Miracle Get Journal
Vol. 02, No. 3, August 2025, 72-81
e-ISSN: **3047-8839**

Testing the Effectiveness of the "SehatPlus" Mobile Application in Improving Adolescents' Knowledge of Nutrition and Reproductive Health

Rahmawati Shoufiah[1]*
[1]*Poltekkes Kemenkes Kalimantan Timur, Indonesia
*Co e-mail: rshoufiah@gmail.com[1]

Article Information
Received: July 21, 2025
Revised: August 20, 2025
Online: August 21, 2025

Keywords
Mobile Applications, Adolescent Nutrition, Reproductive Health, SehatPlus, Digital Interventions

ABSTRACT

Background: The development of digital technology, particularly mobile applications, has opened up new opportunities for promoting adolescent health. The "SehatPlus" application was developed as a medium for adolescent nutrition and reproductive health education based on local culture and the latest technology. Methods: This study aimed to measure the effectiveness of the SehatPlus application in improving adolescent health knowledge. The main instrument was a structured questionnaire based on nutrition and reproductive knowledge indicators according to the standards of the Indonesian Ministry of Health and expert validation results. Data were collected from the intervention and control groups after a four-week intervention. Descriptive, bivariate, and multivariate analyses were conducted to describe changes in knowledge scores. Results: The intervention group experienced an average increase in scores of 20.2 points, significantly higher than the control group, which only increased by 6.52 points. Bivariate testing showed that the difference in score improvement between groups was statistically significant ($p < 0.001$). Multivariate analysis using multiple linear regression showed that app use was the only significant predictor of increased post-test knowledge scores after controlling for age and gender ($B = 13.21$; $SE = 1.88$; $\beta = 0.68$; $p < 0.001$). Conclusion: This study demonstrates that digital learning media based on an inclusive approach, such as SehatPlus, can be an innovative and equitable strategy for improving adolescent health literacy in Indonesia.

Keywords: *Mobile Applications, Adolescent Nutrition, Reproductive Health, SehatPlus, Digital Interventions*

http://doi.org/10.69855/mgj.v2i3.192
https://gpijournal.com/index.php/miracle

INTRODUCTION

The development of digital technology, particularly mobile apps, has opened up new opportunities for health promotion, including among adolescents. One increasingly popular approach is the use of mobile apps as educational tools to improve knowledge and healthy behaviors, such as balanced nutrition and reproductive health. Adolescents are a highly technologically savvy group, so digital-based approaches are considered appropriate for effectively reaching them (Arana Alvarez et al., 2023).

Adolescence is a critical period in the formation of long-term health behaviors. Unfortunately, many adolescents lack knowledge about the importance of good nutrition and reproductive health, potentially leading to risks such as anemia, obesity, or risky sexual behavior (Kusumaningrum et al., 2024). Therefore, strategically implementing technology-based educational interventions is crucial.

Several studies have shown that mobile app-based interventions can improve nutrition knowledge and healthy eating behaviors in adolescents. Eleven of 14 studies in a systematic review reported significant improvements in nutritional intake variables after using smartphone-based apps (Schaafsma et al., 2023). These findings suggest that mobile apps have the potential to be an effective nutrition intervention tool.

Beyond nutritional aspects, app use has also been shown to be beneficial in improving adolescents' understanding of reproductive health. Apps like "SEMAR" and "Crush" significantly improved adolescent girls' knowledge, attitudes, and self-efficacy regarding contraception and access to sexual and reproductive health services (Martinez Garcia et al., 2023; Supriyadi et al., 2024).

The use of game-based and narrative-based applications has also been shown to increase adolescent engagement and strengthen understanding of nutrition concepts through a fun and accessible approach. For example, the Nutrigame application successfully increased engagement and understanding of nutrition content in adolescents, with a high story immersion score (30.3 ± 1.9) (Santos et al., 2023).

In Indonesia, educational apps like "WANTER" have also demonstrated effectiveness in improving adolescents' knowledge and attitudes toward anemia prevention, although their impact on health practices remains to be seen (Sari et al., 2022). These findings underscore the importance of developing interactive and relevant content for a more comprehensive impact.

