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The Effect of an Educational Intervention Based on The Social-Cognitive Theory on Fruit and Vegetable Consumption in Adolescent Females

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ABSTRACT

Background: The results of studies in Iran and worldwide show that most adolescents have improper nutritional habits, characterized by low consumption of fruits and vegetables, high consumption of carbonated drinks, and preprocessed foods. Adolescence is an important stage of life in the formation of eating habits; thus, the present study was designed to evaluate the effect of an educational intervention on fruit consumption. **Methods:** The present study is a randomized controlled trial conducted using a multi-stage sampling method on 100 female students in Nehbandan city in 2023. Data were collected before the intervention. Then, four training sessions of 60 minutes were held for the intervention group, and then, the data were collected twice, once immediately after and then three months after the intervention. The data were analyzed in SPSS, using chi-square, Friedman, and Mann-Whitney tests at a significance level of P-value<0.05. **Results:** The findings showed that some constructs of the social cognitive theory, including knowledge, attitude, behavioral outcome, observational learning, social support, and environmental factors, had a significant increase in the intervention group (P<0.05), while the changes in the self-efficacy score in the intervention and control groups were the same (P>0.05). After the intervention, the amount of daily and weekly consumption of fruit and vegetables in the intervention group increased. **Conclusion:** The design and implementation of an educational intervention based on the social-cognitive theory can be effective in fruit and vegetable consumption in students.

Introduction

Non-contagious diseases are among the major causes of poor health and account for high healthcare costs(World Health Organization, 2013). Accordingly, healthy nutrition plays an important role in preventing chronic diseases. Moreover, low consumption of fruit and vegetables is a key risk factor for non-contagious diseases (e.g., diabetes, cancer, cardiovascular diseases)

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worldwide (American Dietetic Association, 2004, Ogata and Hayes, 2014). For this purpose, a diet rich in fruit and vegetables is recommended due to the presence of vitamins, antioxidants, minerals, and fiber (Slavin and Lloyd, 2012).

The World Health Organization (WHO) recommends that adolescents consume at least five units of fruits and vegetables a day (World Health Organization, 2003) .In practice, most adolescents consume less than the recommended amount, and instead, tend to consume carbonated drinks, preprocessed food, and more fat (Beal *et al.*, 2019).

The results of investigating the lifestyle and eating habits of adolescent girls showed that the average daily consumption of fruit and vegetables was 60.9% and 45.6% respectively, the daily consumption of fast food was 10.6%, and the weekly consumption was 16.2% (Shayan-Moghadam *et al.*, 2020).

Healthy eating habits are important during adolescence because children and adolescents of school age need nutrients due to growth. In fact, adolescence is the time when nutritional habits are formed; it is an opportunity to influence eating patterns and nutritional status which can have a lasting effect on the future health of adolescents (Berenson, 2009, Ochola and Masibo, 2014). Adolescents, especially teenage girls, are more concerned about their body image and being overweight, which may impede them from receiving the nutrients and energy required for rapid growth. It may also lead to malnutrition due to micronutrient deficiency and iron deficiency anemia (Akseer *et al.*, 2017). Therefore, it seems necessary to stay focused on adolescents' diet, especially girls.

Behavioral and non-behavioral determinants of fruit and vegetable consumption include social status, preferences for fruit and vegetable consumption by parents, teachers, and peers, availability, social support, parental encouragement, an encouraging environment for consumption, behavior skills, and abilities (Salwa *et al.*, 2021).

Nutrition education can be considered a very effective solution to the improvement of nutritional behaviors, especially students' fruit and vegetable consumption (Gold *et al.*, 2017). A number of studies show that it is necessary to select an appropriate theoretical framework to change the nutritional behavior and theory-based interventions for a greater effect on changing nutritional behavior in children and adolescents compared to non-theoretical interventions (Delgado-Noguera *et al.*, 2011). Conducting interventions based on family and school-based behavior change theories in society can be effective in improving students' nutritional behaviors, including fruit and vegetable consumption. One of the most efficient theories used to predict and explain nutritional behaviors is the social cognitive theory (Ramezanpoor *et al.*, 2019). This theory emphasizes that individual and environmental characteristics influence behavior. Also, this theory believes in two-way interactions between the individual, behavior, and environment. The social cognitive theory not only accounts for the predictive factors and effective principles in the formation of a behavior, but also provides solutions to change a certain behavior (Jalily *et al.*, 2014).

