart media significantly improved adolescent girls' attitudes toward nutrition in stunting prevention, with a p-value of 0.010 ($p < 0.05$). The control group also experienced a significant increase (p-value 0.001), but the difference was smaller compared to the intervention group. The average difference in pretest and posttest scores in the intervention group reached 16.27, much higher than the 4.13 observed in the control group (see Table 3). These results confirm that flip charts are effective as an educational medium that not only delivers information but also changes perspectives and enhances attitudes regarding the importance of nutrition. These findings align with research in Surabaya, which showed an improvement in knowledge and attitudes following health education using flip charts. This health education also supports the community empowerment process to maintain and improve health, while demonstrating that flip charts are an effective tool for strengthening individuals' cognitive aspects in stunting prevention (33).

However, these results contrast with the study by Fauziatin et al., which found no difference in attitude scores between the pretest and posttest in the control group regarding stunting prevention, as they did not receive education like the intervention group (34). In contrast, a study in Semarang showed that attitude improvement in the control group could occur even without direct intervention, as adolescents tend to acquire information from other sources such as social media, their environment, or discussions with peers, which also influences attitude changes (6). This

discrepancy suggests that external factors, such as access to information through technology or exposure to community activities, can play a role in shaping adolescent attitudes, even in the absence of structured education.

Effective nutrition education not only increases knowledge about nutrition but also encourages attitude changes among adolescents toward health, including stunting prevention (2,35,36). Better knowledge enables adolescents to make wiser decisions regarding eating habits and lifestyle choices that support optimal growth and development. A positive attitude toward the importance of proper nutrition, if maintained in the long term, becomes a key factor in preventing stunting and supporting their future health (37).

Although the flip chart-based approach shows effectiveness, this study also faces several limitations that need to be considered. One of these is the possibility that the control group may have gained knowledge related to stunting from other sources, such as family, peers, or mass media. These external factors could influence their knowledge and attitudes, making the observed results potentially not fully reflect the effects of the educational intervention provided. Therefore, for future research, it is important to consider strategies that can control or mitigate the influence of these external factors to ensure that the obtained results are more accurate.

Limitations and Cautions

Despite the strengths of this study that relationships of several factors influencing physicians' prescribing behaviour were studied comprehensively within single theoretical framework, but still some limitations should be acknowledged. The first limitation of this study is that it was conducted only in Sana'a, the capital city of Yemen. However, the researcher assumed a reasonable representativeness of the sample because about quarter of physicians participated in the study were Board (Residents) whose elected from different governorates in Yemen. Another limitation which should be considered is that, as in case of all self-reported surveys, it includes the risk of recall bias and social desirability bias.

Recommendations for Future Research

It is important to consider local factors such as the availability of resources, accessibility, and the educational level of parents to ensure that the educational material is effectively received by the target audience. For future researchers, strategies for mitigation can be considered, such as providing general education not directly related to the research topic to the control group, to maintain their involvement without affecting the main variables. Another alternative is to use blinding methods to minimize exposure to external information during the study.

CONCLUSION

Nutrition education using flip charts is effective in improving knowledge and attitudes among adolescent girls regarding stunting prevention (p-value 0.001). The intervention group showed a significant improvement compared to the control group. Flip charts help convey information visually and in an easily understandable manner, which strengthens understanding and fosters a positive attitude toward nutrition. Although there are external factors that may influence the results, this approach has proven effective in encouraging behavioral changes that support stunting prevention.

AUTHOR'S CONTRIBUTION STATEMENT

CONFLICTS OF INTEREST

The authors declare that they have conflict of interest related to this publication.

SOURCE OF FUNDING STATEMENTS

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ETHICAL APPROVAL

This study was approved by the Health Research Ethics Committee of Sekolah Tinggi Ilmu Kesehatan Banyuwangi (Approval Number: 123/KEPK/2024). All participants, including parents or guardians for participants under 18, provided informed consent prior to participating in the study. The confidentiality of all participants was strictly maintained throughout the research process.

LIMITATIONS AND CAUTIONS

This study provides evidence and innovations on early education and prevention toward stunting among adolescents. However, despite the strengths, this research also has its limitations. This study did not control several confounding variables such as family background, level of education, and other source of information.

AUTHOR'S CONTRIBUTION STATEMENT

LH leading and coordinating research and writing articles; ME preparing questionnaires, coordinating with research respondent, taking care of ethical clearance, and collecting research data; HT Helping coordinate research and writing articles; TNN Processing research data and compiling reports and publications; IF Assisting with technical implementation of interventions, assisting with data collection (pretest and posttest); AAS Assisting with compiling reports and publications; TV Assisting with technical implementation of interventions and compiling reports/publications; AJN Assisting with technical and logistical research during interventions and their preparation; AIBA Assisting with compiling reports, and translators

CONFLICTS OF INTEREST

The authors declare that we don't have conflict of interest related to this publication.

