



# Effect of Theory-Based Environmental-Behavioral Interventions With Student-Family-School Approach on Fruit and Vegetable Consumption Among the Adolescents

Mohtasham Ghaffari<sup>1</sup>, Sakineh Rakhshanderou<sup>1</sup>, Yadollah Mehrabi<sup>2</sup>, Ali Ramezankhani<sup>1</sup>, Bita Shahbazzadegan<sup>3\*</sup>

## Abstract

**Objectives:** The consumption of fruits and vegetables (F and V) improves health and nutritional status while it reduces the risk of diseases. The present study aimed to promote fruit and vegetable consumption among adolescents using Albert Bandura's social cognitive theory (SCT) among students of Ardabil.

**Materials and Methods:** In this interventional-experimental study, a total of 308 second-grade male and female high school students were selected and randomly assigned into control and intervention groups (154 subjects in each group). The entry criteria included the age range of 13-15 years, informed consent, and voluntary participation in the study. The SCT-based interventions were employed for the students, families, and schools using the student-family-school (SFS) approach. Data were collected employing a 3-part questionnaire including demographic characteristics, SCT-based determinants of F and V consumption by adolescents, as well as the frequency of F and V consumption. Finally, the obtained data were analyzed by descriptive and analytical statistics using SPSS software.

**Results:** Based on the results, the application of the student, family, and school-based interventions significantly increased the scores related to the constructs of environment, knowledge, skills, outcome expectations, outcome expectancies, observational learning, reinforcement, and self-efficacy in the intervention group compared to the control group ( $P<0.001$ ). In addition, the average amount of F and V consumption prior to intervention was  $3.7\pm1.40$  and  $2.98\pm1.38$  in experimental and control groups, respectively. Further, the corresponding values were  $3.39\pm1.56$  and  $2.83\pm1.53$  in the intervention and control groups two months after the intervention while they found to be  $3.27\pm1.31$  and  $3.04\pm1.11$  six months after the intervention in the two groups, respectively, which showed a difference between the groups during 2 and 6 months after the intervention ( $P<0.002$ ,  $<0.106$ , respectively).

**Conclusions:** In general, the application of interventions based on SFS approach led to an increase in the scores of SCT structures and the amount of F and V consumption in students. Therefore, SCT-based interventions are recommended to be used at the level of schools, families, and students in order to enhance the consumption of F and V among the students.

**Keywords:** Fruit and vegetable consumption, Social cognitive theory, Student, Family, School

## Introduction

Insufficient consumption of fruits and vegetables (F & V) is associated with major diseases such as obesity, cardiovascular disorders, diabetes, and cancers (1). Therefore, the authorized bodies worldwide recommend the consumption of at least 400 g of F and V (equivalent to 5 meals a day) per day (2). Based on the results of a study, F and V consumption can prevent 5 to 12% of cancer prevalence (3) while the inadequate intake of F and V is among the top ten causes of reported risk factors of global mortality. According to the Ministry of Health and Medical Education of Iran, the average number of daily fruit consumption units in men, women, and the entire country is 1.57, 1.82, and 1.32, respectively, which subjects

them to the risk factors for non-communicable diseases and that of the vegetable is reported 1.47, 1.59, and 1.45 in men, women, and the country as a whole. In addition, about 84.87% of men and 79.4% of women in Tehran and 88.2% of the total population of the country consume less than 5 units of fruit or vegetable per day (4). The need for interventions that help to increase the consumption of F and V by adolescents is emphasized accordingly (5). Further, selecting a model for health education and promotion is the first step in assessing the educational program (6). Meanwhile, the family is considered as one of the most important social units influencing the behavioral development of children and adolescents and the rules and dietary behaviors which guide these children

Received 15 October 2018, Accepted 19 January 2019, Available online 23 February 2019

<sup>1</sup>Department of Health Education and Health Promotion, Environmental and Occupational Hazards Control Research Center, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran. <sup>2</sup>Department of Epidemiology, Environmental and Occupational Hazards Control Research Center, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran. <sup>3</sup>Department of Health Education and Health Promotion, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran, and Social Determinants of Health Research Center, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran.

