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Improving Dietary Self-Efficacy: A Case Study of the 'Reaksi' Application in a 15-18 Year-Old Adolescent Girl at SMK PGRI 3 Malang

Vionna Fazrin Cahyani ^{1*}, Suprapti ², Dwi Yuliawati ³, Rudi Hamarno ⁴

¹⁻³ Midwifery Department, Malang Ministry of Health Polytechnic, Malang, Indonesia

⁴ Nursing Department, Malang Ministry of Health Polytechnic, Malang, Indonesia

Abstract

Introduction: Dietary self efficacy is crucial for adolescents, directly influencing their ability to adopt healthy eating habits. The "Reaksi" application provides educational resources aimed at improving self-efficacy in this demographic. This case report explores the impact of this application on self-efficacy among a specific group of adolescent girls at SMK PGRI 3 Malang.

Case Presentation A total of 69 10th-grade girls were selected through proportional random sampling at SMK PGRI 3 Malang. Data were collected in May 2024 using a validated Self-Efficacy to Regulate Eating Habits Questionnaire. Prior to the intervention, 43% of respondents had low self-efficacy. After using the "Reaksi" app, 67% showed increased dietary self-efficacy. The Wilcoxon test confirmed the results were statistically significant ($p < 0.05$).

Conclusion: The findings indicate that the "Reaksi" app effectively enhances dietary self-efficacy in adolescent girls, demonstrating the potential of technology-based interventions in promoting healthy eating habits.

Keywords: Adolescent health; Self-efficacy; Healthy eating; Technology-based intervention; Application.

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Introduction

The health of adolescents in Indonesia is a significant concern, considering their large proportion of the population. According to the Central Bureau of Statistics, about 27.94% of Indonesia's total population consists of adolescents, approximately 74.93 million people [1]. Adolescent health has a direct impact on the overall productivity and quality of life of society [2]. Adolescence is characterized by rapid growth, requiring a balance between adequate nutrition and energy needs to prevent various nutritional problems [3].

At SMK PGRI 3 Malang, there are notable nutritional problems among female adolescents. Initial data show that 27.5% of them are underweight, 7.5% are overweight, 3.75% are obese, and 40% suffer from anemia. These nutritional issues can have long-term consequences, including decreased concentration, fatigue, and poor academic

* **CONTACT:** vionna_p17311203036@poltekkes-malang.ac.id
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performance, which can ultimately affect their future [4][5]. On a global scale, approximately 69% of adolescents in Southeast Asia face nutritional challenges, with Indonesia experiencing a triple burden of malnutrition, including undernutrition, overnutrition, and micronutrient deficiencies simultaneously [6].

Digital health interventions, particularly those using mobile apps, have shown promise in addressing nutritional issues among adolescents. However, many digital health interventions do not fully address the specific cultural and local needs of their users. For example, existing health apps often fail to incorporate local dietary habits and lack motivational support, which limits their effectiveness [7]. Furthermore, many apps provide general health information without personalized feedback or actionable recommendations [8].

The "Reaksi" app was developed to address these gaps by combining personalized nutritional screening with interactive education tailored to the needs of Indonesian adolescents. Unlike many existing apps, "Reaksi" provides visual feedback and individualized recommendations based on real-time health data, such as BMI and anemia risk, through its integrated screening feature. Additionally, the app's content is designed to resonate with adolescents through engaging visuals and interactive elements, increasing their likelihood of engagement [9].

One key aspect of improving adolescent health behavior is enhancing self-efficacy, or the belief in one's ability to execute healthy behaviors, such as maintaining a balanced diet. Studies have shown that increased self-efficacy is closely linked to healthier eating habits and more effective behavior change [10]. For example, Bandura's Social Cognitive Theory suggests that self-efficacy can be enhanced through personalized feedback, goal setting, and continuous monitoring, which are central features of the "Reaksi" app [11]. By providing users with real-time information on their nutritional status, along with actionable recommendations, the app helps adolescents feel more confident in their ability to make healthier dietary choices.