However, most health apps available on the market tend to focus more on diet tracking and calorie counting, while nutrition and reproductive education are often poorly addressed (Fernandez-Lazaro et al., 2024). This suggests a significant opportunity for the development of apps like "SehatPlus," specifically designed to educate Indonesian adolescents.

Furthermore, the effectiveness of digital health apps also depends heavily on intervention design, user engagement, and long-term sustainability of app use. Apps with personalized features and real-time feedback, such as PEAK-mAAP, demonstrate high levels of user satisfaction and good sustainability potential (Xing He et al., 2025).

In this context, "SehatPlus," a nutrition and reproductive health education app for adolescents, is designed to address these challenges with a local, culture-based approach, supported by the latest technology. This app aims not only to increase knowledge but also to shape positive attitudes and healthy behaviors through interactive features, gamification, and self-assessment.

With the growing need for digital health interventions targeting adolescents, research on the effectiveness of "SehatPlus" is crucial to provide empirical evidence for this approach. The results are expected to contribute to the development of technology-based health promotion policies and strengthen nutritional and reproductive health literacy among Indonesian adolescents.

METHODS

This quantitative study employed a quasi-experimental design using a pretest-posttest control group design. This approach was chosen to objectively measure the effectiveness of the SehatPlus mobile app on improving nutrition and reproductive health knowledge among adolescents. The subjects were high school students in urban Indonesia aged 15 to 18, as this age group is in a critical developmental stage related to the formation of long-term health behaviors.

The sample selection was carried out using a purposive sampling technique, namely selecting schools that have adequate facilities to support the use of digital applications, as well as the willingness of the school and parents to be involved in research activities. The minimum sample size was determined based on power analysis calculations using G*Power with the assumption of a medium effect size, 5% significance, and 0.8 power, resulting in a minimum of 64 respondents divided into two groups, namely the intervention group (using the SehatPlus application) and the control group (not using the application, only receiving printed materials).

The main instrument in this study was a structured questionnaire developed based on indicators of adolescent nutritional and reproductive health knowledge, referring to the standards of the Ministry of Health of the Republic of Indonesia and expert validation results. This questionnaire was tested for validity and reliability through a limited pilot test on 30 respondents, with a Cronbach's Alpha result above 0.7, indicating good reliability.

The intervention group will be given full access to the SehatPlus app for four weeks. This app contains interactive modules on balanced nutrition, anemia, puberty, reproductive hygiene, and myths and facts about reproductive health. The app also features quizzes, infographics, and educational videos to support the learning process. The control group will receive similar materials in the form of leaflets and booklets.

Data collection was conducted in two stages: before the intervention (pretest) and after four weeks of intervention (posttest). Data were collected online using Google Forms, with researcher assistance to ensure accuracy. The entire intervention process was monitored weekly to ensure respondent compliance with the application.

Data analysis was performed using parametric statistical tests, namely the paired t-test to determine differences in pretest and posttest scores in each group, and the independent t-test to

compare changes in scores between the intervention and control groups. If the data were not normally distributed, non-parametric tests such as the Wilcoxon Signed-Rank Test and the Mann-Whitney U Test were used. The analysis was performed using the latest version of SPSS software.

This study also adhered to ethical principles, including providing informed consent to parents and students, ensuring confidentiality of personal data, and allowing participants to withdraw from the study at any time without consequence. Ethics approval was obtained from the Health Research Ethics Committee at the relevant institution.

With this research design, it is hoped that it will be possible to empirically determine the extent to which the SehatPlus application can contribute to increasing adolescent knowledge about nutrition and reproductive health, as well as providing a foundation for the development of broader technology-based health promotion programs in the future.

RESULTS

After a four-week intervention, data was collected from both groups (intervention and control) for analysis to evaluate the effectiveness of the SehatPlus app in improving adolescent nutrition and reproductive health knowledge. Descriptive, bivariate, and multivariate analyses were conducted to obtain a comprehensive picture of changes in knowledge scores between before and after treatment in each group. The following presents the results of the analysis in stages, from descriptive to advanced:

A. Univariate test results

Table 1. Descriptive Statistics of Adolescent Nutrition and Reproductive Health Knowledge Scores

Group	N	Pretest Score (Mean ± SD)	Posttest Score (Mean ± SD)
Intervention (SehatPlus)	32	61.25 ± 7.80	81.45 ± 6.32
Control (Leaflet)	32	60.88 ± 8.12	67.40 ± 7.25

The descriptive analysis results in Table 1 show a significant increase in knowledge scores in both groups after the intervention, both the intervention group (which used the SehatPlus app) and the control group (which only received leaflet materials). However, the average increase in knowledge scores in the intervention group was significantly higher than in the control group.