\*Corresponding Author: Bita Shahbazzadegan, Tel: +984533534680, Email: bitashahbaz2004@yahoo.com



and adolescents are formed in the family (7). Parents, who consider F and V intake as a significant health-promoting activity, provide their children with suitable opportunities to eat the kind of food that can have a positive effect on the pattern of F and V consumption (8). To increase the consumption of F and V, emphasis should have been made on F and V consumption in school-based educational intervention programs (9).

Nutritional education programs are regarded as a suitable investment that can decrease costs (10). Several studies highlighted the importance of educational intervention programs in increasing the consumption of F and V (11,12) since nutrition interventions affect the socioeconomic situation differently (13). The efficacy of the intervention programs heavily depends on the correct use of theories and models which are employed in health education and promotion (14). Furthermore, social cognitive theory (SCT), as a behavioral and interpersonal theory, is one of the most efficacious theories used to predict and explain nutritional behaviors. This theory describes human behavior in a 3-dimensional reciprocal determinism structure (i.e., the interactions between behavior, environmental variables, and individual factor including individual cognition) in which the individual influences the environment and his or her own behavior (15). On the other hand, this theory is a strong guide for selecting the determinants regarding comprehending health behaviors and is widely employed in fields related to children's F and V consumption (16). Adolescence is one of the most critical periods of life and lifestyle is formed and consolidated during this period (17). The results of various studies showed that those behaviors that form during the adolescence affect the health of the individual in adulthood (18). Family and school-based interventions can be used as an appropriate approach in promoting healthy nutritional behaviors from early childhood if supported by parents and school managers. Moreover, such interventions are considered effective in preventing the institutionalization of malnutrition among children and adolescents. Although SCT has theoretical integrity, the whole structure of the theory has not been considered in most studies and thus they are not often comprehensive. Interventional approaches in this field should be based on student, family, and school, therefore, the student-family-school (SFS) approach was selected for the current study and using this approach and learning based on school, family, and student was hypothesized to improve F and V consumption and the health of the students. Therefore, the present study sought to improve the pattern of F and V consumption among adolescents by employing Albert Bandura's SCT among the students of Ardabil in northwest of Iran.

## Materials and Methods

### Study Design, Population, and Sampling

The population of the present interventional-experimental

study included 308 second-grade male and female high school students of Ardabil. The study was implemented during 2017 and the inclusion criteria included the age range of 13-15 years, informed consent, and voluntary participation in the study. Additionally, the exclusion criteria were reluctance to continue studying and shifting, being transferred, or changing the school. The requirement of following up the study in the second year was the reason for selecting these students for the study. On the other hand, students within the age range of 13-15 years were selected due to their growing up toward adolescence and considering that most of adult behavior, especially nutritional patterns form and consolidate at this age (19). In addition, the sample size was computed based on the study by Rakhshanderou et al (20) and using the following formula and taking into account type 1 error,  $\alpha=5\%$ , the test power of 90%,  $\beta=10\%$ ,  $Z_{1-\alpha/2}=1.96$ ,  $Z_{1-\beta}=1.28$ , and  $S_1=S_2=6.46$  for the self-efficacy structure (i.e., the highest score in the above-mentioned research) with the effect size of  $\Delta=2.5$ , and finally, the number of samples was estimated 140 students for each group. Additionally, considering a 10% probable loss, a total of 308 students (154 in each group) was obtained.

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 (S_1^2 + S_2^2)}{\Delta^2}$$

Then, the required information including the number of districts, schools, and students was collected from the Education and Training Office of Ardabil and a multistage study was conducted in 2 districts of Ardabil. Next, 2 female and 2 male schools with good geographical distance were randomly selected. Further, 3 classes were randomly chosen from each school and 77 students from 4 schools participated in the study based on the inclusion criteria.