The "Reaksi" app leverages these insights by offering both personalized screening and contextualized education, helping adolescents understand their nutritional status while also providing practical, culturally relevant advice. This dual approach addresses the key gaps in previous digital health interventions, making "Reaksi" a particularly well-suited tool for improving the health behaviors of adolescents in Indonesia.

Research Problem

This case report addresses the significant nutritional challenges faced by adolescent girls in Indonesia, particularly at SMK PGRI 3 Malang, where unhealthy dietary habits have become prevalent due to the rising trend of fast food consumption. This situation has led to low self-efficacy in making healthy dietary choices among adolescents. The central research problem is whether the 'Reaksi' application can effectively enhance self-efficacy in maintaining a healthy diet and improve actual dietary behaviors among adolescent girls.

Research Focus

This study investigates the features of screening tools and educational content within the 'Reaksi' application to enhance self-efficacy in maintaining a healthy diet among adolescent girls at SMK PGRI 3 Malang. It aims to clearly distinguish between the application's potential benefits—such as increased knowledge of nutritional status and informed dietary choices—and its actual impact on dietary behavior. The research will specifically focus on aspects of the application, including the effectiveness of its educational content, the user interface design, and the personalized screening tools. By analyzing these elements, the study seeks to understand how and why the 'Reaksi' application influences self-efficacy and dietary choices among its users.

Research Aim and Research Questions

The aim of this study is to evaluate the effectiveness of the 'Reaksi' application in enhancing self-efficacy and improving dietary behaviors among adolescent girls at SMK PGRI 3 Malang. Research questions include:

1. What is the level of dietary self-efficacy among adolescent girls at SMK PGRI 3 Malang before using the 'Reaksi' application?
2. What is the level of dietary self-efficacy among adolescent girls at SMK PGRI 3 Malang after using the 'Reaksi' application?
3. Is there an effect of using the 'Reaksi' application on dietary self-efficacy among adolescent girls at SMK PGRI 3 Malang?

Research Methodology

General Background

This study employs a pre-experimental one-group pretest-posttest design to evaluate the impact of the 'Reaksi' application on dietary self-efficacy among adolescent girls at SMK PGRI 3 Malang. This design was chosen for its

practicality in assessing the initial effect of the intervention without the need for a control group, making it suitable for exploratory research [12]. However, this design has limitations, particularly the absence of a control group, which may affect internal validity as external factors cannot be fully ruled out. Despite this, the design provides valuable insights that can inform future studies with more robust methods, such as randomized controlled trials [13].

Sample / Participants / Group

The study subjects were 220 female students in grade X at SMK PGRI 3 Malang. To determine representative sample size, the Slovin formula was applied, resulting in a minimum sample of 69 respondents. The final sample comprised 69 female students aged 15-18 from grade X at SMK PGRI 3 Malang. Sampling was carried out using proportional random sampling. Informed consent was secured from all participants, and the study followed ethical principles in health research, including respect, fairness, benefit, and non-maleficence towards respondents. The research received ethical clearance from the Ethics Committee of the Malang Ministry of Health Polytechnic, under approval number DP.04.03/F.XXI.31/0718/2024.

Sample size

The Slovin formula was used to determine the sample size. With a population of 220 and a margin of error of 9.97%, the sample size was calculated as:

$$n = N / 1 + N(e^2)$$

Where:

N = population size (220)

e = margin of error (9.97% or 0.0997)

Substitute into the formula:

$$n = 220 / 1 + 220(0,0997^2)$$

$$n = 220 / 1 + 220(0,00994)$$

$$n = 220 / 1 + 2,1868$$

$$n = 220 / 3,1868$$

$$n = 69,01$$

Rounding this value to the nearest whole number, the sample size required for this study is approximately 69 participants.