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Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency

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ABSTRACT

Background: Adolescence is a critical stage requiring adequate nutrition for long-term health. Adolescent girls are particularly vulnerable to iron deficiency, which increases the risk of anemia and stunting. Enhancing adolescent girls' knowledge of nutrition through health education, which can be delivered using tools such as flipcharts, can prevent and address stunting.

Method: This quasi-experimental study involved 541 adolescent girls aged 12–18 years, with a purposive sample of 91 participants divided into an intervention group and a control group. The intervention group received flip chart-based education, while the control group did not. The study was conducted in Kalurahan Triharjo and Pandowoharjo, Sleman, DI Yogyakarta. Data were collected using validated pre- and post-intervention questionnaires and analyzed with Wilcoxon and paired t-tests.

Result: The intervention group showed significant improvements in knowledge and attitudes about nutrition. Knowledge scores increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest (mean difference: 4.94, p = 0.001). Attitude scores rose from 59.04 ± 8.512 to 75.31 ± 2.410 (mean difference: 16.27, p = 0.001). In the control group, smaller increases were observed for both knowledge (mean difference: 0.73, p = 0.001) and attitudes (mean difference: 4.13, p = 0.036).

Conclusion: Flip chart-based education effectively improves adolescents' knowledge and attitudes about nutrition for stunting prevention. However, external exposure to nutrition information in the control group was a limitation. Future research should minimize such exposure by limiting information to basic content for control groups.

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INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental

development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anaemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls, especially during menstruation, require additional iron intake to support haemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues (2–5). Adolescence can be a key moment to address malnutrition conditions such as stunting or anaemia. Micronutrient deficiencies, especially iron, can hinder linear growth (6).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anaemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (7). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (8). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anaemia, most of which is caused by iron deficiency (iron deficiency anaemia). Anaemia is more prevalent among female adolescents than male adolescents (9).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (7). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future (10). In 2022, the WHO reported that 149 million children under the age of five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread impacts on health, the economy, and social development (11).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (12). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (12). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (13).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counselling, iron supplementation, and reproductive health education to prevent anaemia, which negatively impacts pregnancy and future child growth (14). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential (15). A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (16).

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (14). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (17). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting. In its implementation, several factors must be considered to ensure the success of the desired behavior modification, such as a targeted approach, motivated change agents, and appropriate educational strategies in the use of media and the messages conveyed (18).

One of the key strategies implemented in stunting prevention is education through health promotion media. Promotional media, such as flip charts, leaflets, and posters, have proven effective in delivering information in an engaging and easily understood manner (19). Flip charts, in particular, are visual aids consisting of sheets of paper

with images and supporting information that facilitate audience comprehension (20). Previous studies have shown that the use of flip charts can enhance audience knowledge and attitudes regarding specific health issues, including stunting prevention. Flip charts present information visually and in a comprehensible way, thereby strengthening the audience's understanding of the material delivered (16).

In this study, flipcharts were used as a nutrition education medium for adolescent girls to prevent stunting. This medium serves as a visual aid consisting of sheets of paper with images and supporting information that facilitates audience comprehension (14). Nugraheni (2024) emphasized the urgency of investing in nutrition education as one of the strategies to support sustainable health development (23). Similarly, Lestari (2023) revealed that future nutrition intervention programs should ideally begin during the preconception phase or before pregnancy, including providing education on nutrition to enhance cognitive understanding among prospective mothers in preventing stunting (24). These two recommendations form the foundation for the researcher to implement nutrition education using flipcharts to improve the knowledge and attitudes of adolescent girls regarding stunting prevention.

METHOD

This study employed a quantitative approach with a quasi-experimental two-group design (pre-test and post-test) to examine the effect of nutrition education on improving adolescents' knowledge and attitudes regarding stunting prevention. The study population consisted of 541 adolescent girls, 91 of whom were selected as respondents through purposive sampling with a 1:1 ratio. The intervention group received flipchart-based education after the pre-test, while the control group did not.The inclusion criteria were adolescent girls aged 12–18 years, residing in Triharjo Village, Sleman, Yogyakarta (intervention group) or Pandowoharjo Village, Sleman, Yogyakarta (control group), and willing to participate in the study. The exclusion criterion was the refusal of adolescents to participate. Data collection was conducted from late August 2024 to September 2024. To minimize the effect of confounding variables such as economic status, the intervention and control groups were matched in terms of occupational distribution, ensuring similar economic conditions.

A closed-ended questionnaire with the Guttman scale was used in this study. Knowledge was assessed through questions evaluating participants' understanding of the importance of balanced nutrition, the impacts, causes, and preventive measures of stunting. Attitudes were measured using a Likert scale, focusing on respondents' perceptions, beliefs, and readiness to support healthy eating practices in stunting prevention. The educational material covered topics such as balanced nutrition, the impacts and causes of stunting, and strategies to prevent stunting through proper nutrition.