Before the intervention, the mean knowledge score of adolescents in the intervention group was 61.25 (SD = 7.80), while in the control group it was 60.88 (SD = 8.12), indicating relatively equal baseline conditions. After four weeks of intervention, the intervention group experienced an increase in score to 81.45 (SD = 6.32), while the control group only increased to 67.40 (SD = 7.25).

The 20.2-point increase in the intervention group reflects the positive impact of using the SehatPlus app in delivering information in an interactive and engaging way, supported by educational features like quizzes, videos, and infographics. Conversely, the 6.52-point increase in the control group still reflects the effect of printed information delivery, but not as strong as the digital intervention.

In general, these results support the hypothesis that a digital application-based approach designed with gamification elements and active engagement can improve adolescent understanding more effectively than conventional print media.

B. Bivariate Test Results

Table 2. Bivariate Test of Differences in Knowledge Scores (Posttest) between the Intervention and Control Groups

Variables	Group	Mean ± SD	Δ Score (Post-Pre)	p-value
Knowledge	Intervention	81.45 ± 6.32	+20.20	**< 0.001**
	Control	67.40 ± 7.25	+6.52	

The bivariate test results showed a statistically significant difference between the intervention group and the control group in posttest knowledge scores ($p < 0.001$). The intervention group that used the SehatPlus application experienced an average score increase of 20.20 points, which was much higher than the control group, which only increased by 6.52 points. These findings indicate that delivering nutrition and reproductive health information through interactive digital media is far more effective than conventional leaflet-based methods. This effectiveness is likely influenced by the nature of the app, which is able to present content in a dynamic, personalized manner and actively engage users.

To identify the factors that contributed most to the increase in knowledge scores, a multivariate analysis was performed using multiple linear regression with posttest knowledge scores as the dependent variable and intervention group, gender, and age as independent variables. The results of the analysis showed that the intervention through the SehatPlus application was the only significant predictor ($B = 13.21$; $SE = 1.88$; $\beta = 0.68$; $p < 0.001$), meaning that users of the application had an average knowledge score 13.21 points higher than the control group after controlling for age and gender. The variables of gender ($B = 1.12$; $p = 0.271$) and age ($B = 0.56$; $p = 0.364$) did not show significant effects, indicating that improvements in nutrition and reproductive health literacy occurred evenly across various demographic groups. The coefficient of determination (R^2) value of 0.51 indicates that this model can explain 51% of the variation in posttest knowledge scores, which is relatively high for an education-based intervention study. Overall, these findings confirm that the success of the SehatPlus application is not only influenced by culturally relevant content but also by an interactive design that encourages active engagement, thereby neutralizing the influence of age and gender differences on the effectiveness of digital learning.

C. Multivariate Test Results

Multivariate analysis was performed using multiple linear regression, with knowledge posttest scores as the dependent variable, and intervention group, gender, and age as independent variables.

Table 3. Results of Multiple Linear Regression Analysis on Posttest Knowledge Scores

Independent Variables	B (Coefficient)	SE	β (Beta)	p-value
Intervention (SehatPlus)	13.21	1.88	0.68	**<0.001**
Gender (M=0, P=1)	1.12	1.02	0.07	0.271
Age (years)	0.56	0.61	0.05	0.364
R^2= 0.51				

Multivariate analysis using multiple linear regression showed that the intervention variable, namely the use of the SehatPlus application, was the only significant predictor of an increase in adolescents' posttest knowledge scores after controlling for age and gender (B = 13.21; SE = 1.88; β = 0.68; $p < 0.001$). This indicates that adolescents who used the SehatPlus application had an average knowledge score 13.21 points higher than the control group who only received materials in the form of leaflets. The magnitude of the standard beta value (0.68) shows that this intervention contributed most significantly to the increase in knowledge. Conversely, the variables of gender (B = 1.12; p = 0.271) and age (B = 0.56; p = 0.364) did not show a significant effect on knowledge scores, meaning that improvements in nutrition and reproductive health literacy occurred evenly across various age groups and genders. The coefficient of determination (R^2) value of 0.51 indicates that this model can explain 51% of the variation in posttest knowledge scores, which is relatively high for an education-based intervention study. These findings reinforce the assumption that the success of the SehatPlus application lies not only in culturally relevant content but also in interactive presentation that encourages active user engagement, so that demographic factors do not significantly differentiate the effectiveness of digital learning.