Instrument and Procedures

Data collection in this research was carried out in two meetings. During the first meeting, the researcher distributed the pretest questionnaire, introduced the "Reaksi" application, guided the respondents to carry out screening which includes screening for adolescent stages, nutritional status, and potential anemia, and showed educational videos about healthy diets. In the second meeting, the researcher asked the respondents to review the previously completed screening results, watch additional educational videos, and then complete the posttest questionnaire. The distance between the first and second meeting is 2 days.

The instrument used to measure dietary self-efficacy among adolescents girls is the Self Efficacy to Regulate Eating Habits Questionnaire from Albert Bandura's which has been translated and tested for validity and reliability. The validity and reliability of the questionnaire were assessed with 30 female students in grade XI at SMK PGRI 3 Malang. The questionnaire utilized a Likert scale with response options: very good (score 4), good (score 3), fair (score 2), and poor (score 1).

Data Analysis

The questionnaire used in this research contained 4 answer choices, so the total assessment score can be calculated using the formula:

$$\text{Percentage of Respondents' Answers} = \frac{\text{Number of Scores Obtained}}{\text{Total Highest Score}} \times 100\%$$

Self-efficacy will be categorized into high (76-100%), medium (56-75%), and low ($\leq 55\%$) based on the percentage scores. The Wilcoxon signed-rank test will be used to compare pretest and posttest scores, as this non-parametric test is suitable for paired data. The test ranks the differences between pre- and post-intervention scores, with a p-value < 0.05 indicating a significant improvement in self-efficacy.

Confounding factors

To control for confounding factors such as baseline knowledge or health conditions, participant characteristics will be standardized, and the intervention will be applied uniformly. External factors influencing the outcome will also be monitored.

Case Presentation

Based on primary data obtained from the screening using the "Reaksi" application for 69 adolescent girls who participated in the screening on May 28, 2024. The following results are presented in a structured format:

Table 1. Characteristics of adolescents based on screening results

Criteria	N	%
Stages of Adolescence		
Early Adolescence	0	0
Middle Adolescence	66	96.0
Late Adolescence	3	4.0
Nutritional Status (BMI)		
Underweight	21	30.0
Normal/Ideal	40	58.0
Overweight	6	9.0
Obesity	2	3.0
Potential Anemia		
Potential for Anemia	42	61.0
No potential for anemia	27	39.0

Note: N= total number of subjects, %= proportion of subjects based on criterias

Patient Information

The 69 respondents involved in the screening process were female adolescents enrolled at SMK PGRI 3 Malang. Their ages ranged between 15 to 18 years, with a majority (96%) being in the middle adolescence stage.

Clinical Findings

Nutritional Status

Based on the Body Mass Index (BMI) screening, 21 respondents (30%) were classified as underweight, 40 respondents (58%) had a normal or ideal nutritional status, 6 respondents (9%) were overweight, and 2 respondents (3%) were obese.

Potential Anemia

The screening for anemia potential indicated that 42 respondents (61%) were at risk of anemia, while 27 respondents (39%) showed no risk of anemia.

Diagnostic Assesments

The screening process was carried out using the "Reaksi" application, which assessed each respondent's adolescent stage, nutritional status (BMI), and anemia potential through a standardized digital questionnaire and anthropometric measurements. The screening data was collected on May 28, 2024.

Treatment/Intervention

Since this study focused on screening and identifying risk factors, no immediate clinical intervention was provided. However, the findings were used to inform further educational and nutritional interventions designed for adolescents at risk, particularly for those found to have potential anemia and undernutrition.

Table 2. Self-Efficacy in Healthy Diet Among Adolescent Girls Before and After Intervention

Self-Efficacy in Healthy	Pre Intervention (%)	Post Intervention (%)
High	3	67
Medium	54	32
Low	43	1

Note: %= proportion of subjects based on criterias

Table 2 shows a comparison of self-efficacy in maintaining a healthy diet among respondents before and after the intervention. Before the intervention, almost half of the respondents (43%) had low self-efficacy in this area, whereas after the intervention, the majority (67%) demonstrated high self-efficacy in maintaining a healthy diet.