The study began with a 10-minute pre-test, followed by a one-hour intervention session and discussion for the intervention group. The post-test was conducted on the third day after the intervention. Before analysis, the data were tested for normality, as shown in Table 2. Statistical tests included the Wilcoxon test for non-normally distributed data and the Paired T-test for normally distributed data. These analyses aimed to compare differences in knowledge and attitudes between the intervention and control groups (P-value < 0.05). This study obtained ethical approval from the Health Research Ethics Committee of the Banyuwangi Public Health School with reference number 332/04/KEPK-STIKESBWI/VIII/2024, dated August 15, 2024.

Ethical Approval

This study was approved by the Health Research Ethics Committee of X University (Approval Number: 123/KEPK/2024). All participants, including parents or guardians for participants under 18, provided informed consent prior to participating in the study. The confidentiality of all participants was strictly maintained throughout the research process.

RESULTS

The characteristics of the respondents in this study include variables such as age, parental education level, and occupation. The youngest respondent is 12 years old, while the oldest is 18 years old. A detailed description of the respondents' characteristics is presented in Table 1.

Table 1. Respondent Characteristics

Variable	n	%
Age		
12 years	11	12.1
13 years	15	16.5
14 years	8	8.8
15 years	15	16.5
16 years	12	13.2
17 years	17	18.7
18 years	13	14.3
Father's Last Education		
Middle School	16	17.6
High School	54	59.3
Bachelor's Degree	21	23.1
Mother's Last Education		
Elementary School	6	6.6
Middle School	19	20.9
High School	49	53.8
Bachelor's Degree	17	18.7
Father's Occupation		
Laborer	38	41.8
Entrepreneur	22	24.2
Merchant	5	5.5
Civil Servant	14	15.4
Police Officer	2	2.2
Teacher	4	4.4
Millitary	6	6.6
Mother's Occupation		
Laborer	7	7.7
Entrepreneur	3	3.3
Merchant	12	13.2
Civil Servant	2	2.2
Nurse	1	1.1
Teacher	9	9.9
Midwife	6	1.1
Housewife	56	61.5

Table 1 indicates that most respondents were aged between 12 and 18 years, with the highest proportion at age 17 (18.7%) and the lowest at age 14 (8.8%). The majority of fathers had a high school education (59.3%), and similarly, most mothers also completed high school as their highest level of education (53.8%). Regarding parental occupations, the largest proportion of fathers worked as labourers (41.8%), while most mothers were housewives (61.5%).

Table 2. Normality Test Results of Pretest and Posttest Differences

	Tests of Normality					
	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Knowledge Difference (Intervention)	0.205	45	0.001	0.911	45	0.001
Attitude Difference (Intervention)	0.225	45	0.001	0.843	45	0.001
Knowledge Difference (Control)	0.210	46	0.001	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.001, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption. However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 3. Differences Between Variables

Variable	Group	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.001
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.001
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.001
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the post-test with a standard deviation of 0.883. The mean difference between the pretest and post-test was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.001 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the post-test with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the post-test with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the post-test with a standard deviation of 3.607. The mean difference between the pretest and post-test was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

DISCUSSION

Knowledge and attitude are the most important domains of health behavior because they originate from the individual themselves (3,25,26). The sensory process that occurs from what happens around a person will make them more "aware," allowing them to respond with agreement or disagreement. In other words, the attitude someone has is a representation of the knowledge they previously possessed. These two domains are in the phase of educational diagnosis and ecology as predispositional factors in the Precede-Proceed model of behavior change theory by Lawrence Green in 1980. This theory suggests that health education is an effort made to identify the interrelated

domains of behavior change, namely predisposition, enabling, and reinforcing factors (27).

In order to optimize the effectiveness of health education, an efficient tool or medium is required to convey information more clearly, with one such tool being a flip chart. A 2022 review of 10 articles found that flip charts are a valuable resource in health intervention programs addressing public health concerns. When used, they have been shown to enhance the audience's knowledge following the intervention. The flip chart facilitates the visual presentation of information in an easily digestible format, which in turn helps reinforce the target audience's comprehension of the content provided (21).

Adolescence is a phase where individuals begin to develop their identity, knowledge, attitudes, and habits, which will shape their future behavior. Health education for adolescents, particularly in the context of stunting prevention, is crucial for shaping their understanding and attitudes toward health issues, such as nutrition. Proper health interventions can significantly influence their knowledge and attitudes (28). Special focus on adolescent girls is important to support them in facing the physical, emotional, and social changes that occur during adolescence, as well as preparing them for reproductive health roles in the future (29). Therefore, nutrition education is a critical step in enhancing knowledge, shaping attitudes, and encouraging actions that support adolescent health in preventing stunting.

This study indicates that education using flip chart media significantly increased knowledge about nutrition for stunting prevention in the intervention group ($p = 0.001$; $p < 0.05$). The control group also experienced a significant increase ($p = 0.001$; $p < 0.05$), although the average improvement score was smaller, 0.73 compared to 4.94 in the intervention group (see Table 3). These results affirm the effectiveness of flip charts in enhancing adolescent girls' knowledge and strengthen the role of nutrition education in stunting prevention efforts. These findings suggest that health education through flip charts has a significant impact on improving knowledge about nutrition in the context of stunting prevention. Better knowledge of nutrition among adolescents plays a crucial role in reducing stunting rates.

