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Effect of "Social Cognitive Theory"-based Intervention on Promoting Physical Activity in Female High-School Students of Rafsanjan City, Iran

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ABSTRACT

Aims One of the effective factors in causing chronic diseases is inactivity. Therefore, considering the importance of modifying adolescent girls' physical activity behavior and developing appropriate educational strategies and interventions in this field, this study aimed to investigate the effect of educational intervention based on social cognitive theory (SCT) on adolescent girls' physical activity.

Materials & Methods A Quasi-experimental study was conducted among 246 female high schools' Students (124=intervention group and 122=control group) in Rafsanjan (Southern Iran) by random cluster sampling in 2018-19. Demographics variables and valid and reliable questionnaire included the physical activity assessment of the last week and its effective factors based on SCT constructs collected in two stages. Educational interventions were applied in four sessions to students and two sessions to parents, teachers, and school officials. Data analysis was performed using SPSS 16.0, the Mann-Whitney U test, the Wilcoxon test, and the T-test.

Findings After executing the educational program, there was a significant difference between the mean scores of the two groups in environmental factors (p=0.027), knowledge (p<0.001), family support (p=0.001), self-efficacy (p=0.001), and self-regulation (p=0.008), comparative between two groups the rates of daily and weekly physical activity increased (p=0.001).

Conclusions The implementation of educational programs based on the SCT positively affects promoting physical activity in adolescents.

Keywords Physical Activities; Education; Theory; Female

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Introduction

Physical activity is one of the major effective factors preventing cardiovascular diseases, osteoporosis, and cancers [1]. According to the World Health Organization (WHO), adolescents should do at least 60 minutes of moderate to vigorous physical activity daily, which improves fitness as well as cardiovascular, muscle, and bone health, in addition to body metabolism [2]. About 31.1% of adults and 80.3% of adolescents in the world within the age range of 13 to 15 do not do sufficient physical activity, including 43% of Americas and eastern Mediterranean adults and 17% of Southeast Asian adults [3]. In addition, more than four-fifths of the Iranian population is somehow inactive [4] and 30 to 70% of them are sedentary [5, 6]. Girls participate less than boys in sports and physical activity [3, 7]. The average scores for the daily and weekly physical activity of the female adolescents of Tehran were reported to be 42.15 and 127.75 minutes, respectively [8]. In Kazemi *et al*. study, only 18% of Rafsanjan pre-university female students had favorable physical activity [9]. Hashemian *et al*. reported that the average daily physical activity was 24 minutes among 325 female high school students in Rafsanjan, lower than the rate recommended by Word Health Organization (60 minutes per day) [10]. In this research, there was a positive and significant relationship between students' daily physical activity with environmental factors, knowledge, behavioral skill, expected outcome, outcome value, family support, support of friends, and self-efficacy [10].

Inactivity has been introduced as the major cause of 30% of ischemic heart diseases, 21 to 25% of breast and colon cancers, 27% diabetes, and the fourth leading cause of death, with 3.2 million deaths worldwide [11-12, 1]. Regular physical activity reduces osteoporosis and increases life expectancy and life expectancy in women [13-14].

Many lifestyle-forming behaviors, such as exercise and proper nutrition, are shaped and institutionalized in individuals during childhood and adolescence [15]. One of the essential tools in changing lifestyle is a training program as a part of health care [16]. Learning and teaching are two interrelated processes. Learning is the goal, and training is the means to achieve that goal [17]. In addition, due to the importance of the adolescent girls' role in the formation of next-generation behavioral patterns as future mothers, the behavioral patterns of this group of people are of great importance [18]. Theory-based intervention programs facilitate a change in health behaviors by enhancing the understanding of the behavioral mechanisms of the change [19]. Bandura's SCT (1963) is one of the most effective theories of behavior change based on the interaction among dynamic triad of personal cognitive, physical and social environment and behavioral factors; in addition, it is highly effective in predicting, explaining, and modifying behavior in different situations, especially in adolescents [19, 20]. Bandura considers behavior as the product of the individual and the environment, which affects the individual and the environment [21], and believes that human health is not merely an individual matter but a social one [22].

The constructs of SCT include knowledge, self-efficacy, outcome expectations, outcome value, environment, observational learning, social support, behavioral skills, and Behavioral ability [19, 20]. Mirzaei-Alavijeh *et al*. reported outcome expectation, self-efficacy, and peer support as the major predictors of physical activity behavior among Southern Iranian students [23]. In addition, among other determinants of girls' physical activity behavior, knowledge level [24] and perceived barriers (as the most important predictor) have been alluded to [9, 25].