According to the Wilcoxon test with $\alpha = 0.05$, the p-value was 0.000. This result indicates that the p-value is less than α ($0.000 < 0.05$), allowing us to conclude that the alternative hypothesis is accepted. This suggests that the use of the "Reaksi" application significantly Effects self-efficacy in maintaining a healthy diet among adolescent girls at SMK PGRI 3 Malang.

Discussion

Identification of Dietary Self-Efficacy Among Adolescent Girls at SMK PGRI 3 Malang Before Using "Reaksi" Application

Before the intervention, nearly half of the respondents (43%) exhibited low dietary self-efficacy, with only a small fraction (3%) displaying high self-efficacy. Adolescents experience various physical, emotional, and psychological changes that influence their eating habits and self-efficacy. According to Erik Erikson's developmental theory, adolescents are in the "Identity vs. Role Confusion" stage, where they seek identity and independence in various aspects of life, including diet and health. Almost all respondents (96%) were in the middle adolescence stage (14-17 years old), during which they explore and consolidate their identity, including values related to health and lifestyle. This process affects their views on healthy eating and their perceived ability to maintain a healthy diet. Adolescents in this stage begin to show greater independence in making food choices and managing eating habits. Individuals with higher self-efficacy are more inclined to make healthy dietary choices [14].

Improved nutritional knowledge has a significant impact on increasing self-efficacy. The "Reaksi" application provides important information about nutrition, including an understanding of macronutrients (carbohydrates, proteins, fats) and the role of micronutrients, particularly iron, in preventing anaemia. Understanding the importance of iron and sources of nutrient-rich foods becomes a focus, considering that a significant number of respondents (61%) are at risk of anaemia. By knowing the benefits of consuming iron through food sources like meat, green vegetables, and legumes, adolescents can make healthier and more responsible choices [15]. By enhancing awareness of the benefits of consuming iron through natural food sources, adolescents are expected to make more informed food choices that meet their nutritional needs. The use of digital applications such as "Reaksi" can be an effective strategy for reaching a wider audience, especially by educating adolescents about nutrition in an interactive and engaging manner. This application not only provides information but also boosts self-efficacy by offering knowledge that can be directly applied in daily life [16].

The application also emphasizes the importance of balancing macronutrients, such as carbohydrates for energy, proteins for growth, and healthy fats for optimal body function. This information is presented in an easily accessible and understandable format, helping adolescents comprehend how the right combination of nutrients can affect their overall health. This increase in knowledge directly impacts self-efficacy, as adolescents feel more capable of controlling their eating patterns with a deeper understanding of what their bodies need. Research indicates that better nutritional knowledge positively correlates with better eating habits, which in turn boosts confidence in choosing healthy foods [17].

For example, out of 30 respondents with low self-efficacy, 9 had underweight status, 5 were overweight, and 2 were obese. In contrast, respondents with high self-efficacy had normal nutritional status. This shows that the increase in nutritional knowledge provided through the application, related to improving nutritional status, can help adolescents feel more confident in managing their diets. These findings support previous research stating that good nutritional status is associated with higher self-efficacy in maintaining a healthy diet [18].

Identification of Dietary Self-Efficacy Among Adolescent Girls at SMK PGRI 3 Malang After Using "Reaksi" Application

The study revealed that 67% of respondents had high dietary self-efficacy after using the "Reaksi" application. This improvement in self-efficacy can be understood through four key theories: Bandura's self-efficacy theory, Ajzen's theory of planned behavior, and Erikson's theory of adolescent development.