The study by Alviani and Dwianggitamawati aligns with this research, showing that health education is effective in improving understanding related to stunting prevention. Health education plays a strategic role in enhancing health quality, both through increasing knowledge and fostering more constructive attitude changes (22). Similarly, according to the research by Juhari and Suan, individuals with high nutrition knowledge tend to meet both micro and macro nutritional needs and ensure that their children's nutritional status is adequate (30). This understanding encourages proactive behavior in maintaining and improving adolescent nutritional status, which directly supports stunting prevention efforts.

Knowledge plays a crucial role in influencing an individual's attitude and actions toward stunting prevention. As found in a study in Jambi City, a deep understanding of nutrition can drive attitude changes, so individuals with higher knowledge of the importance of nutrition are more likely to demonstrate positive and proactive attitudes toward stunting prevention (31). Attitude is defined as an individual's response or reaction to a specific stimulus or object, involving cognitive, affective, and attentional aspects toward that stimulus. Attitude is not merely an instant reaction but reflects various aspects of integrated mental and emotional experiences (32).

The results of this study show that education using flip chart media significantly improved adolescent girls' attitudes toward nutrition in stunting prevention, with a p-value of 0.010 ($p < 0.05$). The control group also experienced a significant increase (p-value 0.001), but the difference was smaller compared to the intervention group. The average difference in pretest and posttest scores in the intervention group reached 16.27, much higher than the 4.13 observed in the control group (see Table 3). These results confirm that flip charts are effective as an educational medium that not only delivers information but also changes perspectives and enhances attitudes regarding the importance of nutrition. These findings align with research in Surabaya, which showed an improvement in knowledge and attitudes following health education using flip charts. This health education also supports the community empowerment process to maintain and improve health, while demonstrating that flip charts are an effective tool for strengthening individuals' cognitive aspects in stunting prevention (33).

However, these results contrast with the study by Fauziatin et al., which found no difference in attitude scores between the pretest and posttest in the control group regarding stunting prevention, as they did not receive education like the intervention group (34). In contrast, a study in Semarang showed that attitude improvement in the control group could occur even without direct intervention, as adolescents tend to acquire information from other sources such as social media, their environment, or discussions with peers, which also influences attitude changes (6). This

discrepancy suggests that external factors, such as access to information through technology or exposure to community activities, can play a role in shaping adolescent attitudes, even in the absence of structured education.

Effective nutrition education not only increases knowledge about nutrition but also encourages attitude changes among adolescents toward health, including stunting prevention (2,35,36). Better knowledge enables adolescents to make wiser decisions regarding eating habits and lifestyle choices that support optimal growth and development. A positive attitude toward the importance of proper nutrition, if maintained in the long term, becomes a key factor in preventing stunting and supporting their future health (37).

Although the flip chart-based approach shows effectiveness, this study also faces several limitations that need to be considered. One of these is the possibility that the control group may have gained knowledge related to stunting from other sources, such as family, peers, or mass media. These external factors could influence their knowledge and attitudes, making the observed results potentially not fully reflect the effects of the educational intervention provided. Therefore, for future research, it is important to consider strategies that can control or mitigate the influence of these external factors to ensure that the obtained results are more accurate.

Limitations and Cautions

Despite the strengths of this study that relationships of several factors influencing physicians' prescribing behaviour were studied comprehensively within single theoretical framework, but still some limitations should be acknowledged. The first limitation of this study is that it was conducted only in Sana'a, the capital city of Yemen. However, the researcher assumed a reasonable representativeness of the sample because about quarter of physicians participated in the study were Board (Residents) whose elected from different governorates in Yemen. Another limitation which should be considered is that, as in case of all self-reported surveys, it includes the risk of recall bias and social desirability bias.

Recommendations for Future Research

It is important to consider local factors such as the availability of resources, accessibility, and the educational level of parents to ensure that the educational material is effectively received by the target audience. For future researchers, strategies for mitigation can be considered, such as providing general education not directly related to the research topic to the control group, to maintain their involvement without affecting the main variables. Another alternative is to use blinding methods to minimize exposure to external information during the study.

CONCLUSION

Nutrition education using flip charts is effective in improving knowledge and attitudes among adolescent girls regarding stunting prevention (p-value 0.001). The intervention group showed a significant improvement compared to the control group. Flip charts help convey information visually and in an easily understandable manner, which strengthens understanding and fosters a positive attitude toward nutrition. Although there are external factors that may influence the results, this approach has proven effective in encouraging behavioral changes that support stunting prevention.

AUTHOR'S CONTRIBUTION STATEMENT

CONFLICTS OF INTEREST

The authors declare that they have conflict of interest related to this publication.

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Flip Chart-based Nutrition Education to Improve Knowledge and Attitude towards Stunting among Adolescent Girls in Sleman Regency

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ABSTRACT

Background: Adolescence is a critical stage requiring adequate nutrition for long-term health. Adolescent girls are particularly vulnerable to iron deficiency, which increases the risk of anemia and stunting. Enhancing adolescent girls' knowledge of nutrition through health education, which can be delivered using tools such as flipcharts, can prevent and address stunting.