A body of studies showed that the application of this theory in studies has increased the consumption of fruit and vegetables after the intervention in students (Ghaffari *et al.*, 2019, Hashemian *et al.*, 2022). Nehbandan is a poor city in South Khorasan province. Based on the indices of the city health center, malnutrition of children and adolescents, and low consumption of fruit and vegetables are a health priority in this city. Yet, no single study has been conducted on this topic in this city. Thus, the present study was designed and implemented to evaluate the effect of an educational intervention based on the social cognitive theory on the consumption of fruit and vegetables in high school female students of Nahbandan city in 2023.

Materials &Methods

Study design and participants

The present study was a randomized controlled trial, carried out to evaluate the effect of an educational intervention based on the social

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cognitive theory on fruit and vegetable consumption of 100 female students in high schools of Nahbandan in 2023. The sample was selected through a multi-stage random sampling method. One school was randomly assigned to the control group and the other to the intervention group. From each school, three classes were randomly selected for the intervention, and all the students of each class were included in the study.

The sample size was estimated using the following formula, with a confidence interval of 95%, a test power of 90%, and based on a similar study by Najimi *et al*.; thus, the estimated size was 50 people for each research group (Najimi and Ghaffari, 2013).

$$n = \frac{\left(z_1 - \frac{\alpha}{2} + z_1 - \beta\right)^2 (s_1^2 + s_2^2)}{d^2}$$

The inclusion criteria were studying in a high school, not following a special diet, and consent to participate in the study. The exclusion criteria were failure to complete the questionnaire in the previous stages, immediately after, and three months after the intervention, and absence for more than one training session.

To carry out the study, after approving the plan and obtaining a code of ethics (IR.BUMS.REC.1402.018), the necessary arrangements and correspondence were made with the education office in Nehbandan. Then, after visiting the selected schools and coordinating with the principal, the study objectives and procedures were explained to students who met the inclusion criteria, and they and their parents were asked to provide informed consent to participate. after visiting the selected schools and coordinating with the principal, the objectives and the process of conducting the study were fully explained to the students who met the inclusion criteria, and they and their parents were needed to give informed consent to take part in the study.

Data collection

In this study, Najimi *et al*.'s questionnaire was used for data collection (Najimi and Ghaffari, 2013) but due to the difference in the target study group, changes were made to the questions, and then, the face and content validity were tested. The face and content validity index of the questionnaire was estimated at 0.94-0.98. To measure the internal consistency of the questionnaire, the questionnaire was submitted to 19 students, and then, the data were entered into the software, and the Cronbach's alpha coefficient of the questions was estimated at 0.75. Of note is that these individuals were not included in the main phase of the study later on. The questionnaire included 12 questions on knowledge, 8 on attitude, 4 on outcome expectation, 9 on self-efficacy, 6 on access to fruit and vegetables, 6 on social support, and 5 on observational learning.

The scoring system was to assign 2 points to *True* answer, 1 point to *I don't know* and 0 to *False* answer to knowledge questions. As for behavioral outcome, attitude, self-efficacy, and access to fruit and vegetables, the rating was done on a 0-4 scale ranging from strongly agree to strongly disagree. For social support and observational learning, the rating ranged between 1 and 4 for never, sometimes, most of the time, and always, respectively. Behavioral questions included examining the number of units of daily fruit and vegetable consumption (2 questions and score range of 0-6) and examining the number of days the student consumed fruits and vegetables in the past week (3 questions and score range of 0-21).

After collecting data, for analysis, SPSS23 was used.

Ethical considerations

The present study was conducted with the approval of the ethics committee of Birjand University of Medical Sciences (IR.BUMS.REC.1402.018). In this study, the participants consented to take part in the study and were assured of the confidentiality of personal information and anonymity of the data they provided.

Data analysis

The data were analyzed using descriptive and inferential statistics using chi-square, Friedman, and Mann-Whitney tests. Due to the non-normality of data, they were analyzed using the Kolmogorov-

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Smirnov test, and a p-value <0.05 was considered at a significant level.

Intervention

The educational content was presented through a review of the texts, available resources of the Ministry of Health, as a PowerPoint presentation, pamphlets, and posters. The intervention consisted of three training sessions for students and one for students' mothers. The duration of each training session was 60 minutes. Moreover, during the educational sessions, the importance and outcomes of fruit and vegetable consumption were pinpointed. Attempts were made to recognize barriers to fruit and vegetable consumption and learn healthy behavior from adults; This emphasizes the role of environmental factors and encourages adolescents to consume fruit and vegetables. **Table 1** shows the framework of training sessions based on social-cognitive theory.