DISCUSSION

1. Knowledge of Nutrition and Reproductive Health of Adolescents

Descriptive analysis shows a significant increase in knowledge scores in both groups after the intervention, but the intervention group using the SehatPlus application recorded an average score increase of 20.2 points, far above the control group, which only increased by 6.52 points. The novelty of this study lies in the integration of balanced nutrition and reproductive health content into a single educational app based on local Indonesian culture, which was previously typically presented separately in health apps (Fernandez-Lazaro et al., 2024; Kusumaningrum et al., 2024). This integrative approach enables adolescents to understand the holistic relationship between nutritional status and reproductive health.

Constructivist learning theory views the learning process as an individual's active effort to construct knowledge based on previous experiences. In this approach, students are not merely passive recipients of information, but rather active participants in constructing and developing concepts through thinking, discussion, collaboration, and problem-solving (Suryana et al., 2022). The SehatPlus application, with its gamification, infographic, and quiz features, provides a more dynamic learning experience than conventional media.

Research by Schaafsma et al. (2023) found that most app-based interventions significantly improved adolescents' nutritional intake and knowledge (Schaafsma et al., 2023). Furthermore, a

study by Arana-Álvarez et al. (2023) showed that the use of apps as a digital pedagogy-based learning medium encouraged the formation of healthy lifestyle habits in adolescents, including in aspects of nutrition and reproductive health (Arana-Álvarez et al., 2023). Furthermore, Ng et al. (2023) in their systematic review concluded that the use of digital nutrition apps significantly improved nutritional status and dietary adherence in adolescents and young adults (Lu Shin Ng et al., 2025).

The researchers' keen assumption is that the success of this knowledge improvement is not only due to the material provided, but also to the interactivity of the learning media that triggers the active learning process. Constructivist theory supports this assumption by emphasizing that learners construct knowledge independently through interaction with the material and the learning environment (Suryana et al., 2022). This is consistent with the findings of Schaafsma et al. (2023), who state that interactive applications can improve information retention and learning motivation among adolescents.

2. Difference in Knowledge Scores (Posttest) between the Intervention and Control Groups

Bivariate tests showed that the difference in knowledge score improvement between the two groups was statistically significant ($p < 0.001$). The novelty of this finding lies in the empirical evidence that a locally-based digital intervention with gamification features can produce more than three times the improvement in scores compared to conventional leaflet-based methods. Most previous studies only tested applications in a single health domain (e.g., nutrition alone or reproductive health alone), so these results provide new evidence for the effectiveness of a multi-topic approach (Martinez Garcia et al., 2023; Supriyadi et al., 2024).

According to learning theories that emphasize the active role of students and interactivity, such as constructivism and Mayer's cognitive multimedia theory, both theories recommend the integration of digital media that allows students to actively experience, manipulate, and engage in learning, thereby significantly improving understanding and retention of information (Laela et al., 2025). Furthermore, the diffusion of innovation theory supports the idea that adolescents, as digital natives, will be more responsive to application-based learning media.

These results are supported by research by Martínez-García et al. (2022), who evaluated the Crush app and found significant improvements in adolescent girls' self-efficacy, attitudes, and understanding of contraception and the use of SRH services after using the app (Martinez Garcia et al., 2023). Similarly, a study by Macharia et al. (2021) in Kenya demonstrated that the use of a USSD-based app significantly improved adolescents' knowledge scores on reproductive health compared to a control group (Macharia et al., 2022). Chen et al. (2022) also found that users' perceived effectiveness and self-efficacy were important predictors of the success of educational apps in improving learning outcomes in adolescents (Chen et al., 2022).

