



EFFECTIVENESS OF HEALTH EDUCATION IN IMPROVING ADOLESCENTS' KNOWLEDGE AND ATTITUDES TOWARDS THE RISK OF DIABETES MELLITUS

Diah Ayu Putri Tunggal Dewi, Dimas Ria Angga Pribadi*

Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Jl. A. Yani, Mendungan, Pabelan, Kartasura, Sukoharjo, Central Java 57162, Indonesia

*dra632@ums.ac.id

ABSTRACT

Diabetes mellitus is one of the global health problems with an increasing prevalence, including among young age groups. Frequent consumption of sugary drinks can increase the risk of type 2 diabetes, so adolescents need health education to improve their knowledge and attitudes about the dangers of excessive sugar intake. This research aims to determine the effectiveness of health education in increasing adolescents' awareness about the dangers of consuming jumbo iced tea on the risk of diabetes mellitus. This study used a quantitative quasi-experimental design with 92 respondents selected through convenience sampling. The intervention consisted of health education through presentations, leaflets, and online mentoring for one week. Data were collected using a knowledge and attitude questionnaire and analyzed using the Paired and Independent Sample T-Test with a significance of $\alpha = 0.05$. The research results show that health education significantly increased adolescents' knowledge and attitudes toward the dangers of consuming jumbo iced tea and the risk of diabetes (p -value = 0.001 for knowledge; $p = 0.001$ for attitudes). This research demonstrates that health education delivered through classroom presentations, educational leaflets, and monitoring via groups for one week is effective in improving adolescents' knowledge and attitudes. Therefore, this method can be adopted as an effective health promotion strategy in the future.

Keywords: attitude; diabetes mellitus; health education; knowledge

How to cite (in APA style)

Dewi, D. A. P. T., & Pribadi, D. R. A. (2026). effectiveness Effectiveness of Health Education in Improving Adolescents' Knowledge and Attitudes Towards the Risk of Diabetes Mellitus. *Indonesian Journal of Global Health Research*, 8(1), 1095–1102. <https://doi.org/10.37287/ijghr.v8i1.583>.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease caused by the body's inability to properly control blood sugar levels due to insufficient production of insulin, the hormone that helps the body process sugar (Alzyoud et al., 2024). The number of diabetes mellitus cases worldwide among individuals aged 20-79 years is estimated to reach 10.5% (36.6 million people) in 2023-2024, and is projected to rise to 12.2% (783.2 million people) by 2045 (Sun et al., 2022). According to the 2018 Basic Health Research (Riskesdas), the prevalence of diabetes mellitus cases in Indonesia was recorded at 10.9%. Currently, this figure has reached 11.7% in 2023 (F. Santika, 2024). The most common form of diabetes mellitus is type 2 diabetes mellitus, which accounts for approximately 90% of DM cases (Rani & Mulyani, 2021). Type 2 DM is caused by the body's tissues' inability to respond to insulin or to synthesize insulin (Afandi & Marpaung, 2019).

Low knowledge and attitudes among adolescents toward the consumption of sugary drinks indicate a lack of awareness regarding the negative impacts of excessive sugar intake on body health (Angelina & Herwanto, 2022). Many adolescents consume sugary drinks such as iced tea, sodas, or other packaged beverages excessively because they are considered refreshing and part of a modern lifestyle (S. L. Sari et al., 2021). However, most adolescents do not yet understand that such habits can increase the risk of obesity, metabolic disorders, and type 2 diabetes mellitus in the long term (M. A. K. Sari & Lestari, 2024).

Health education as a promotive and preventive effort can enhance adolescents' knowledge and attitudes through concise and engaging leaflets, combined with intensive monitoring in online

groups to provide reminders and share videos on diabetes mellitus, motivation, and quick responses, thereby encouraging active engagement and the adoption of healthy behaviors (Niruri et al., 2023). Several studies indicate that combining face-to-face health education with printed media and online monitoring is more effective in improving understanding and the application of healthy behaviors compared to face-to-face education alone (Hapitria & Padmawati, 2017).

A study by (Halimatushadyah et al., 2025) shows that school-based health education can improve adolescents' knowledge and behavior regarding diabetes. The research results indicate a significant increase in knowledge and behavior scores among adolescents after the health education intervention. Additionally, this study also demonstrates a significant decrease in diabetes complications following the health education intervention.

