

The Effect of the Educational Halma Game on Improving Adolescents' Knowledge and Attitudes Toward the Prevention of Type II Diabetes Mellitus at SMA Negeri 2 Pekalongan

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ABSTRACT

Type II Diabetes Mellitus is a non-communicable disease with an increasing prevalence, including among adolescents. Lifestyle changes such as high sugar consumption, lack of physical activity, and sedentary habits are risk factors for developing Type II Diabetes Mellitus at an early age. Health education for adolescents is generally still delivered using conventional methods that are less attractive, while the use of traditional game media for health promotion remains limited. Research on educational game media has mostly focused on elementary school children and has rarely been applied to adolescents in preventing Type II Diabetes Mellitus. This study aimed to determine the effect of Halma media on improving adolescents' knowledge and attitudes regarding the prevention of Type II Diabetes Mellitus at SMA Negeri 2 Pekalongan. This study used a pre-experimental design with a one-group pre-test and post-test approach. The sample consisted of 30 tenth-grade students selected using purposive sampling. Data were collected using knowledge and attitude questionnaires before and after the educational intervention using Halma media. Data analysis was performed using the Wilcoxon Signed Rank Test. The results showed that the average knowledge score increased from 80.47 to 89.33 with a p-value of 0.001, while the average attitude score increased from 85.00 to 90.33 with a p-value of 0.016. The p-value < 0.05 indicated that Halma media significantly improved adolescents' knowledge and attitudes in preventing Type II Diabetes Mellitus.

Keywords: Adolescent, Attitude, Halma Media, Knowledge, Type II Diabetes Mellitus.

INTRODUCTION

Non-Communicable Diseases (NCDs) remain a major global public health challenge due to their substantial contribution to morbidity and mortality rates in many countries, including Indonesia (Wahidin et al., 2023). One of the NCDs that has shown a significant increase is Diabetes Mellitus (DM), particularly Type II Diabetes Mellitus, which is no longer limited to adults but is increasingly found among adolescents. This condition is associated with modern lifestyle changes, such as unhealthy dietary habits, low levels of physical activity, and

increasing sedentary behavior resulting from advances in technology and digital media (Projo Angkasa et al., 2024).

Globally, the prevalence of metabolic disorders that serve as risk factors for Diabetes Mellitus continues to rise. Data indicate that approximately 9.1% of the world's population experienced Impaired Glucose Tolerance (IGT), while 5.8% experienced Impaired Fasting Glucose (IFG) in 2021 (Rooney et al., 2023). Furthermore, the prevalence of Type II Diabetes Mellitus among adolescents aged 10–19 years has increased significantly, making this age group an important target for early diabetes prevention efforts (Indah Restika BN et al., 2025). According to the World Health Organization (WHO), deaths caused by NCDs are expected to continue increasing, with more than two-thirds of global deaths attributable to non-communicable diseases, including Diabetes Mellitus (World Health Organization., 2023).

In Indonesia, Diabetes Mellitus has become one of the priority health concerns. The International Diabetes Federation (IDF) ranks Indonesia as the seventh country in the world with the highest number of people living with diabetes (International Diabetes Federation., 2021). The number of diabetes cases in Indonesia is projected to increase from 10.8 million in 2020 to 28.57 million cases by 2045 (Ardila et al., 2024). The 2023 Indonesian Health Survey (SKI) also reported an increase in diabetes prevalence among individuals aged ≥ 15 years, from 10.9% in 2018 to 11.7% in 2023 (Maharani et al., 2024). These findings indicate that Diabetes Mellitus is increasingly affecting productive-age individuals and adolescents.

At the local level, Diabetes Mellitus cases in Central Java Province have also shown an upward trend. Data from the Central Java Health Profile 2022 reported a diabetes prevalence of 15.6%, with a total of 647,093 cases (Agustina, 2024). Moreover, in 2023, individuals aged 15–24 years accounted for approximately 90% of diabetes cases in Central Java, totaling 88,180 cases (Dinkes Jateng, 2023). Meanwhile, in Pekalongan City, the number of people with Diabetes Mellitus increased from 6,533 in 2020 to 6,690 in 2022 (Dinkes Kota Pekalongan, 2022). These conditions highlight the need for promotive and preventive efforts initiated during adolescence through health education programs in schools.