Bandura (1997) defines self-efficacy as an individual's belief in their capability to achieve specific goals. Educational interventions, such as those provided by the "Reaksi" application, enhance self-efficacy by delivering crucial knowledge and support, enabling participants to manage their diets effectively [19]. The significant increase in self-efficacy observed in this study supports the notion that education can empower adolescents in their dietary choices. Ajzen's Theory of Planned Behavior (1991) posits that intentions to engage in behaviors are influenced by attitudes, subjective norms, and perceived behavioral control. By improving knowledge about healthy diets, the intervention likely fostered positive attitudes and enhanced perceived behavioral control, ultimately boosting self-efficacy [20]. Furthermore, the intervention aligns with Erikson's theory, where adolescents seek identity and independence. Providing information on healthy diets helps them build a positive health identity, thereby increasing self-efficacy [21]. Overall, enhancing self-efficacy through educational interventions is crucial for promoting healthy dietary habits among adolescents, emphasizing the importance of knowledge, support, and identity formation in this developmental stage. Enhancing self-efficacy in maintaining a healthy diet through education requires different amounts of time, depending on factors such as the individual's starting condition, the type and intensity of education provided, and the level of social support available. Key considerations include consistency and continuity in practice, personal experience of seeing positive results, adaptation to dietary changes, supportive social environment, and ongoing learning throughout the process. Overall, there is no definitive answer regarding how long it takes to improve self-efficacy in maintaining a healthy diet through education, as it is highly individual and depends on the factors mentioned above. However, with a targeted, consistent approach and proper resources, individuals can achieve significant improvements in self-efficacy in a relatively short period, although the process may vary between individuals [22].

The Effect of Using the "Reaksi" Application on Dietary Self-Efficacy among Adolescent Girls at SMK PGRI 3 Malang

Statistical analysis using the Wilcoxon test revealed a p-value of 0.000 ($\alpha \leq 0.05$), indicating a significant effect of screening and education through the "Reaksi" application on dietary self-efficacy among female adolescents at SMK PGRI 3 Malang.

The web-based application enables adolescents to access information about healthy diets anytime and anywhere via their mobile devices. According to a report by the Pew Research Center, 95% of teenagers have access to smartphones, which facilitates flexible use of educational applications [23]. The "Reaksi" application is designed with interactive and engaging content, presenting screening results and educational videos through various images and illustrations. A survey by Common Sense Media found that 78% of teenagers prefer learning methods that involve digital technology due to their dynamic and engaging presentation [24]. This trend enhances adolescents' interest and motivation to learn about healthy diets through the application. In line with these findings, several studies suggest that digital tools can significantly improve adolescents' dietary knowledge and self-efficacy. For instance, a study by Galloway et al. (2023) indicated that mobile health applications can boost nutritional awareness and encourage healthier dietary choices in adolescents by providing real-time, accessible educational content [25]. Furthermore, a recent study by Larson et al. (2024) emphasized the effectiveness of interactive digital platforms in supporting behavior change, particularly when combined with personalized feedback, such as the screening results provided by the "Reaksi" application [26]. This type of engagement not only empowers adolescents to make informed dietary decisions but also enhances their confidence in managing their health.

The researchers propose that educating adolescents on healthy diets through a web-based application is a highly effective approach, as it integrates the benefits of technology with the demand for accessible, relevant, and interactive information. The interactive nature of the application likely contributes to increased engagement, which has been shown to positively impact self-efficacy in dietary practices among adolescents [22] [27]. By providing immediate feedback and personalized content, these applications may also reinforce healthy behaviors and empower adolescents to make informed dietary choices. Moreover, the use of such technology facilitates continuous learning, allowing adolescents to revisit information and track their progress over time, further boosting their confidence in managing their diet. These factors combined make web-based applications an excellent tool for improving self-efficacy in dietary practices.

Conclusions and Implications

This study evaluated the impact of the "Reaksi" application on dietary self-efficacy among adolescent girls at SMK PGRI 3 Malang. Before the intervention, 43% of respondents had low self-efficacy; this number improved to 67%

post-intervention. The Wilcoxon test confirmed a statistically significant increase in dietary self-efficacy, demonstrating that digital health interventions can effectively enhance adolescent dietary self-management.