Method: This quasi-experimental study involved 541 adolescent girls aged 12–18 years, with a purposive sample of 91 participants divided into an intervention group and a control group. The intervention group received flip chart-based education, while the control group did not. The study was conducted in Kalurahan Triharjo and Pandowoharjo, Sleman, DI Yogyakarta. Data were collected using validated pre- and post-intervention questionnaires and analyzed with Wilcoxon and paired t-tests.

Result: The intervention group showed significant improvements in knowledge and attitudes about nutrition. Knowledge scores increased from 14.42 ± 2.388 at pretest to 19.36 ± 0.883 at posttest (mean difference: 4.94, p = 0.001). Attitude scores rose from 59.04 ± 8.512 to 75.31 ± 2.410 (mean difference: 16.27, p = 0.001). In the control group, smaller increases were observed for both knowledge (mean difference: 0.73, p = 0.001) and attitudes (mean difference: 4.13, p = 0.036).

Conclusion: Flip chart-based education effectively improves adolescents' knowledge and attitudes about nutrition for stunting prevention. However, external exposure to nutrition information in the control group was a limitation. Future research should minimize such exposure by limiting information to basic content for control groups.

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INTRODUCTION

Adolescence, the period from ages 10 to 19, is one of the most transformative stages of human development, marked by rapid physical, cognitive, emotional, social, and sexual changes that lay the foundation for lifelong health and well-being. The WHO Southeast Asia Region accounts for 27% of the global adolescent population, nearly 360 million young people, the highest proportion for any region (1). Adolescence is a crucial stage for physical and mental

development, characterized by an increased need for nutrition. Nutritional deficiencies during this phase can trigger problems such as anaemia, obesity, chronic energy deficiency (CED), and eating disorders. Adolescent girls, especially during menstruation, require additional iron intake to support haemoglobin production. The nutritional status of adolescents often reflects pre-existing malnutrition issues (2–5). Adolescence can be a key moment to address malnutrition conditions such as stunting or anaemia. Micronutrient deficiencies, especially iron, can hinder linear growth (6).

UNICEF findings reveal slow and threatened global progress in adolescent girls' nutrition. Globally, no country is on track to meet the 2030 global targets for reducing anaemia and low birth weight, and acute malnutrition has increased by 25% since 2020 in crisis-affected countries (7). Meanwhile, in Indonesia, the prevalence of undernutrition among adolescents aged 13-15 years is 8.7%, with 1.9% categorized as severely underweight and 6.8% as underweight. Overnutrition is 16.2%, with 12.0% categorized as overweight and 4.8% as obese (8). According to the Ministry of Health, one of the problems faced by Indonesian adolescents is micronutrient malnutrition, with around 12% of male adolescents and 23% of female adolescents suffering from anaemia, most of which is caused by iron deficiency (iron deficiency anaemia). Anaemia is more prevalent among female adolescents than male adolescents (9).

Poor nutrition is passed down from generation to generation: about half of children under 2 years old with stunting were stunted during pregnancy and the first six months of life (7). Adolescent girls who suffer from nutritional deficiencies, particularly iron and other micronutrients, may increase the risk of stunting in the children they will have in the future (10). In 2022, the WHO reported that 149 million children under the age of five were stunted globally, with nearly half of under-five deaths linked to malnutrition, especially in low- and middle-income countries, leading to widespread impacts on health, the economy, and social development (11).

Stunting remains a serious health issue in Indonesia. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in children under five decreased from 27.9% in 2019 to 21.6% in 2022 (12). In the Special Region of Yogyakarta (DIY), the prevalence of stunting decreased by 0.9%, from 17.3% the previous year to 16.4% in 2022. In Sleman, a significant reduction was observed, from 16% to 15%, and by 2024, it was recorded to have further decreased to 4.41% (12). Although the decline is encouraging, continued efforts are necessary to meet national targets and improve the quality of life for Indonesian children (13).

The Ministry of Health emphasizes the importance of early stunting prevention, as once stunting occurs, its management becomes more complex and requires significant effort with a low chance of recovery. To reduce stunting rates, the Ministry has launched 11 intervention programs focused on two critical growth phases: before and after the birth of the child. In the first phase, there are two interventions: the first targets pregnant women, and the second focuses on adolescent girls in grades 7 and 10. These programs include nutrition counselling, iron supplementation, and reproductive health education to prevent anaemia, which negatively impacts pregnancy and future child growth (14). With a focus on the pre-birth phase, it is hoped that these programs will help create a healthier generation, ready to grow without developmental barriers caused by stunting.

Among adolescents, there is a connection between high curiosity and the desire to realize one's potential (15). A strong sense of curiosity drives adolescents to actively seek new information that is deemed important for self-development. With the knowledge gained, adolescents can maximize their inherent potential. When this curiosity is fulfilled, adolescents tend to feel more motivated to contribute and become individuals who are beneficial to others (16).