### Questionnaire

Employing a 3-sectioned questionnaire, data were collected including demographic and socioeconomic information (i.e., the number of family members, position among children, parents' job and education level, and residence status), as well as SCT-based determinants of F and V consumption encompassing environment (10 items), behavioral ability (8 items), outcome expectations (12 items), outcome expectancies (12 items), observational learning (8 items), reinforcement (4 items), and self-efficacy (8 items). Questions in this section were structured in a 5-point Likert-type spectrum with scores ranging from 1-5. Finally, food frequency questionnaire (FFQ) was employed to evaluate the F and V intake. FFQ is the most appropriate method for assessing dietary intake (21,22). The validity of questionnaire was estimated based on the research by Rakhshanderou et al (20). In addition, internal consistency and stability methods were conducted for calculating the reliability. The Cronbach alpha and the value for internal consistency were 0.65-

0.87 and 0.9, respectively. Further, the test-retest method was used to determine the stability of the instrument. The gained scores for these 2 stages employing the intraclass correlation coefficient varied from 0.67 to 0.87 for the tool structures and 0.93 for the entire instrument (20). The data were collected in triplicate before the intervention and 2 and 6 months after the intervention.

#### Intervention Based on SCT Using SFS Approach

In SFS approach, educational and practical interventions are considered at student, family, and school levels based on the following protocol. These interventions are conducted by the researchers at the beginning of the study after the pre-test (Figure 1).

#### Data Analysis

SPSS software, version 16 was employed for data analysis. Descriptive statistics were used to estimate the mean, standard deviation, and frequency distribution. Furthermore, the Kolmogorov-Smirnov test was utilized to check the normality of data and the obtained scores were converted to a scale of 100. Then, the repeated measurements of the analysis of variance test were used for the comparison of the mean scores before the intervention, as well as 2 and 6 months after the intervention in both groups. Eventually, between-group comparisons were

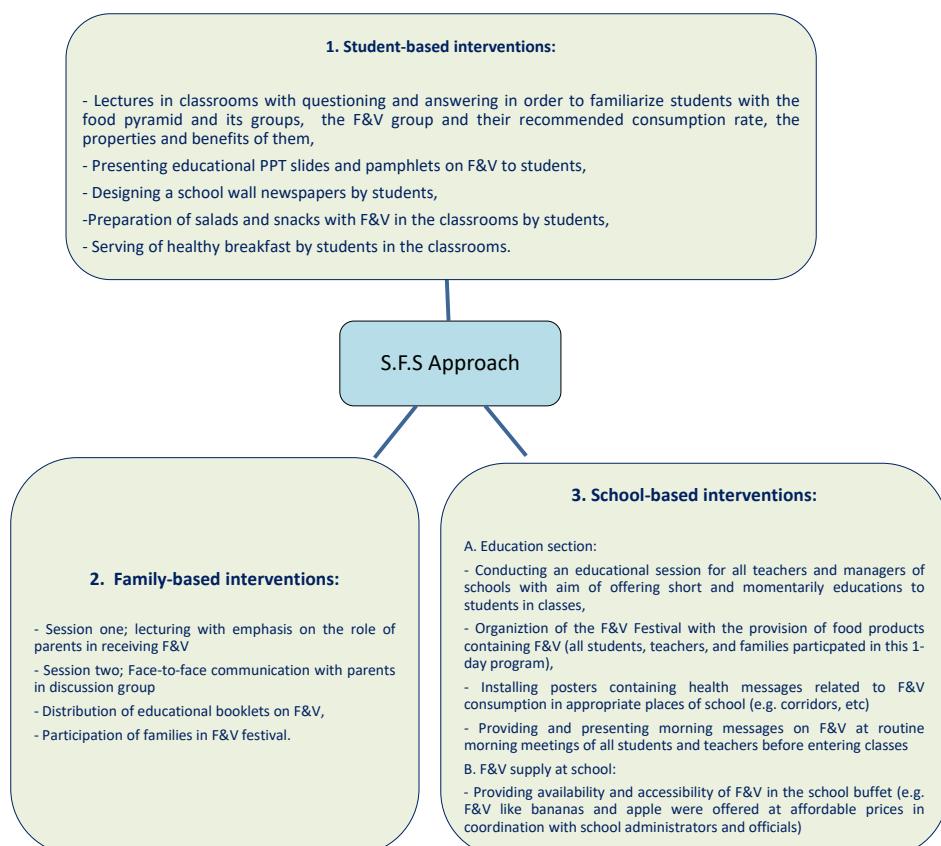
implemented using the independent *t* test.