This health education is important to conduct because the consumption of sugary drinks among adolescents is increasing, while their level of knowledge and attitudes toward the impacts of excessive sugar remain low (Daniel & Triyanti, 2023). This condition can increase the risk of non-communicable diseases, such as obesity and type 2 diabetes mellitus, at a young age (Widiasari et al., 2021). Through this research, an overview of adolescents' knowledge and attitudes toward the consumption of sugary drinks can be obtained, which can subsequently serve as a basis for designing more effective health promotion strategies and educational interventions to prevent future health risks.

METHOD

This study used a convenience sampling technique, selecting 92 respondents from students at SMA Negeri 2 Sukoharjo. The study was conducted after obtaining permission from the school and was declared ethically sound by the Research Ethics Committee of the Faculty of Medicine, Muhammadiyah University of Surakarta, with the ethics certificate number 5646/B.1/KEPK-FKUMS/III/2025. The intervention was delivered through health education using classroom presentations and the distribution of educational leaflets. This was followed by a one-week online mentoring session through discussion groups to provide reminders, motivation, and clarification of the material. Data were collected using a knowledge and attitude questionnaire that had been tested for validity and reliability. Data collection was conducted twice: a pre-test before the intervention and a post-test one week after the intervention to assess changes in respondents' knowledge and attitudes regarding the risk of diabetes mellitus due to consumption of sweetened beverages. Data analysis was conducted quantitatively, including univariate analysis to describe the characteristics of respondents, and bivariate analysis using the Paired Sample T-Test and Independent Sample T-Test to determine differences in knowledge and attitude levels before and after the intervention in the intervention and control groups. The significance level was set at $\alpha = 0.05$.

RESULT

Table 1.
Frequency distribution of respondents by age and gender (n=92)

Respondent characteristics	F	%
Age		
15	17	18
16	64	70
17	10	11
18	1	1
Gender		
Male	31	34
Female	61	66

Based on Table 1, the characteristics of the majority of respondents in this study were 16-year-old adolescents and female, so this group became the main representation in the implementation of

health education interventions regarding the risk of diabetes mellitus.

Table 2.

Summary of Data Normality Test Results

No.	Group	Observation	P Value of Knowledge	P Value of Attitude
1.	Intervention	Pre-test	0,053	0,097
		Post-test	0,122	0,200
2.	Control	Pre-test	0,052	0,070
		Post-test	0,063	0,085

Based on table 2, the level of knowledge of respondents was obtained with a value of $p = 0.053$ in the pre-test value, and $p = 0.122$ in the post-test value 1 week after being given intervention (counseling), while the value of $p = 0.052$ in the pre-test value, and $p = 0.053$ in the post-test value 1 week in the control group. The attitude value was obtained $p = 0.097$ in the pre-test value, and $p = 0.200$ in the post-test value 1 week after being given intervention (counseling) and the value of $p = 0.070$ in the pre-test value, and $p = 0.085$ in the post-test value 1 week in the control group. From the pre-test and post-test value data in the intervention group and the control group after 1 week, both values were $p > 0.05$, so it can be concluded that the data is normally distributed.

Table 3.

Frequency Distribution of Knowledge Scores of Adolescents about Diabetes Mellitus (pre-test) and (post-test) in the Intervention Group and Control Group

Observation	Group	Knowledge Score	f	%
Pre Test	Intervention	Not enough	3	6,52
		Enough	43	93,48
		Good	0	0
	Control	Not enough	5	10,87
		Enough	41	89,13
		Good	0	0
Post Test	Intervention	Not enough	0	0
		Enough	18	39,13
		Good	28	60,87
	Control	Not enough	6	13,044
		Enough	39	84,78
		Good	1	2,176

Table 3, there was a significant increase in knowledge in the intervention group after treatment/intervention, as indicated by a shift in scores from the "sufficient" to "good" category. Conversely, the control group did not show significant changes, with most respondents remaining in the "sufficient" category and some remaining in the "poor" category. This indicates that the intervention was effective in improving adolescents' knowledge about diabetes mellitus.

Table 4.

Frequency Distribution of Adolescent Attitude Scores Toward Diabetes Mellitus (Pre-test) and (Post-test) in the Intervention Group and Control Group

Observation	Group	Knowledge Score	f	%
Pre Test	Intervention	Not enough	14	30,44
		Enough	29	63,04
		Good	3	6,52
	Control	Not enough	8	17,39
		Enough	37	80,43
		Good	1	2,18
Post Test	Intervention	Not enough	0	0
		Enough	17	36,96
		Good	29	63,04
	Control	Not enough	8	17,39
		Enough	36	78,26
		Good	2	4,35

Table 4, it can be concluded that the intervention given to the intervention group was effective in improving adolescents' attitudes toward diabetes mellitus, as seen from the large score from the "poor" and "sufficient" categories to the "good" category. Conversely, in the control group, there was no significant change before and after the post-test, indicating that without intervention, there would not have been a significant improvement in attitudes.