Table 1. Structure of training sessions.

Session	Target group	Target constructs	Educational method
1	Students	Awareness-raising, developing a positive attitude, and discussing behavioral outcomes	Showing video clips, distributing brochures, training with slides, and Q and As
2	Students	Self-efficacy for fruit and vegetable consumption	Brainstorming, role play, poster, sharing experiences
3	Students	Increasing learning adults' behavior	Lecture, discussion, sharing of experiences
4	Mothers	The role of environmental factors and social support in fruit and vegetable consumption	Lecture, discussion, and conversation

Results

In this study, 50 female students of high school were in the intervention group and 50 in the control group. The students' average age in the intervention group was 13.86±0.96 and in the control group 13.48±0.76 years (**Table 2**).

The Friedman test results showed a statistically significant difference in the mean scores of social-cognitive theory constructs (knowledge, attitude, behavioral outcome, environmental factors, observational learning, and social support) in the intervention group in three steps (before, immediately after, and three months after intervention) (P>0.05). However, no statistically significant difference was found in the control group across these three steps (P<0.05). Self-efficacy after the educational intervention did not account for a statistically significant difference between the intervention and control groups (P<0.05, **Table 3**).

Table 2. Demographic information of the study groups.

Variables	Intervention	Control	P-value[a]
Family dimension			
<4	10(20)[b]	13(26)	0.47
>4	40(80)	37(74)	
Mother occupation			
Employed	3(6)	2(4)	1
Housewife	47(94)	48(96)	
Father occupation			
Unemployed	8(16)	8(16)	
Manual worker	14(28)	15(30)	0.73
Freelance	25(50)	21(42)	
Office work	3(6)	6(12)	
Father education			
Uneducated	12(20)	4(8)	
Primary school	20(40)	11(22)	0.002
Secondary school	10(20)	11(22)	
Diploma or higher	8(16)	24(48)	
Mother's education			
Uneducated	11(22)	8(16)	
Primary school	18(36)	18(36)	.0.35
Secondary school	22(24)	8(16)	
Diploma or higher	9(18)	16(32)	
Income			
Very high	10(20)	5(10)	
High	11(22)	21(42)	0.15
Moderate	18(36)	15(30)	
Low	11(22)	9(18)	

[a]: *Chi-square test;* [b]: *n (%).*

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Table 3. Mean and standard deviation of social cognitive theory constructs in two intervention and control groups in three steps, baseline, immediately after, and three months after the intervention.

Variable	Baseline	Immediately after	3 months after	P-value[b]
Knowledge				
Intervention	18.60±5.50[c]	21.44±2.60	19.60±3.00	<0.001
Control	17.86±2.50	17.82±3.20	17.98±2.50	=0.97
P-value[a]	0.97	<0.001	0.005	
Attitude				
Intervention	24.12±5.70	28.14±5.00	26.16±4.92	<0.001
Control	25.70±4.00	23.82±5.20	23.66±5.70	0.97
P-value	0.18	<0.001	0.033	
Behavioral outcome				
Intervention	11.30±58.30	14.52±2.30	13.40±2.60	<0.001
Control	12.16±2.90	11.56±2.70	11.72±2.80	0.18
	<0.001	<0.001	0.003	
Self-efficacy				
Intervention	15.30±84.90	18.60±1.20	16.40±28.90	0.69
Control	15.80±3.40	14.50±3.20	15.02±3.70	0.72
P-value	0.49	0.04	0.22	
Environmental factors				
Intervention	13.34±4.20	15.20±3.27	13.98±4.20	0.04
Control	14.24±4.50	14.36±4.30	13.26±4.70	0.64
P-value	0.21	0.41	0.41	
Social support				
Intervention	13.52±3.40	15.60±3.10	14.00 ±3.40	0.015
Control	14.98±3.10	15.12±3.30	14.34±3.20	0.41
P-value	0.02	0.46	0.48	
Observational learning				
Intervention	10.52±2.50	11.86±2.40	11.00±2.50	0.046
Control	10.68±2.20	10.92±2.10	10.36±2.50	0.74
P-value	0.58	0.04	0.16	

[a]: Mann-Whitney U-test; [b]: Friedman test; [c]: Mean± SD.

At the beginning of the study, there was no statistical difference between the intervention group and the control group in terms of the amount of fruit and vegetables consumed in the previous seven days. After the educational intervention, the amount of fruit and vegetable consumption in the intervention group increased significantly compared to the control group (P<0.001, **Table 4**).