#### Results

The results demonstrated no significant differences between the intervention and control groups in terms of demographic characteristics (Table 1).

The results related to SCT constructs (i.e., environment, knowledge, skills, outcome expectations, outcome expectancies, observational learning, reinforcement, and self-efficacy) are presented in Table 2. As regards the mean comparison of the groups, the independent *t*-test showed no significant difference between the intervention and control groups before the intervention ( $P>0.05$ ) while the difference between the groups was statistically significant at 2 and 6 months after the intervention ( $P<0.001$  and  $P<0.005$ , respectively) except for the observational learning construct in the second follow-up ( $P>0.2$ ). Moreover, based on the results of the repeated estimation of ANOVA, there was no significant difference in the mean scores of the constructs in control group before the intervention and 2 and 6 months after the intervention except for the observational learning, outcome expectancies, and outcome expectations whereas changes in all variables were significant in the intervention group.

Additionally, the independent *t* test for mean



**Figure 1.** Fruit and Vegetable Consumption Interventions Based on Social Cognitive Theory Using Student-Family-School Approach.

**Table 1.** Demographic Characteristics of the Students in Intervention and Control Groups

Character	Grouping	Control Group	Intervention Group	P Value
		No. (%)	No. (%)	
Number of family members	3	15 (9.7)	23 (14.9)	0.062
	4	85 (55.2)	97 (63.0)	
	5	40 (26.0)	27 (17.5)	
	6	14 (9.1)	7 (4.5)	
Rank of the student among the children	1	76 (49.4)	85 (55.2)	0.514
	2	54 (35.1)	51 (33.1)	
	3	14 (9.1)	13 (8.4)	
	4	10 (6.5)	5 (3.2)	
Father's job	Governmental Non-governmental	62 (34.4) 92 (65.6)	70 (45.5) 84 (54.5)	0.357
Mother's job	Housewife Employed	125 (86.4) 29 (13.6)	112 (72.7) 42 (27.3)	0.079
Father's education	Under the diploma	57 (37.0)	40 (20.8)	0.072
	Diploma	42 (27.3)	42 (27.3)	
	Academic	55 (35.7)	72 (51.9)	
Mother's education	Under the diploma	62 (47.4)	48 (26.0)	0.217
	Diploma	39 (25.3)	41 (26.6)	
	Academic	53 (27.7)	65 (47.4)	
Residence status	Private home Rented home	134 (87.0) 20 (13.0)	135 (87.7) 19 (12.3)	0.864

comparison of the groups showed no significant difference in the amount of consumed fruit and vegetable (F and V) between the intervention and control groups before the intervention whereas the difference was significant between the groups during 2 and 6 months after the intervention ( $P<0.002$ ,  $<0.106$ , respectively). The baseline average amounts of F and V consumption in the intervention and control groups were  $3.07\pm1.40$  and  $2.98\pm1.38$ , respectively. In addition, the corresponding amounts for 2 and 6 months after the intervention were  $3.39\pm1.56$  and  $2.83\pm1.53$ , as well as  $3.27\pm1.13$  and  $3.04\pm1.11$ , respectively, which indicated an increase in the mean scores in the intervention group at the intervals of 2 and 6 months after the intervention (Table 3).

## Discussion

The average scores of the environmental structure increased 2 months after the intervention while it decreased slightly over the 6 months. Several studies highlighted the impact of fruit and vegetable (F and V) accessibility and availability at home and school on the consumption of F and V (23-25). For example, Ahlstrom et al identified accessibility as one of the factors influencing F and V consumption (26). Similarly, Al-Otaibi reported the lack of F and V supply in restaurants and buffets as an influential factor for the lack of F and V consumption (27). Ilesanmi et al indicated that the physical environment was related to the consumption of F and V and the amount of food availability was associated with their lower prices (28). According to Hartman et al the high cost of F and V and the lack of accessibility were as among the barriers to the consumption of these foods and thus they emphasized the need to increase F and V availability in order to increase