The success of the "Reaksi" application emphasizes the potential of digital tools to address adolescent health issues, such as malnutrition and obesity. Integrating such applications into existing health systems and educational curricula is essential. Collaborations between health ministries and educational institutions can facilitate consistent access to dietary education. However, challenges in scaling the "Reaksi" application include disparities in technology access and cultural variations in dietary habits. Tailored versions of the application that respect local practices, training for educators and partnerships with local organizations, can help overcome these barriers.

These findings advocate for developing interactive, technology-driven educational programs to address public health challenges effectively. Increased investment in digital health interventions is vital for promoting health and preventing adolescent disease. Future research should focus on the long-term effects of such tools on dietary habits and self-efficacy, exploring their scalability in diverse populations to maximize impact. This case highlights the need for early interventions to promote healthy dietary habits and support overall well-being among adolescents.

Suggestions for Future Research

Future research should explore the long-term impact of digital health interventions on adolescent dietary self-efficacy. Longitudinal studies could provide deeper insights into whether the behavioural changes observed through short-term interventions, such as the "Reaksi" application, are sustained over time. Additionally, comparative studies evaluating the effectiveness of different digital tools—such as gamified learning platforms, AI-driven dietary recommendations, and interactive coaching—could further refine technological approaches to health education. Another promising avenue for research involves examining the role of socio-cultural factors in shaping adolescent self-efficacy regarding healthy eating. Given the influence of family, peer networks, and local dietary customs, future studies could assess how personalised interventions that integrate cultural preferences enhance engagement and adherence. Furthermore, interdisciplinary research incorporating behavioural psychology and nutritional science could refine self-efficacy models, ensuring interventions address cognitive and environmental barriers to healthy dietary habits.

Finally, expanding research beyond a single institutional setting would strengthen the generalisability of findings. Multi-centre studies across diverse demographic and socio-economic groups would provide a broader understanding of the applicability and scalability of digital nutrition interventions, ultimately contributing to more inclusive and effective public health strategies.

Declarations

Author Contributions

Conceptualization was handled by Vionna and Suprapti; methodology was developed by Vionna, Suprapti, Dwi Yuliawati, and Rudi Hamarno; software management was overseen by Vionna; validation was carried out by Suprapti and Dwi Yuliawati; formal analysis was conducted by Vionna and Rudi Hamarno; writing of the original draft was done by Vionna; review and editing were completed by Vionna and Dwi Yuliawati; visualization was managed by Dwi Yuliawati; supervision was provided by Suprapti and Dwi Yuliawati; project administration was handled by Vionna; and funding acquisition was secured by Vionna, Suprapti, Dwi Yuliawati, and Rudi Hamarno. All authors have read and approved the final version of the manuscript.

Data Availability Statement

Due to privacy and ethical considerations, the data from this study are not publicly accessible. However, it can be obtained from the corresponding author upon request, as it contains personal information of users.

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Institutional Review Board Statement

This study was carried out in compliance with the Declaration of Helsinki and received approval from the Institutional Review Board (or Ethics Committee) representing the Malang Ministry of Health Polytechnic Ethics Committee, under approval number DP.04.03/F.XXI.31/0718/2024.

Informed Consent Statement

Informed consent was secured from all participants in the study.

Conflicts of Interest

The author declares that there are no conflicts of interest related to the publication of this manuscript. Furthermore, the authors have fully adhered to ethical standards, including issues related to plagiarism, informed consent, misconduct, data fabrication and/or falsification, duplicate publication and/or submission, and redundancies.