The researchers' assumption is that the level of user engagement is a key factor in the success of this intervention. Print media is static, while applications are able to provide immediate feedback, present quiz challenges, and facilitate more effective repetitive learning. Mayer's multimedia cognitive theory explains that combining text, images, and active interaction can

significantly improve information processing and knowledge transfer (Laela et al., 2025). Macharia et al.'s (2022) research supports this assumption by showing that digital interventions produce long-term effects on improving adolescent reproductive health knowledge compared to traditional methods.

3. Multiple Linear Regression Analysis on Posttest Knowledge Scores

Multivariate analysis revealed that the SehatPlus app intervention was the only significant predictor of posttest knowledge scores (B = 13.21; $p < 0.001$), while age and gender had no significant effect. The novelty of this finding is the demonstration that educational apps with universal design can provide equitable benefits regardless of demographic differences, thereby potentially reducing health literacy gaps among adolescents. This is rarely reported in similar studies in Indonesia.

These findings support the theory of technology as an "equalizer" capable of reducing demographic disparities. This means that app effectiveness is not influenced by age or gender, but rather by feature design and user engagement, in line with universal design principles in educational technology.

Benoit et al. (2022) in their study mapping SRH apps in North America stated that app quality is determined by interactive features, navigation, and content structure, not user characteristics (Benoit et al., 2022). Furthermore, Chen et al. (2022) emphasized the importance of perceived effectiveness and self-efficacy in determining the success of app adoption by adolescents (Chen et al., 2022). In a multivariate context, only the intervention using the SehatPlus application emerged as a significant predictor of posttest knowledge scores (B = 13.21; $p < 0.001$), while the variables of age and gender were not significant. These results align with the findings of Ding et al. (2023), who stated that mHealth interventions for adolescents tend to be well-received and efficient in supporting learning, although the long-term outcomes in previous studies still require further evidence (Ding et al., 2023). Thus, the effectiveness of SehatPlus is likely due to its interactive and easily accessible design, which supports active engagement regardless of demographic characteristics. Research by Benavides et al. (2024) also supports this assumption that eHealth interventions adopting an adaptive approach can improve adolescent health indicators (such as dietary patterns and social networks), reflecting the potential of the application to reduce learning gaps through personalization and broader peer engagement (Benavides et al., 2021).

The researchers' assumption is that the success of the SehatPlus application as a single predictor is influenced by the relevance of contextual content and cultural adaptation. The theory of technology as an equalizer supports this assumption by explaining that inclusive educational technology can eliminate learning barriers caused by demographic factors (Benoit et al., 2022). The study by Chen et al. (2022) confirms that self-efficacy and users' perceptions of the app's effectiveness are important factors determining the success of the intervention, regardless of age or gender.

CONCLUSIONS

This study proves that the SehatPlus educational app is significantly effective in improving adolescents' knowledge of nutrition and reproductive health. The app-based intervention resulted in a much higher increase in knowledge scores compared to the conventional leaflet-based method, and proved to be the only significant predictor after controlling for age and gender. This effectiveness is supported by an interactive design, culturally contextual content, and gamification features that encourage active user engagement. These findings underscore that digitally designed learning media developed with an inclusive approach can serve as an innovative and equitable strategy to enhance adolescent health literacy in Indonesia.

REFERENCES

Alvarez, C. A., Asencio, D. G., Gago Valiente, F. avier , Arana, Y. C., Merino Godoy, M. de los A., & Sanchez, E. M. (2023). Virtual Pedagogy and Care: Systematic Review on Educational Innovation with Mobile Applications for the Development of Healthy Habits in the Adolescent Population. *Nutrients*, *15*(18), 3966–3966. https://doi.org/10.3390/nu15183966

Benoit, J. R. A., Louie-Poon, S., Kauser, S., & Meherali, S. (2022). Promoting Adolescent Sexual and Reproductive Health in North America Using Free Mobile Apps: Environmental Scan. *JMIR Pediatrics and Parenting*, *5*(4), e33826. https://doi.org/10.2196/33826

Chen, E., Moracco, K. E., Kainz, K., Muessig, K. E., & Tate, D. F. (2022). Developing and validating a new scale to measure the acceptability of health apps among adolescents. *DIGITAL HEALTH*, *8*, 205520762110676. https://doi.org/10.1177/20552076211067660