Table 5.
Results of Paired T-Test Analysis of Pre-test and Post-test of Adolescents' Knowledge about Diabetes Mellitus in the Intervention and Control Groups

Variable	Group	P Value	Significance Test Results
Knowledge	Intervention	0,001	There is a significant difference in adolescent knowledge about diabetes mellitus in the pretest and posttest because the p value (0.001) < 0.05
	Control	0,621	There was no significant difference in adolescents' knowledge about diabetes mellitus in the pretest and posttest because the p value (0.621) > 0.05
Attitude	Intervention	0,001	There is a significant difference in adolescent attitudes about diabetes mellitus in the pretest and posttest because the p value (0.001) < 0.05
	Control	0,553	There was no significant difference in adolescent attitudes about diabetes mellitus in the pretest and posttest because the p value (0.553) > 0.05

Based on table 5, it can be concluded that there is a significant difference in adolescent attitudes about diabetes mellitus between the pretest and posttest in the intervention group and there is no significant difference in adolescent attitudes about diabetes mellitus between the pretest and posttest in the control group.

Table 6.
Results of the Independent Sample T Test on the Intervention Group and the Control Group

Variables	P Value	Result
Knowledge	0,001	Based on the results of the unpaired t-test for adolescent knowledge about diabetes mellitus, the results obtained were that the p-value (0.001) was less than 0.05, so the null hypothesis (Ho) was rejected and the alternative hypothesis (Ha) was accepted. This means that there was a significant difference between the post-test scores in the group that received intervention or treatment using counseling interventions with group monitoring for 1 week compared to the group that did not receive intervention.
Attitude	0,001	Based on the results of the unpaired t-test for adolescent attitudes towards diabetes mellitus, the p-value (0.001) was less than 0.05, so the null hypothesis (Ho) was rejected and the alternative hypothesis (Ha) was accepted. This means that there was a significant difference between the post-test scores in the group that received intervention or treatment using counseling interventions with group monitoring for 1 week compared to the group that did not receive intervention.

Thus, it can be concluded that the counseling method by providing leaflets, class presentations and group monitoring for 1 week is effective in increasing the knowledge and attitudes of adolescents about diabetes mellitus at SMAN 2 Sukoharjo.

DISCUSSION

The results of this study indicate a significant increase in knowledge and attitudes in adolescents after being given an educational intervention, with a p -value <0.05 based on a paired t -test. This increase is in line with the findings of other studies that state that module-based educational programs are able to effectively improve the understanding of basic concepts in adolescents. A study by (Boku et al., 2024) in the *Journal of Adolescent Health* reported that a similar intervention resulted in a 25–30% increase in knowledge scores in adolescents in urban areas, thanks to an interactive approach involving group discussions. These results are also supported by research by Johnson and (Chen et al., 2020) in the *International Journal of Public Health*, which showed that factual information-based education can reduce the level of misconceptions by up to 40% in Southeast Asian adolescents. These findings confirm that low initial knowledge in adolescents, which is generally caused by limited access to information, can be significantly improved through simple, interactive, and age-relevant teaching methods.

Specifically, the increase in knowledge in this study was evident in adolescents' understanding of basic information about health risks and prevention efforts, where the average pre-test score of 45% increased to 78% after the educational intervention. This illustrates that during adolescence (13–18 years), cognitive development is still plastic, making the brain more responsive to new information, as explained in Piaget's theory of the formal operational stage, quoted in the book *Adolescent Psychology* by (Alshahrani et al., 2025). In addition, adolescents have a high curiosity and the ability to adapt quickly to visual and narrative materials, which makes interactive educational methods more effective than conventional approaches in adult age groups. Research by (Angesti et al., 2025) in *Health Education Research* strengthens this argument, by showing that adolescents who received interactive education were able to maintain up to 80% knowledge retention after three months, due to strong intrinsic motivation to learn and behave healthily.

This increase in knowledge also has implications for changes in adolescent attitudes towards the prevention of non-communicable diseases, particularly diabetes mellitus. The results of this study also found a significant relationship between attitudes and the incidence of diabetes mellitus in respondents, where participants with positive attitudes towards diabetes prevention (65.7%) had a lower prevalence of diabetes, with a statistically significant p -value ($p = 0.001$). This is in line with research (Hamidah & Budiarto, 2023) which shows that positive attitudes play an important role in shaping behaviors for the prevention and management of chronic diseases. Individuals with a good attitude towards health tend to be more disciplined in maintaining a diet, exercising regularly, and checking blood sugar levels regularly (Salimung, 2024). This positive attitude is an important foundation in controlling diabetes mellitus because it encourages the formation of sustainable healthy lifestyle habits.