Adolescence is a critical period for establishing healthy lifestyle behaviors. However, adolescents tend to adopt unhealthy lifestyles due to social influences, technological developments, and high consumption of fast food and sugar-sweetened beverages. Such habits can increase the risk of obesity and Type II Diabetes Mellitus during productive age (Hervilanti et al., 2024). Limited knowledge and negative attitudes toward diabetes prevention among adolescents also contribute to unhealthy behavioral patterns. Therefore, health education

interventions are needed to improve both knowledge and positive attitudes toward the prevention of Type II Diabetes Mellitus.

The development of interactive learning media has encouraged the use of educational methods that are more engaging and suitable for adolescent characteristics. One such medium is the educational Halma game. Halma, when modified as a health education tool, allows students to learn actively, interactively, and collaboratively through a play-based learning experience. The use of educational game media has been shown to improve students' attention, learning motivation, and understanding of health-related materials compared to conventional lecture-based methods (Wahyudi & Raharjo, 2024). Previous studies have demonstrated that Halma media effectively improves health knowledge among elementary school students (Ilham et al., 2025). However, the use of Halma as an educational medium for Type II Diabetes Mellitus prevention among senior high school adolescents remains limited.

Based on a preliminary study conducted by the researcher, Kusuma Bangsa Community Health Center (Puskesmas Kusuma Bangsa) in Pekalongan City is one of the health facilities with the highest achievements in Diabetes Mellitus control programs and implements the Free Health Check-up (CKG) program, including blood glucose screening for students as an early detection effort for diabetes risk factors. SMA Negeri 2 Pekalongan, which is located within the working area of Puskesmas Kusuma Bangsa, represents a strategic setting for implementing health education interventions related to the prevention of Type II Diabetes Mellitus. Initial observations also revealed that health education activities at the school are still predominantly delivered through lecture methods, resulting in limited student engagement during the learning process.

Although numerous studies have examined health education media, most have focused solely on improving knowledge without simultaneously assessing changes in attitudes. In addition, the use of the traditional Halma game as an educational medium for Type II Diabetes Mellitus prevention among senior high school adolescents in Pekalongan City remains underexplored. Therefore, this study aims to analyze the effect of educational Halma media on adolescents' knowledge and attitudes regarding the prevention of Type II Diabetes Mellitus among tenth-grade students at SMA Negeri 2 Pekalongan City.

METHODS

This study employed a pre-experimental research design using a one-group pretest–posttest approach to examine the effect of the Halma educational game on improving adolescents' knowledge and attitudes toward the prevention of Type II Diabetes Mellitus. The study was

conducted among tenth-grade students at SMA Negeri 2 Pekalongan City, with a total population of 291 students. A sample of 30 respondents was selected using a purposive sampling technique based on the study's inclusion and exclusion criteria.

Data were collected through three stages: administration of a pretest, implementation of the educational intervention using the interactive Halma game, and administration of a posttest after the intervention. The Halma game was modified as a health education medium to deliver information on Type II Diabetes Mellitus prevention through interactive play, discussion, and reflection activities. The research instruments consisted of knowledge and attitude questionnaires regarding the prevention of Type II Diabetes Mellitus. The knowledge questionnaire comprised 30 multiple-choice questions, while the attitude questionnaire consisted of 30 statements measured using a five-point Likert scale.

The validity test results indicated that all questionnaire items were valid, with calculated correlation coefficients (*r*-value) exceeding the critical *r*-table value (0.361). Reliability testing using Cronbach's Alpha yielded coefficients of 0.946 for the knowledge questionnaire and 0.715 for the attitude questionnaire, indicating that both instruments were reliable and demonstrated good internal consistency for data collection.

Data were analyzed using both univariate and bivariate statistical methods. Univariate analysis was conducted to describe respondents' characteristics and the distribution of knowledge and attitude scores before and after the intervention. Bivariate analysis was performed to evaluate the effect of the Halma educational game on improving adolescents' knowledge and attitudes. The Paired Sample *t*-test was used when the data were normally distributed, whereas the Wilcoxon Signed Rank Test was applied when the normality assumption was not met. Statistical significance was determined at a 95% confidence level ($p < 0.05$).