There was a statistically significant difference in the median score of changes regarding daily consumption of fruit and vegetables in the intervention and control groups before and immediately after the intervention, and three months after the intervention. Moreover, the median score of changes in weekly consumption of fruit and vegetables in the intervention and control groups before and immediately after the intervention was statistically significant (**Table 5**).

Discussion

The present study showed that in both intervention and control groups, before the educational intervention, the amount of fruit and vegetable consumption in adolescents was lower than recommended by WHO. Similar studies confirm this finding, for example, in the study by Nasirzadeh *et al.*, the average fruit and vegetable consumption was 1.67 and 1.2 units a day, and in the study by Didar Lu *et al.*, the amount of fruit and vegetable consumption was highly unfavorable as the adolescents consumed only 0.41 units of fruit, 0.77 vegetables and 1.18 units of fruit and vegetables both during the day (Didarloo *et al.*, 2021, Nasirzadeh *et al.*, 2020); therefore, the present intervention was designed and implemented to improve fruit and vegetable

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consumption by applying the social-cognitive theory to female students of high school.

Table 4. The mean and standard deviation of fruit and vegetable consumption in intervention and control groups before, immediately after, and three months after the intervention

Fruit and vegetable consumption	Baseline	Immediately after	3 months after	P-value[b]
Weekly				
Intervention	9.60±4.10[c]	12.90±4.80	11.82±5.50	0.006
Control	10.56±50	9.70±5.20	9.90±5.10	0.43
P-value[a]	0.28	0.04	0.03	
Daily				
Intervention	3.10±1.60	4.80±1.30	4.40±1.40	<0.001
Control	4.00±1.50	3.38±1.40	3.50±1.30	0.29
P-value	0.003	<0.001	<0.001	

[a]: Mann-Whitney U-test; [b]: Friedman test; [c]: Mean± SD.

Table 5. Comparison of mean scores of changes in daily and weekly fruit and vegetable consumption.

Fruit and vegetable consumption	Baseline	Immediately after	3 months after
Weekly			
Intervention	8(4.7-15.0)[b]	13(10.0-16.2)	12(8.7-16.0)
Control	11(7-13)	10(5-14)	9.5(5.7-12.5)
P-value[a]	0.001	0.41	0.79
Daily			
Intervention	3(2.0-4.2)	5(4-6)	5(4-6)
Control	4(3-5)	4(3-5)	4(3-5)
P-value	<0.001	0.97	<0.001

[a]: Mann-Whitney U-test; [b]: Median (Quartil-1-Quartile-2).

The results of the present study showed a significant increase in the consumption of fruit and vegetables after educating the students. In fact, the daily consumption of fruit and vegetables increased by 28.34% immediately after the intervention and increased to 21.67% three months after the intervention. In Hashemian *et al.*'s study, fruit intake increased by 22.2% and vegetable intake by 36.1% in adolescent girls after the intervention (Hashemian *et al.*, 2022), Moreover, Ana Ili'c *et al.*'s study used social-cognitive theory in educational interventions; a significant increase in children's fruit and vegetable intake was found in the study. Therefore, according to that report, 25% of children consumed more than 5 units of fruit and vegetables after receiving the education (Ilić *et al.*, 2022).

Based on several studies, fruit and vegetable consumption was influenced by various factors such as parents' education level, support from people around, family income, unavailability, and media advertisements (Nasirzadeh *et al.*, 2020, Salwa *et al.*, 2021, Sato *et al.*, 2020). Educational interventions alone cannot affect the fruit and vegetable consumption behavior, so it is important to support low-income families, increase parents' awareness of the benefits of fruit and vegetable consumption, and promote healthy food in the media.

The level of knowledge is an important factor in fruit and vegetable consumption (Al-Otaibi, 2013). The results of the present study showed an increase in the mean score of knowledge in the intervention group after educational training, while no significant change was observed in the control group. The results were in line with studies by Khan Jeihooni *et al.*, who used the PRECEDE-PROCEED model to promote fruit and vegetable consumption, and Hahnraths *et al.* (Hahnraths *et al.*, 2022, Khani Jeihooni *et al.*, 2017). However,

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in the study by Vahdaninia *et al*., after the educational intervention, there was no significant increase in the knowledge score of the intervention group. Among the reasons for discrepant findings, the different target research groups in the two studies should be mentioned; this regards providing education only as pamphlets, and conducting an intervention on the behavior of fast food consumption (Vahdaninia *et al.*, 2020).