their consumption (29). Bere and Klepp highlighted the highest correlation between the consumption of F and V and the availability of these foods as well (30). In another study, Papadaki pinpointed the role of accessibility and family influence on the consumption of F and V (31). Rakhshanderou et al considered accessibility to other unhealthy foods in the environment and the promotion of these foods as the reason for the lack of F and V consumption (23). Based on the report by Abbasian et al, F and V consumption reduced at the end of the study in the intervention group (32), which is consistent with the finding of the present study. Further, the average scores increased 2 months after the intervention and the impact of intervention declined over time. Similar results were obtained for the participants' awareness about the benefits of F and V and the recommendations of the World Health Organization on F and V consumption (23,33). Al-Otaibi reported that the level of knowledge of the individuals is an important factor that influences the consumption of F and V. They further concluded that students who consumed more F and V (more than 5 meals a day) were more knowledgeable (27). In the present study, the interventions included training the students and promoting the benefits of F and V consumption. Furthermore, other researchers demonstrated that holding educational classes significantly increased the students' awareness of F and V consumption (24,25,32). For instance, Hashemi et al found that among the structures of SCT, only awareness structure significantly increased in the group under investigation after the intervention (34).

The mean scores of skill structure in the intervention group increased at 2 and 6 months after the intervention and the increase was higher at 2 months after intervention,

**Table 2.** Comparison of the Mean Scores for SCT Constructs Within and Between Groups

Structure	Stage	Groups		P Value (t test)
		Control Mean ± SD	Intervention Mean ± SD	
Environment	Before intervention	75.11±10.02	77.33±8.79	0.12 NS
	2 months after intervention	74.31±9.90	79.59±9.70	<0.001**
	6 months after intervention	73.44±11.57	79.02±9.01	<0.001**
<i>P</i> value (Repeated measures ANOVA)		0.165	0.046	
Knowledge	Before intervention	75.69±14.07	79.17±14.57	0.059 NS
	2 months after intervention	76.78±12.79	91.23±8.40	<0.001**
	6 months after intervention	75.55±14.74	89.89±10.43	<0.001**
<i>P</i> value (Repeated measures ANOVA)		0.505	0.001<	
Skill	Before intervention	59.69±14.36	60.27±18.95	0.946 NS
	2 months after intervention	57.52±14.81	68.75±19.34	<0.001**
	6 months after intervention	57.88±16.42	62.08±16.17	<0.027*
<i>P</i> value (Repeated measures ANOVA)		0.307	0.001<	
Outcome expectancies	Before intervention	82.18±10.55	84.53±10.51	0.107 NS
	2 months after intervention	79.77±12.66	87.91±10.42	<0.001**
	6 months after intervention	80.16±14.15	85.01±12.77	<0.002**
<i>P</i> value (Repeated measures ANOVA)		0.049	0.004	
Outcomes expectations	Before intervention	82.17±9.58	84.37±8.97	0.051
	2 months after intervention	81.92±9.11	87.25±8.28	<0.001**
	6 months after intervention	79.94±10.93	83.94±9.93	<0.001**
<i>P</i> value (Repeated measures ANOVA)		0.024	0.001<	
Observational learning	Before intervention	69.83±12.51	72.02±11.05	0.169 NS
	2 months after intervention	69.03±11.03	79.69±12.49	<0.001**
	6 months after intervention	72.94±11.77	74.69±12.19	0.209 NS
<i>P</i> value (Repeated measures ANOVA)		<0.001	0.001<	
Reinforcement	Before intervention	64.63±14.91	68.19±14.33	0.086 NS
	2 months after intervention	62.98±15.35	76.12±15.85	<0.001**
	6 months after intervention	64.90±13.86	70.27±14.37	<0.001**
<i>P</i> value (Repeated measures ANOVA)		0.238	0.001<	
Self-efficacy	Before intervention	67.20±11.98	65.91±15.10	0.372 NS
	2 months after intervention	66.82±14.06	74.67±15.84	<0.001**
	6 months after intervention	68.90±12.53	76.44±10.90	<0.001**
<i>P</i> value (Repeated measures ANOVA)		0.137	0.001<	

SCT: Social cognitive theory; NS: Without significant difference; \* Significant difference at 5% level; \*\* Significant difference at 1% level.