This study was conducted after obtaining research approval from the Faculty of Health Sciences, Universitas Pekalongan, the Pekalongan City Health Office, and SMA Negeri 2 Pekalongan City. Prior to participation, all respondents received an explanation of the study objectives and provided written informed consent.

RESULTS

This study was conducted among 30 tenth-grade students of SMA Negeri 2 Pekalongan City to examine the effect of the educational Halma game on adolescents' knowledge and attitudes toward the prevention of Type II Diabetes Mellitus. The data collected included respondents'

characteristics, pre-test and post-test knowledge scores, pre-test and post-test attitude scores, normality test results, and hypothesis testing results.

1. Respondents' Characteristics

Table 1. Respondents' Characteristics by Age and Gender

Characteristics	Category	Frequency (n)	Percentage(%)
Age	15 years	12	40.0
	16 years	17	56.7
	17 years	1	3.3
Gender	Male	3	10.0
	Female	27	90.0
Class	Grade 10	30	100.0
Total		30	100,0

Source: Primary Data Processed Using SPSS (2026)

Based on Table 1, the majority of respondents were 16 years old, accounting for 17 respondents (56.7%), followed by 15-year-old respondents with 12 students (40.0%) and 17-year-old respondents with 1 student (3.3%). Regarding gender, most respondents were female, with 27 students (90.0%), while 3 respondents (10.0%) were male. All respondents were tenth-grade students at SMA Negeri 2 Pekalongan City.

2. Knowledge Levels Before and After the Intervention

Table 2. Adolescents' Knowledge Levels Before and After the Intervention

Knowledge Category	Pre-test n (%)	Post-test n (%)
Good	25 (83.3%)	28 (93.3%)
Moderate	5 (16.7%)	2 (6.7%)
Poor	0 (0%)	0 (0%)
Total	30 (100%)	30 (100%)

Source: Primary Data Processed Using SPSS (2026)

As shown in Table 2, before the Halma educational intervention, most respondents had a good level of knowledge, with 25 respondents (83.3%), while 5 respondents (16.7%) were categorized as having a moderate level of knowledge. No respondents were classified as having poor knowledge. Following the intervention, the number of respondents with good knowledge increased to 28 (93.3%), while the number of respondents with moderate knowledge decreased to 2 (6.7%). No respondents were categorized as having poor knowledge after the intervention.

3. Attitude Levels Before and After the Intervention

Table 3. Adolescents' Attitude Levels Before and After the Intervention

Attitude Category	Pre-test n (%)	Post-test n (%)
Positive	29 (96.7%)	30 (100%)
Fair	1 (3.3%)	0 (0%)
Negative	0 (0%)	0 (0%)
Total	30 (100%)	30 (100%)

Source: Primary Data Processed Using SPSS (2026)

Based on Table 3, prior to the intervention, 29 respondents (96.7%) demonstrated a positive attitude toward the prevention of Type II Diabetes Mellitus, while 1 respondent (3.3%) was categorized as having a fair attitude. No respondents demonstrated a negative attitude. After the intervention, all respondents (100%) demonstrated a positive attitude, with no respondents remaining in the fair or negative categories.

4. Normality Test

Table 4. Shapiro–Wilk Normality Test Results

<i>Saphiro-Wilk</i>			
	Statistic	df	Sig
Pre-test Knowledge	0,926	30	0,039
Post-test Knowledge	0,929	30	0,046
Pre-test Attitude	0,985	30	0,940
Post-test Attitude	0,885	30	0,004

Source: Primary Data Processed Using SPSS (2026)

The results of the Shapiro–Wilk normality test presented in Table 4 indicate that both the pre-test and post-test knowledge data had p -values of less than 0.05, indicating a non-normal distribution. For the attitude variable, the pre-test data were normally distributed ($p > 0.05$), whereas the post-test data were not normally distributed ($p < 0.05$). Therefore, the data were analyzed using the non-parametric Wilcoxon Signed Rank Test.