The Ministry of Health states that one of the key programs in stunting prevention is education, outreach, and promotion programs (14). Health education is a continuous, dynamic, and complex learning process that takes place throughout life in various contexts. This process involves a collaborative partnership between the community and healthcare providers, with the goal of facilitating and empowering individuals to change adolescent lifestyles for better health outcomes (17). With the right approach, health education can bring about significant positive changes in public health, particularly in terms of nutrition to prevent stunting. In its implementation, several factors must be considered to ensure the success of the desired behavior modification, such as a targeted approach, motivated change agents, and appropriate educational strategies in the use of media and the messages conveyed (18).

One of the key strategies implemented in stunting prevention is education through health promotion media. Promotional media, such as flip charts, leaflets, and posters, have proven effective in delivering information in an engaging and easily understood manner (19). Flip charts, in particular, are visual aids consisting of sheets of paper

with images and supporting information that facilitate audience comprehension (20). Previous studies have shown that the use of flip charts can enhance audience knowledge and attitudes regarding specific health issues, including stunting prevention. Flip charts present information visually and in a comprehensible way, thereby strengthening the audience's understanding of the material delivered (16).

In this study, flipcharts were used as a nutrition education medium for adolescent girls to prevent stunting. This medium serves as a visual aid consisting of sheets of paper with images and supporting information that facilitates audience comprehension (14). Nugraheni (2024) emphasized the urgency of investing in nutrition education as one of the strategies to support sustainable health development (23). Similarly, Lestari (2023) revealed that future nutrition intervention programs should ideally begin during the preconception phase or before pregnancy, including providing education on nutrition to enhance cognitive understanding among prospective mothers in preventing stunting (24). These two recommendations form the foundation for the researcher to implement nutrition education using flipcharts to improve the knowledge and attitudes of adolescent girls regarding stunting prevention.

METHOD

This study employed a quantitative approach with a quasi-experimental two-group design (pre-test and post-test) to examine the effect of nutrition education on improving adolescents' knowledge and attitudes regarding stunting prevention. The study population consisted of 541 adolescent girls, 91 of whom were selected as respondents through purposive sampling with a 1:1 ratio. The intervention group received flipchart-based education after the pre-test, while the control group did not.The inclusion criteria were adolescent girls aged 12–18 years, residing in Triharjo Village, Sleman, Yogyakarta (intervention group) or Pandowoharjo Village, Sleman, Yogyakarta (control group), and willing to participate in the study. The exclusion criterion was the refusal of adolescents to participate. Data collection was conducted from late August 2024 to September 2024. To minimize the effect of confounding variables such as economic status, the intervention and control groups were matched in terms of occupational distribution, ensuring similar economic conditions.

A closed-ended questionnaire with the Guttman scale was used in this study. Knowledge was assessed through questions evaluating participants' understanding of the importance of balanced nutrition, the impacts, causes, and preventive measures of stunting. Attitudes were measured using a Likert scale, focusing on respondents' perceptions, beliefs, and readiness to support healthy eating practices in stunting prevention. The educational material covered topics such as balanced nutrition, the impacts and causes of stunting, and strategies to prevent stunting through proper nutrition.

The study began with a 10-minute pre-test, followed by a one-hour intervention session and discussion for the intervention group. The post-test was conducted on the third day after the intervention. Before analysis, the data were tested for normality, as shown in Table 2. Statistical tests included the Wilcoxon test for non-normally distributed data and the Paired T-test for normally distributed data. These analyses aimed to compare differences in knowledge and attitudes between the intervention and control groups (P-value < 0.05). This study obtained ethical approval from the Health Research Ethics Committee of the Banyuwangi Public Health School with reference number 332/04/KEPK-STIKESBWI/VIII/2024, dated August 15, 2024.

RESULTS

The characteristics of the respondents in this study include variables such as age, parental education level, and occupation. The youngest respondent is 12 years old, while the oldest is 18 years old. A detailed description of the respondents' characteristics is presented in Table 1.

Table 1. Respondent Characteristics

Variable	n	%
Age		
12 years	11	12.1
13 years	15	16.5
14 years	8	8.8
15 years	15	16.5
16 years	12	13.2

17 years	17	18.7
18 years	13	14.3
Father's Last Education		
Middle School	16	17.6
High School	54	59.3
Bachelor's Degree	21	23.1
Mother's Last Education		
Elementary School	6	6.6
Middle School	19	20.9
High School	49	53.8
Bachelor's Degree	17	18.7
Father's Occupation		
Laborer	38	41.8
Entrepreneur	22	24.2
Merchant	5	5.5
Civil Servant	14	15.4
Police Officer	2	2.2
Teacher	4	4.4
Millitary	6	6.6
Mother's Occupation		
Laborer	7	7.7
Entrepreneur	3	3.3
Merchant	12	13.2
Civil Servant	2	2.2
Nurse	1	1.1
Teacher	9	9.9
Midwife	6	1.1
Housewife	56	61.5

Table 1 indicates that most respondents were aged between 12 and 18 years, with the highest proportion at age 17 (18.7%) and the lowest at age 14 (8.8%). The majority of fathers had a high school education (59.3%), and similarly, most mothers also completed high school as their highest level of education (53.8%). Regarding parental occupations, the largest proportion of fathers worked as labourers (41.8%), while most mothers were housewives (61.5%).