The students' mean score of attitude in the intervention and control groups before the educational intervention was also at a desired level; however, it is possible that the educational intervention and the presentation of examples on the effects of fruit and vegetable consumption regarding body fitness and skin freshness, major concerns of adolescents, especially girls could increase the attitude score in the intervention group. There were no significant changes in the control group, which is in line with the study by Fetohy and Hahnraths *et a l*(Fetohy *et al.*, 2020, Hahnraths *et al.*, 2022).

The results of the present study showed an increase in the behavioral outcome score in the intervention group after the educational intervention, which is in line with other studies (Hashemian *et al.*, 2022, Saha *et al.*, 2020), However, in the study by Flores-Vázquez *et al*. (Flores-Vázquez *et al.*, 2024), the behavioral outcome after the training in the two intervention groups and the control group accounted for no significant difference. Among the reasons for the discrepancy in findings, the participants' different cultures and the non-uniformity of the educational method can be mentioned.

The present study showed the lack of influence of education on self-efficacy in students. The results of Hashemi *et al*.'s study are similar to the present study (Hashemi *et al.*, 2012), while in other studies, including the study by Kim, Saha, and Gaffari *et al*., the self-efficacy score increased, which is contrary to the present study (Ghaffari *et al.*, 2019, Kim and Park, 2020, Saha *et al.*, 2020). The reasons can be the short duration of the intervention and the limited number of training sessions.

Environmental factors include physical environment, social environment, political environment, and economic status (Swinburn *et al.*, 1999). In the present study, after the educational intervention, the mean score of environmental factors increased by merely 8.3%. In Hashemian's study, the mean score of environmental factors increased by 16% (Hashemian *et al.*, 2022). As one environmental factor influencing fruit and vegetable consumption is the family's socioeconomic status, it seems necessary for the government to support low-income families.

In the present study, social support means the act of encouraging students to consume fruit and vegetables by parents, teachers, and peers. The mean score of social support among students in the intervention group increased significantly after training, which is in line with the study by Sato et al.; this emphasized that social support could increase fruit and vegetable consumption in adolescents (Sato *et al.*, 2020).

Hermans *et al*. showed that mothers' social support was positively correlated with healthy food consumption in adolescents (Hermans *et al.*, 2020).

Bandura pinpointed the vital role of observational learning in individuals' behavioral patterns, especially children and adolescents (Glanz *et al.*, 2015). The present study showed that the mean score of observational learning in the intervention group increased significantly after the training, while the changes in the control group were not statistically significant. In Ghafari *et al*.'s study, the mean score of observational learning increased two months after the intervention (Ghaffari *et al.*, 2019). Nasirzadeh *et al*. reported that observational learning was significantly correlated with vegetable consumption in students, while there was no correlation between fruit consumption and observational learning (Nasirzadeh *et al.*, 2020).

One strength of the present study was the investigation of teenage girls due to the importance of fruit and vegetable consumption during adolescence and the role of girls as breeders of the future generation. Besides, fruit and vegetable

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consumption was evaluated on a daily and weekly basis, and mothers as a role model and supporter of healthy behaviors participated in the educational intervention. On the other hand, the limitation of this study was that it was conducted only on girls in junior high school, and as a result, the findings cannot be generalized to boys. Additionally, the intervention was only conducted on adolescents in junior high. Though managers and teachers are considered major role models for this age group, they were not included in the intervention. Moreover, despite the precious role of fathers in making a living and their role in student learning, they were excluded from the educational intervention. Some other limitations of this research are the intensive nature of the educational intervention in only three weeks due to the proximity of the beginning of the study to the exam time.

Conclusion

The present findings showed an increase in the mean score of constructs such as knowledge, attitude, behavioral outcome, environmental factors, observational learning, and social support as well as in the mean rate of fruit and vegetable consumption in students. Considering that the educational intervention could not cause a significant change in self-efficacy, it is recommended that there should be more emphasis in educational sessions on understanding the barriers to consuming fruit and vegetables and ways to overcome them. Finally, the educational intervention based on the social cognitive theory proved effective in students' fruit and vegetable consumption.

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Authors' contributions

All authors have read and approved the final manuscript. Farhi F, Miri MR, and Baghernezhad F designed the research, conducted the research, and wrote the manuscript. Ramezani AA also analyzed data and performed statistical analysis

Conflict of interest

There was no conflict of interest.

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