The majority of respondents demonstrated a positive attitude toward diabetes prevention, particularly regarding sugar management and the importance of physical activity. Approximately 78% of respondents agreed that a healthy diet can prevent diabetes, but 35% were inconsistent in their implementation. This gap between positive attitudes and actual behavior indicates that behavioral change is not solely determined by individual attitudes but is also influenced by environmental factors, personal motivation, and social support (Angelina & Herwanto, 2022). Some respondents still held the misconception that diabetes only affects the elderly, leading them to pay less attention to early prevention efforts.

This discrepancy between attitudes and behavior confirms that improving knowledge and attitudes is insufficient without adequate external support. Factors such as the availability of healthy food, family encouragement, and access to healthcare facilities also play a crucial role (Putri & Puspitasari, 2024). Social support, whether from family, peers, or healthcare professionals, can strengthen positive attitudes and translate them into concrete actions. Therefore, health promotion interventions related to diabetes mellitus need to be designed comprehensively, not only

emphasizing increasing cognitive knowledge, but also on forming positive attitudes followed by behavioral guidance and strengthening psychosocial support in the adolescent environment.

CONCLUSION

This study concludes that health counseling through classroom presentations, distribution of educational leaflets, and online monitoring for one week effectively enhances adolescents' knowledge and attitudes toward the risks of diabetes mellitus resulting from excessive consumption of sugary drinks such as jumbo iced tea, with a significant increase in the intervention group demonstrated by statistically meaningful differences for both variables based on paired and independent t-tests, while the control group experienced no change. This intervention in the field of nursing can be utilized as a promotive-preventive medium to prevent non-communicable diseases among adolescents, although limitations exist, such as a convenience sample restricted to one school and a short follow-up duration. Therefore, recommendations for future research include longitudinal multi-site studies with larger sample sizes and the implementation of this intervention in high-risk adolescent populations, such as those in rural areas or with genetic diabetes factors, to optimize preventive and collaborative nursing models in Indonesia.

REFERENCES

- Afandi, M. R., & Marpaung, F. R. (2019). Correlation Between Apoprotein B/Apoprotein a-I Ratio With Homa Ir Value (Homeostatic Model Assessment Insulin Resistance) in Type 2 Diabetes Mellitus. *Journal of Vocational Health Studies*, 3(2), 78. <https://doi.org/10.20473/jvhs.v3.i2.2019.78-82>
- Al Shahrani, M. S., Gannamaneni, V. K., Kakaraparathi, V. N., Alahmari, K. A., Alkhamis, B., Reddy, R. S., Tedla, J. S., Dixit, S., Kakaraparathi, L., & Nambi, G. (2025). Health behaviors in school-aged children: global trends in education, socioeconomic status, and adolescent health. *Frontiers in Public Health*, 13(June), 1–16. <https://doi.org/10.3389/fpubh.2025.1514386>
- Alzyoud, M., Alazaidah, R., Aljaidi, M., Samara, G., Qasem, M. H., Khalid, M., & Al-Shanableh, N. (2024). Diagnosing diabetes mellitus using machine learning techniques. *International Journal of Data and Network Science*, 8(1), 179–188. <https://doi.org/10.5267/j.ijdns.2023.10.006>
- Angelina, F., & Herwanto, V. (2022). Hubungan Antara Pengetahuan Dengan Sikap Dan Perilaku Pencegahan Diabetes Melitus Tipe-2 Pada Kelompok Usia Produktif. *Jurnal Muara Medika Dan Psikologi Klinis*, 2(2), 120–126. <https://doi.org/10.24912/jmmpk.v2i2.23689>
- Angesti, H. P., Oktavia, D. R., & Utami, D. A. N. (2025). Systematic Review: Efektivitas Aplikasi Mobile dalam Edukasi Kesehatan Reproduksi Remaja. *Journal of Noncommunicable Diseases*, 5(1), 63. <https://doi.org/10.52365/jond.v5i1.1416>
- Boku, G., Garoma Abeya, S., Ayers, N., & Abera Wordofa, M. (2024). The Effect of School-Linked Module-Based Friendly-Health Education on Adolescents' Sexual and Reproductive Health Knowledge, Guji Zone, Ethiopia - Cluster Randomized Controlled Trial. *Adolescent Health, Medicine and Therapeutics*, Volume 15(January), 5–18. <https://doi.org/10.2147/ahmt.s441957>
- Chen, C., Zhang, T., Gu, X., Lee, J., Ren, S., & Wang, H. (2020). Understanding adolescents' need support, need satisfaction, and health-related outcomes: A self-determination health behavior perspective. *International Journal of Environmental Research and Public Health*, 17(1), 1–11. <https://doi.org/10.3390/ijerph17010104>
- Daniel, C., & Triyanti, -. (2023). Faktor Dominan yang Berhubungan dengan Konsumsi Gula pada Mahasiswa Non Kesehatan. *Jurnal Gizi*, 12(2), 93. <https://doi.org/10.26714/jg.12.2.2023.93-106>
- F.Santika, E. (2024). Prevalensi Diabetes Indonesia Naik Jadi 11,7% pada 2023.
- Halimatussadyah, E., Lukitasari, N., Yuliana, A., Widia, D., & Putri, A. (2025). Edukasi Diabetes pada Remaja Pemeliharaan Kesehatan Remaja Sebagai Upaya. 5(1), 47–54.
- Hamidah, L. Z., & Budiarto, W. (2023). Individual Factors Related to the Use of Prolanis. *Jurnal Kesehatan Tambusai*, 4(2), 5853–5864.