**Table 3.** Comparison of Fruit and Vegetable Consumption Between Intervention and Control Groups

Structure	Stage	Groups		P Value (t test)
		Control Mean ± SD	Intervention Mean ± SD	
Fruit & vegetable consumption	Before intervention	2.98±1.38	3.07±1.40	0.589 NS
	2 months after intervention	2.83±1.53	3.39±1.56	<0.002*
	6 months after intervention	3.04±1.11	3.27±1.31	<0.106

NS: Without significant difference; \* Significant difference at 1% level.

indicating the positive effect of intervention on enhancing the skill of the students in preparing F and V. Several research findings highlighted the relationship between skill levels in the preparation of F and V and their consumption. In fact, the skill level of participants is believed to be an imperative factor influencing F and V consumption (23, 31). Najimi et al indicated that the

average score of the participants' behavioral capability increased after the intervention, which is in line with the results of the current study (25).

In the case of the outcome expectations regarding the effects of interventions, students were more likely to believe that consuming F and V had an impact on their health promotion. Rakhshanderou et al, investigating the

effect of outcome expectations on F and V consumption, found a positive effect on this structure and concluded that the expectation of positive short-term outcomes of F and V is regarded as one of the influential factors in their consumption (23). Moreover, Bashirian et al. reported a significant increase in the outcome expectation scores of the intervention group after the intervention (35). This result is in conformity with the results of the present study. However, Abbasian et al and Hashemi et al indicated that interventions had no significant effect on the outcome expectations (32, 34), which contradicts the results of the current study. Similarly, Branscum et al observed no significant changes in the outcome expectation structure due to the interventions (36).

In the case of the outcome expectancy structure, the result of the increase in the mean scores indicated the positive impact of interventions on students' attention to their health while the impact of interventions declined over time in this case. The role of outcome expectancy structure in the consumption of F and V and the effect of interventions on the score of this structure were emphasized in studies conducted regarding the impact of interventions on the outcome expectancies, as well as the relationship between the outcome expectancies and the consumption of F and V. Rakhshanderou et al considered the outcome expectancies as factors associated with F and V consumption (23). The study of Bashirian and et al demonstrated the positive effect of educational interventions on the increase in the scores of the outcome expectancy structure (35), which is in agreement with the results of the current study.

Interventions increased the score of observational learning in 2 months while this effect was not observed after the sixth month following the intervention. This result showed that the observational learning structure of F and V consumption had a positive effect on the consumption of F and V by students and such effect was exerted within a short time. Hartman et al evaluated the role of observational learning in relation to F and V consumption and concluded that students' learning through observing the behavior of their parents and peers had the greatest social impact (29). Additionally, Papadaki et al emphasized the role of the family in children's consumption of F and V (30) and Rakhshanderou et al indicated that observational learning is a factor that influences F and V consumption (23).

The scores of the reinforcement structure increased within 2 months after the intervention as well. Therefore, cheering is one of the effective ways to increase the consumption of F and V. Some studies evaluated the impact of encouragement and support on F and V consumption and indicated that encouragement and guidance were among the factors which contributed to the appropriate consumption of F and V (23, 37). Najimi et al emphasized the role of social support in this regard (25) while Shokrvash et al pinpointed family practical support as a

factor influencing F and V consumption (37). However, Amini et al found no significant difference between the intervention and control groups in terms of social support and social cognitive theoretical structures whereas the difference was significant after the intervention (38), which is consistent with the results of this study.