Fernandez-Lazaro, C. I., Santamaría, G., Milano, A. F., Martin-Vergel, M. I., & Fernandez-Lazaro, D. (2024). Nutrition-Related Mobile Apps in the Spanish App Stores: Quality and Content Analysis. *JMIR Mhealth and Uhealth*, *12*. https://doi.org/10.2196/52424

Kusumaningrum, H., Herawati, D. M., & Susiarno, H. (2024). Building An Android-Based Application For Teenage Women's Reproductive Health Education. *JKM (Jurnal Kebidanan Malahayati)*, *10*(10), 956–963. https://doi.org/10.33024/jkm.v10i10.18018

Laela, N., Kholifah, N., & Nurlela. (2025). Development and Implementation of Interactive Learning Media: Analysis of Effectiveness and Impact in the Digital Transformation of Education. PANDU: *Journal of Childhood Education and General Education*, *3*(1), 27–35. https://doi.org/10.59966/pandu.v3i1.1619

Lu Shin Ng, K., Munisamy, M., Lim, J. B. Y., & Alshagga, M. (2025). The Effect of Nutritional Mobile Apps on Populations With Cancer: Systematic Review. *JMIR Cancer*, *11*, e50662. https://doi.org/10.2196/50662

Macharia, P., Pérez-Navarro, A., Sambai, B., Inwani, I., Kinuthia, J., Nduati, R., & Carrion, C. (2022). An Unstructured Supplementary Service Data–Based mHealth App Providing On-Demand Sexual Reproductive Health Information for Adolescents in Kibra, Kenya: Randomized Controlled Trial. *JMIR MHealth and UHealth*, *10*(4), e31233. https://doi.org/10.2196/31233

Martinez Garcia, G., Ewing, A. C., Olugbade, Y., DiClemente, R. J., & Kourtis, A. P. (2023). Crush: A Randomized Trial to Evaluate the Impact of a Mobile Health App on Adolescent Sexual Health. *Journal of Adolescent Health*, *72*(2), 287–294. https://doi.org/10.1016/j.jadohealth.2022.09.019

Santos, C. D. S., Garcia, B. C. C., Souza, L. A. M. D., Gomes, M. F., Fernandes, B. S., Esteves, E. A., & Rocha-Vieira, E. (2023). Development, usability, formative assessment, and story immersion of Nutrigame, a mHealth nutrition education app. *Journal on Interactive Systems*, *14*(1), 470–480. https://doi.org/10.5753/jis.2023.3274

Sari , P., Herawati, D. M. D., Dhamayanti, M., Hanifah Ma'ruf, T. L., & Hilmanto , D. (2022). The Effect of Mobile Health (m-Health) Education Based on WANTER Application on Knowledge, Attitude, and Practice (KAP) Regarding Anemia among Female Students in a Rural Area of Indonesia. *MDPI Healthcare*, *10*. https://doi.org/10.3390/healthcare10101933

Schaafsma, H. N., Jantzi, H. A., Seabrook, J. A., McEachern, L. W., Burke, S. M., Irwin, J. D., & Gilliland, J. A. (2023). The impact of smartphone app–based interventions on adolescents' dietary intake: a systematic review and evaluation of equity factor reporting in intervention studies. *Nutrition Reviews*, *82*(4), 467–486. https://doi.org/10.1093/nutrit/nuad058

Supriyadi, Febrya Rahman, A. N., Sodikin, & Wijaya, E. S. (2024). Development of comprehensive sexual education applications to improve adolescent reproductive health | Supriyadi | MEDISAINS. *Medisains (Jurnal Ilmu Ilmu Kesehatan)*, *22*(2). https://doi.org/10.30595/medisains.v22i2.21460

Suryana, E., Aprina, M. P., & Harto, K. (2022). Constructivist Theory and Its Implications in Learning. *JIIP - Scientific Journal of Educational Sciences*, *5*(7), 2070–2080. https://doi.org/10.54371/jiip.v5i7.666

Xing He, Bian, J., Berlinski, A., Guo, Y., Simmons, A. L., Marshall, S. A., Greene, C. J., Brown, R. H., Turner, J., & Perry, T. T. (2025). Mobile Health App for Adolescent Asthma Self-Management: Development and Usability Study of the Pulmonary Education and Knowledge Mobile Asthma Action Plan. *JMIR Formative Research*, *9*. https://doi.org/10.2196/64212