Table 2. Normality Test Results of Pretest and Posttest Differences

Tests of Normality						
	Kolmogorov-Smirnov			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Knowledge Difference (Intervention)	0.205	45	0.001	0.911	45	0.001
Attitude Difference (Intervention)	0.225	45	0.001	0.843	45	0.001
Knowledge Difference (Control)	0.210	46	0.001	0.901	46	0.001
Attitude Difference (Control)	0.105	46	0.200	0.956	46	0.083

Table 2 provides the results of the normality test for the difference between pretest and posttest scores using the Shapiro-Wilk test. It shows that the difference in knowledge in the intervention group, with a significance value of 0.002, the difference in attitude in the intervention group, with a significance value of 0.001, and the difference in knowledge in the control group, with a significance value of 0.001, all do not follow a normal distribution (significance value < 0.05). This indicates that the data distribution does not meet the normality assumption. However, for the difference in attitudes in the control group, the Shapiro-Wilk test result with a significance value of 0.083 indicates that the data distribution is normal (significance value > 0.05).

Table 3. Differences Between Variables

Variable	Group	Mean ± SD		Mean Difference	Statistical Test	*P-value*
		Pretest	Posttest			
Knowledge	Intervention (n=45)	14.42 ± 2.388	19.36 ± 0,883	4.94	Wilcoxon	0.001
	Control (n=46)	15.70 ± 1.051	16.43 ± 1.068	0.73	Wilcoxon	0.001
Attitude	Intervention (n=45)	59.04 ± 8.512	75.31 ± 2.410	16.27	Wilcoxon	0.001
	Control (n=46)	53.59 ± 4.893	57.72 ± 3.607	4.13	*Paired T Test*	0.036

Table 3 shows that the educational intervention delivered through flip chart media significantly improved adolescents' knowledge and attitudes regarding stunting prevention. In the intervention group, the average knowledge score in the pretest was 14.42 with a standard deviation of 2.388, which increased to 19.36 in the post-test with a standard deviation of 0.883. The mean difference between the pretest and post-test was 4.94, and the Wilcoxon test results indicated a significant difference in respondents' knowledge after the intervention, with a p-value of 0.001 ($p < 0.05$). This indicates that the intervention successfully enhanced knowledge in a significant way.

In the control group, the average knowledge score in the pretest was 15.70 with a standard deviation of 1.051, increasing to 16.43 in the post-test with a standard deviation of 1.068. The mean difference between the pretest and posttest in the control group was 0.73, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), also indicating a significant difference in respondents' knowledge. However, the increase observed in the control group was smaller compared to the intervention group, suggesting that the intervention had a more substantial effect on improving knowledge.

Regarding the attitude variable, the average attitude score in the pretest was 59.04 with a standard deviation of 8.512, which increased to 75.31 in the post-test with a standard deviation of 2.410. The mean difference of 16.27 indicates a significant improvement in attitudes, and the Wilcoxon test results showed a p-value of 0.001 ($p < 0.05$), signifying a significant difference in respondents' attitudes after the intervention. This suggests that the intervention effectively improved adolescents' attitudes towards stunting prevention.

In the control group, the average attitude score in the pretest was 53.59 with a standard deviation of 4.893, which increased to 57.72 in the post-test with a standard deviation of 3.607. The mean difference between the pretest and post-test was 4.13, and the paired T-test results showed a p-value of 0.036 ($p < 0.05$), indicating a significant difference in respondents' attitudes. However, the improvement in attitudes in the control group was lower than in the intervention group, which suggests that while there was an improvement in the control group, the effect was not as pronounced as in the group that received the intervention.

DISCUSSION

Knowledge and attitude are the most important domains of health behavior because they originate from the individual themselves (3,25,26). The sensory process that occurs from what happens around a person will make them more "aware," allowing them to respond with agreement or disagreement. In other words, the attitude someone has is a representation of the knowledge they previously possessed. These two domains are in the phase of educational diagnosis and ecology as predispositional factors in the Precede-Proceed model of behavior change theory by Lawrence Green in 1980. This theory suggests that health education is an effort made to identify the interrelated domains of behavior change, namely predisposition, enabling, and reinforcing factors (27).

In order to optimize the effectiveness of health education, an efficient tool or medium is required to convey information more clearly, with one such tool being a flip chart. A 2022 review of 10 articles found that flip charts are a valuable resource in health intervention programs addressing public health concerns. When used, they have been shown to enhance the audience's knowledge following the intervention. The flip chart facilitates the visual presentation of information in an easily digestible format, which in turn helps reinforce the target audience's comprehension of the content provided (21).