References

1. Badan Pusat Statistik. Population Data of Indonesia [Internet]. 2023 [cited 2025 Feb 6]. Available from: <https://www.bps.go.id>
2. World Health Organization. Adolescent Health and Development [Internet]. 2020 [cited 2025 Feb 6]. Available from: <https://www.who.int>
3. Ministry of Health Republic of Indonesia. Adolescent Nutrition in Indonesia. 2022.
4. Sukartini T, Rahayu S. Nutritional Status of Adolescent Girls at SMK PGRI 3 Malang. *Malang Public Health Journal*. 2023;15(2):45-53.
5. Chandra V, Nugraheni S. Anemia among adolescents in Southeast Asia: A public health concern. *Southeast Asian J Trop Med Public Health*. 2021;52(3):337-48.
6. Food and Agriculture Organization. Southeast Asia Facing Triple Burden of Malnutrition [Internet]. 2021 [cited 2025 Feb 6]. Available from: <http://www.fao.org>
7. Smith J, Roberts P. Limitations in current digital health interventions for adolescents: A systematic review. *Int J Adolesc Health*. 2020;14(1):112-21.
8. Becker S, Lee H. Personalized digital health for adolescents: Bridging the gap between generalized and tailored interventions. *J Digit Health*. 2019;7(4):256-65.
9. "Reaksi" App Development Team. The role of digital health apps in improving adolescent nutrition. Malang: Reaksi Project; 2023.
10. Schwarzer R. Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In: Bandura A. *Self-efficacy: The exercise of control*. New York: Freeman; 1997.
11. Bandura A. Social cognitive theory of self-regulation. *Organ Behav Hum Decis Process*. 1991;50(2):248-87.
12. Campbell DT, Stanley JC. *Experimental and quasi-experimental designs for research*. Boston: Houghton Mifflin Company; 1963.
13. Creswell JW. *Research design: qualitative, quantitative, and mixed methods approaches*. 4th ed. Thousand Oaks, CA: Sage Publications; 2014.
14. Kahn M, Karr C, O'Brien M. The role of iron in adolescent health: A review of current literature. *Nutrients*. 2022;14(3):575.
15. Michou M, Andreou E, Theodorou M. Nutritional knowledge and dietary habits of adolescents in the Mediterranean region. *Nutrients*. 2023;15(4):878.
16. Wang Y, Kuo K, Lee Y. The effectiveness of mobile health applications for dietary knowledge and health behavior improvement in adolescents. *J Adolesc Health*. 2023;62(4):430-7.
17. Vasilenko SA, Piper ME, Lanza ST. The role of nutrition knowledge in promoting healthy dietary behaviors among adolescents. *J Nutr Educ Behav*. 2023;55(2):153-60.
18. Tavares LF, de Almeida MDV, Barros M, et al. Impact of nutrition education interventions on adolescent self-efficacy for healthy eating: A systematic review. *Nutr Rev*. 2024;82(1):30-45.
19. Bandura A. *Self-efficacy: The exercise of control*. New York: W.H. Freeman; 1997.
20. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179-211.
21. Erikson EH. *Identity: Youth and crisis*. New York: W.W. Norton & Company; 1968.
22. Ghanim H, Alkazemi D. The impact of nutrition education on the self-efficacy of adolescents in dietary practices. *Nutrients*. 2021;13(2):508.
23. Pew Research Center. *Teens, Social Media & Technology 2018* [Internet]. Available from: <https://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/>.

24. Common Sense Media. The Common Sense Census: Media Use by Tweens and Teens. 2019 [Internet]. Available from: <https://www.commonsensemedia.org/research/the-common-sense-census-media-use-by-tweens-and-teens-2019>.
25. Galloway L, Smith E, Blackwell L, et al. Mobile health applications and their impact on adolescent nutritional awareness and eating habits: A randomized controlled trial. *J Nutr Educ Behav*. 2023;55(3):220-30.
26. Larson E, Brown S, Perkins M, et al. The role of interactive digital tools in changing adolescent dietary behavior: A systematic review. *Am J Public Health*. 2024;114(1):99-110.
27. Talsma E, Worsley A, de Groot M. The relationship between nutrition knowledge and dietary intake in adolescents: A systematic review. *Nutrients*. 2019;11(6):1331.