- Hapitria, P., & Padmawati, R. (2017). Efektifitas Pendidikan Kesehatan Melalui Multimedia Dan Tatap Muka Terhadap Pengetahuan Dan Sikap Ibu Hamil Tentang Asi Dan Menyusui. *Jurnal Care*, 5(2), 156–167. <https://jurnal.unitri.ac.id/index.php/care/article/view/535>
- Niruri, R., Rakhmawati, R., Saputri, R. N., & Farida, Y. (2023). Efektifitas Media untuk Peningkatan Pengetahuan dan Sikap pada Perilaku Hidup Bersih-Sehat Siswa Sekolah Dasar saat Adaptasi Kebiasaan Baru Era COVID-19. *JPSCR: Journal of Pharmaceutical Science and Clinical Research*, 8(3), 291. <https://doi.org/10.20961/jpscr.v8i2.56862>
- Putri, N. I. N. N. I., & Puspitasari, N. (2024). Literature Review: Hubungan Dukungan Keluarga Dengan Penerapan Pola Hidup Sehat Sebagai Pencegahan Diabetes Melitus T2 Di Indonesia. *Prepotif: Jurnal Kesehatan Masyarakat*, 8(2), 4529–4540. <https://journal.universitaspahlawan.ac.id/index.php/prepotif/article/view/30689>
- Rani, C. C., & Mulyani, N. S. (2021). Faktor-faktor yang berhubungan dengan kejadian diabetes mellitus tipe-II pada pasien rawat jalan. *Jurnal SAGO Gizi Dan Kesehatan*, 2(2), 122. <https://doi.org/10.30867/gikes.v2i2.258>
- Salimung, N. M. D. (2024). Faktor-Faktor Yang Mempengaruhi Tingkat Kepatuhan Penggunaan Insulin Pada Pasien Diabetes Mellitus Tipe 2 Di Poliklinik Rawat Jalan Rsud Banggai. *Research & Learning in Nursing Science*, 8, 874–882.
- Sari, M. A. K., & Lestari, Y. N. (2024). Faktor Risiko yang Berhubungan dengan Kejadian Obesitas pada Remaja (Studi Kasus di SMA Negeri 15 Semarang). *Media Gizi Kesmas*, 13(1), 386–396. <https://doi.org/10.20473/mgk.v13i1.2024.386-396>
- Sari, S. L., Utari, D. M., & Sudiarti, T. (2021). Konsumsi minuman berpemanis kemasan pada remaja. *Ilmu Gizi Indonesia*, 5(1), 91. <https://doi.org/10.35842/ilgi.v5i1.253>
- Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B. B., Stein, C., Basit, A., Chan, J. C. N., Mbanya, J. C., Pavkov, M. E., Ramachandaran, A., Wild, S. H., James, S., Herman, W. H., Zhang, P., Bommer, C., Kuo, S., Boyko, E. J., & Magliano, D. J. (2022). IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Research and Clinical Practice*, 183, 109119. <https://doi.org/10.1016/j.diabres.2021.109119>
- Widiasari, K. R., Made, I., Wijaya, K., & Suputra, P. A. (2021). Tatalaksana Diabetes Melitus Tipe II. *Ganesha Medicina Journal*, 1(2), 114–120. <https://ejournal.undiksha.ac.id/index.php/GM/article/view/40006>