Adolescence is a phase where individuals begin to develop their identity, knowledge, attitudes, and habits, which will shape their future behavior. Health education for adolescents, particularly in the context of stunting prevention, is crucial for shaping their understanding and attitudes toward health issues, such as nutrition. Proper health interventions can significantly influence their knowledge and attitudes (28). Special focus on adolescent girls is important to support them in facing the physical, emotional, and social changes that occur during adolescence, as well as preparing them for reproductive health roles in the future (29). Therefore, nutrition education is a critical step in enhancing knowledge, shaping attitudes, and encouraging actions that support adolescent health in preventing stunting.

This study indicates that education using flip chart media significantly increased knowledge about nutrition for stunting prevention in the intervention group ($p = 0.001$; $p < 0.05$). The control group also experienced a significant increase ($p = 0.001$; $p < 0.05$), although the average improvement score was smaller, 0.73 compared to 4.94 in the intervention group (see Table 3). These results affirm the effectiveness of flip charts in enhancing adolescent girls' knowledge and strengthen the role of nutrition education in stunting prevention efforts. These findings suggest that health education through flip charts has a significant impact on improving knowledge about nutrition in the context of stunting prevention. Better knowledge of nutrition among adolescents plays a crucial role in reducing stunting rates.

The study by Alviani and Dwianggitamawati aligns with this research, showing that health education is effective in improving understanding related to stunting prevention. Health education plays a strategic role in enhancing health quality, both through increasing knowledge and fostering more constructive attitude changes (22). Similarly, according to the research by Juhari and Suan, individuals with high nutrition knowledge tend to meet both micro and macro nutritional needs and ensure that their children's nutritional status is adequate (30). This understanding encourages proactive behavior in maintaining and improving adolescent nutritional status, which directly supports stunting prevention efforts.

Knowledge plays a crucial role in influencing an individual's attitude and actions toward stunting prevention. As found in a study in Jambi City, a deep understanding of nutrition can drive attitude changes, so individuals with higher knowledge of the importance of nutrition are more likely to demonstrate positive and proactive attitudes toward stunting prevention (31). Attitude is defined as an individual's response or reaction to a specific stimulus or object, involving cognitive, affective, and attentional aspects toward that stimulus. Attitude is not merely an instant reaction but reflects various aspects of integrated mental and emotional experiences (32).

The results of this study show that education using flip chart media significantly improved adolescent girls' attitudes toward nutrition in stunting prevention, with a p-value of 0.010 ($p < 0.05$). The control group also experienced a significant increase (p-value 0.001), but the difference was smaller compared to the intervention group. The average difference in pretest and posttest scores in the intervention group reached 16.27, much higher than the 4.13 observed in the control group (see Table 3). These results confirm that flip charts are effective as an educational medium that not only delivers information but also changes perspectives and enhances attitudes regarding the importance of nutrition. These findings align with research in Surabaya, which showed an improvement in knowledge and attitudes following health education using flip charts. This health education also supports the community empowerment process to maintain and improve health, while demonstrating that flip charts are an effective tool for strengthening individuals' cognitive aspects in stunting prevention (33).

However, these results contrast with the study by Fauziatin et al., which found no difference in attitude scores between the pretest and posttest in the control group regarding stunting prevention, as they did not receive education like the intervention group (34). In contrast, a study in Semarang showed that attitude improvement in the control group could occur even without direct intervention, as adolescents tend to acquire information from other sources such as social media, their environment, or discussions with peers, which also influences attitude changes (6). This discrepancy suggests that external factors, such as access to information through technology or exposure to community activities, can play a role in shaping adolescent attitudes, even in the absence of structured education.

Effective nutrition education not only increases knowledge about nutrition but also encourages attitude changes among adolescents toward health, including stunting prevention (2,35,36). Better knowledge enables adolescents to make wiser decisions regarding eating habits and lifestyle choices that support optimal growth and development. A positive attitude toward the importance of proper nutrition, if maintained in the long term, becomes a key factor in preventing stunting and supporting their future health (37).

Although the flip chart-based approach shows effectiveness, this study also faces several limitations that need to be considered. One of these is the possibility that the control group may have gained knowledge related to stunting from other sources, such as family, peers, or mass media. These external factors could influence their knowledge and attitudes, making the observed results potentially not fully reflect the effects of the educational intervention provided. Therefore, for future research, it is important to consider strategies that can control or mitigate the influence of these external factors to ensure that the obtained results are more accurate.

Recommendations for Future Research

It is important to consider local factors such as the availability of resources, accessibility, and the educational level of parents to ensure that the educational material is effectively received by the target audience. For future researchers, strategies for mitigation can be considered, such as providing general education not directly related to the research topic to the control group, to maintain their involvement without affecting the main variables. Another alternative is to use blinding methods to minimize exposure to external information during the study.

CONCLUSION

Nutrition education using flip charts is effective in improving knowledge and attitudes among adolescent girls regarding stunting prevention (p-value 0.001). The intervention group showed a significant improvement compared to the control group. Flip charts help convey information visually and in an easily understandable manner, which strengthens understanding and fosters a positive attitude toward nutrition. Although there are external factors that may influence the results, this approach has proven effective in encouraging behavioral changes that support stunting prevention.

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