5. Hypothesis Testing

Table 5. Wilcoxon Signed Rank Test Results

Variable (Pre-test vs Post-test)	Test Statistic (Z)	Sig (2- tailed)	N
Knowledge	-3,981 ^b	< 0,000	30
Attitude	-2,460 ^b	0,014	30

Source: Primary Data Processed Using SPSS (2026)

The Wilcoxon Signed Rank Test results presented in Table 5 showed a Z value of -3.981 for the knowledge variable with a p -value of <0.001 . For the attitude variable, the Z value was -2.460 with a p -value of 0.014 . Since the significance values for both variables were less than 0.05 , the null hypothesis was rejected and the alternative hypothesis was accepted. These findings indicate that the educational Halma game had a statistically significant effect on improving adolescents' knowledge and attitudes regarding the prevention of Type II Diabetes Mellitus.

Figure 1. Health Education Intervention Using the Educational Halma Game



DISCUSSION

The respondents' characteristics indicated that most participants were 16 years old, representing middle adolescence. Individuals in this developmental stage generally show a high interest in interactive learning media. Therefore, the educational Halma game was considered appropriate for this age group because it creates a more active, enjoyable, and less monotonous learning environment.

The findings demonstrated an improvement in respondents' knowledge following the educational intervention using the Halma game. The proportion of respondents with good knowledge increased from 25 (83.3%) before the intervention to 28 (93.3%) afterward. This improvement may be attributed to the ability of the Halma game to create a more interactive and engaging learning experience compared with conventional lecture-based methods. Through game-based activities, discussions, and reflection, respondents became more actively involved in the learning process, making health information easier to understand and retain. Furthermore, the competitive yet enjoyable learning atmosphere increased participants' enthusiasm throughout the educational sessions.

Regarding attitudes, all respondents demonstrated positive attitudes following the intervention. These findings suggest that the educational Halma game not only enhanced cognitive outcomes but also promoted positive attitudes toward healthy lifestyles and the prevention of Type II Diabetes Mellitus. Active participation during the educational game facilitated the delivery of health messages, thereby encouraging positive attitudinal changes.

The results of the Wilcoxon Signed Rank Test further supported these findings. The significant p -values for both knowledge ($p < 0.001$) and attitude ($p = 0.014$) indicate that the educational Halma game significantly improved adolescents' knowledge and attitudes regarding the prevention of Type II Diabetes Mellitus.

These findings are consistent with previous studies reporting that game-based educational media are effective in improving adolescents' knowledge and attitudes in health education. Interactive learning media increase student engagement, making health promotion activities more effective and enabling participants to better understand educational content than conventional teaching methods.

In addition to improving knowledge acquisition, the implementation of the Halma educational game also promoted active student participation throughout the intervention. Participants actively answered questions, engaged in discussions, and expressed their opinions regarding diabetes risk factors, symptoms, physical activity, healthy eating habits, and preventive measures. These activities indicate that the Halma game also enhanced social interaction and teamwork among students during the educational sessions.

Overall, the findings suggest that the educational Halma game can serve as an alternative health promotion medium for adolescents. Besides improving knowledge and fostering positive attitudes, the game creates an active, engaging, and enjoyable learning environment that facilitates more effective delivery and comprehension of health information.

CONCLUSION

This study concludes that the educational Halma game is an effective health education medium for improving adolescents' knowledge and attitudes toward the prevention of Type II Diabetes Mellitus. By providing an interactive, engaging, and participatory learning experience, the Halma game supports the delivery of health education in a school setting and has the potential to strengthen diabetes prevention efforts among adolescents.

These findings suggest that the educational Halma game may be considered an alternative health promotion medium for schools and healthcare providers in implementing adolescent health education programs. Future studies are recommended to employ larger sample sizes, include control groups, and involve multiple schools to improve the generalizability of the findings and further evaluate the long-term effectiveness of the intervention.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the study employed a pre-experimental one-group pretest–posttest design without a control group, limiting the ability to attribute the observed changes solely to the educational Halma intervention. Second, the sample consisted of only 30 students from a single senior high school, which may limit the generalizability of the findings to other adolescent populations. Third, the intervention was conducted only once, and the study evaluated only the short-term effects on knowledge and attitudes without assessing long-term retention or behavioral changes. Therefore, future studies are recommended to include larger and more diverse samples, use experimental designs with control groups, and evaluate the long-term impact of the educational Halma game on adolescents' preventive health behaviors related to Type II Diabetes Mellitus.

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