In addition, the mean score of self-efficacy structure demonstrated an increase in the intervention group at the sixth month suggesting the preference for continuing F and V consumption 6 months after the intervention. This means that the habit of consuming F and V continues over time. Several other researchers highlighted the preference as an influential factor in F and V consumption (11, 16, 23, 25, 27, 32). Likewise, Al-Otaibi mentioned self-efficacy as a major factor influencing F and V consumption (27), which is consistent with the results of the current study. Further, Ahlstrom et al found that self-efficacy in cooking was a significant factor affecting the consumption of F and V (26) and Hartman et al reported the lack of self-efficacy as one of the factors which reduced the consumption of F and V (29). Furthermore, Rinderknecht and Smith reported that nutritional interventions significantly increased the level of self-efficacy in children while it had no significant effect on adolescents (39), which is contrary to the results of the present study. Branscum et al reported the lack of significant changes in self-efficacy as well (36).

In the present study, the mean of F and V consumption in the intervention group increased at 2 and 6 months after the intervention. F and V are the main sources of different nutrients and vitamins. The higher intake rate of F and V during childhood decreases the risk of many chronic diseases such as cancer, cardiovascular disorders in adulthood, or even Crohn's disease in children (40). The highest rates of F and V consumption were obtained in 2 months. This result shows the need for continuous interventions for changing the behavior of the students towards more consumption of F and V. Branscum et al. in their research found a significant improvement in the overall nutritional behavior in terms of F and V consumption owing to educational interventions (36), which corroborates with the results of the present study. Similarly, Najimi et al, Hashemi et al, and Abbasian and et al demonstrated an increase in the consumption of F and V and change in nutritional behavior in the intervention group (25, 32, 34). Some recent studies clarified the impacts of new aspects of F and V consumption on health. For example, Bishwajit et al showed a negative relationship between F and V consumption and severe and moderate depression (41), whereas Schwingshakl et al reported a significant association between the total F and V consumption and the rate of mortality (42). Although interventions increased the consumption of F and V, the participants of the present study consumed less than five meals per day or more, as recommended by the World Health Organization (WHO). The results of a study by the WHO in 6 Arab countries showed that a small percentage

of the population followed the recommendations of the WHO. Jordan had the best results, accounting for 43% of the population who consumed more than the recommended quantity while only 4.7% and 6.5% of the population consumed the recommended quantity in Syria and Saudi Arabia, respectively (43). Al-Otaibi reported that 78% of students in Saudi Arabia consumed less than five servings of F and V per day (27). Moreover, based on the report of Kpodo et al, most of the participants in Ghana consumed less than 1-3 servings of F and V per day (44). Additionally, Amini et al indicated that only 8.7% and 27% of the participants consumed fruits and vegetables at least 3 times a day, respectively (38). In addition, Zamanian et al found that the frequency of people with less than five meals of F and V was 60% (45).

In order to achieve more accurate results, similar studies are suggested in different seasons, age groups, and educational levels. Considering the importance of F and V consumption in health promotion of the students, implementing appropriate educational intervention programs seems necessary for increasing the consumption of food in schools at provincial and national levels.

### Conclusions

In general, the findings of the present research indicated that conducting interventions based on SFS approach could improve social cognitive factors among the students. Consequently, these types of interventions lead to an increase in F and V consumption among the students and change their behavior in this regard.

The present study had several limitations including the lack of cooperation by the authorities of some schools respecting implementing the research, the use of self-report questionnaire, the application of SCT framework, as well as the lack of complete cooperation of some students regarding completing the questionnaires and seasonal changes in the consumption pattern of F and V.

### Conflict of Interests

Authors have no conflict of interests.

### Ethical Issues

The permission was obtained from Shahid Beheshti University of Medical Sciences, Tehran, and the Education and Training Directorate of Ardabil for implementing the study. Further, the study was conducted in conjunction with school officials, parents, and teachers. At the onset of the research, the purpose of the study and the right of individuals for participating in the study were explained. Furthermore, the study was registered at the Iranian Registry of Clinical Trials under the code of IRCT2016051711371N2 and approval was obtained from the Ethics Committee of Shahid Beheshti University of Medical Sciences under the code of IR.SBMU.RETECH. REC.1395.222.

### Financial Support

None.

### Acknowledgments

The present article is based on the doctoral thesis on health education and promotion at Shahid Beheshti University of Medical Sciences. Thus, the authors are very grateful to the efforts of the education authorities, managers, teachers, and all the students who participated in this research.

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