Given the importance of physical activity in maintaining and promoting adolescent health and reporting the unfavorable physical activity situation in female students of Rafsanjan, this study was conducted to evaluate the effects of educational interventions based on the social cognitive theory on promoting physical activity in female high school students.

Materials and Methods

The target population of the Quasi-experimental study was comprised of the Rafsanjan female high schools' Students (7th to 9th grade) in 2018-19. Four schools were selected by random cluster sampling from 18 schools. They were divided randomly into intervention and control groups. In each school, one class was selected randomly for each grade. Considering a 10% chance of attrition, the sample size was estimated based on the formula ((n= $(Z_1+Z_2)^2\times$ $(2S^2)$ $/d^2$) at least 110 students in each group (Z_1= 1.96, Z_2= 0.84, S is an estimate of the standard deviation of the score of each of the theoretical constructs in the two groups and d is the minimum difference in the mean score of each factor between the two groups, which shows a significant difference, in this study, 0.4S was considered). The inclusion criteria were the students' willingness to participate in the study, lack of specific illnesses inconsistent with physical activity, and lack of mental illnesses. In contrast, the exclusion criteria included being absent for two sessions and withdrawal at the time of educational interventions, giving no response to 20% of the questions. Initially, 274 students were enrolled in the study, but 15 students from the intervention group and 13 from the control group were excluded for the reasons listed above.

Data collection tools included the three sections of demographic information, the standard physical activity assessment questionnaire during the past week, and factors affecting the physical activity questionnaire based on the SCT constructs. Demographic information included educational

grade, parental education, and job, weight, height, Body Mass Index (BMI), and family income was assessed. In the second section, the Physical Activity Behavior Questionnaire [26] (the weekly sports activity self-report questionnaire) was utilized with 20 items. In this section, the level of mild, moderate, and vigorous physical activity was evaluated for the past week Mild exercise, such as leisurely walking, fishing, light exercise, yoga and moderate exercises such as brisk walking, leisurely cycling, volleyball, leisurely swimming, badminton, tennis, skating Recreation for 30 minutes or more and 5 or more times a week and vigorous exercise, such as running, soccer, basketball, mountaineering, brisk swimming, aerobics, brisk cycling, brisk and long skating for 20 minutes or more And 3 times a week or more. The method of calculation is as follows.

Weekly exercise activity score = (3* frequency of mild exercise per week) + (5* frequency of moderate exercise per week) + (9* frequency of vigorous exercise per week) [26]. Reliability of this questionnaire was assessed in Asadpour *et al*. study, and Cronbach's alpha coefficient was determined to be 0.79 [26]. The third part of the questionnaire was used to evaluate the determinants of physical activity behavior based on SCT constructs, based on Shirvani *et al*. [8]. Its validity was confirmed by the opinions of ten experts (health education, physical education, and epidemiology experts). The general features of SCT constructs were presented in Table 1 in terms of physical activity.

The Research Ethics Committee approved this study of Rafsanjan University of Medical Sciences. The objectives of the study were stated, and the students participated in the study with conscious consent. Firstly, both intervention and control groups completed the questionnaires. Next, based on the analysis of the pre-test results, and after determining and prioritizing educational needs, an intervention program (including educational goals, educational content, training methods, as well as duration and number of training sessions) was designed as a lesson plan for each session (Table 2). After the 6-week training sessions for students, officials and teachers, and parents, the intervention group received 11 short message services (SMSs) on physical activity for 88 days (one text message per week). There was no educational intervention applied to the control group during this period. After completing the post-test questionnaires, a training session was held based on an educational pamphlet for the control group to meet ethical requirements in the research. Three months after the end of the training period, the questionnaires were completed by both groups.

After checking the data normality by Kolmogorov-Smirnov test, data were analyzed using SPSS 16.0, a chi-square test, the Mann-Whitney U test, the Wilcoxon test, the independent t-test, and a paired t-test based on the normality of constructs and the type and role of variables. The significance level was considered to be 0.05.

Table 1) Tool specifications of SCT constructs in terms of physical activity

Tool name	Number of questions	Scope of scores	Response Scale	Cronbach's alpha
Environmental factors	4	4-20	Five-choice Likert	0.65
Behavioral ability (Knowledge)	17	0-34	Multiple choice, answers of Yes, No, and I do not know	0.68
Behavioral ability (Behavioral Skills)	3	3-15	Five-choice Likert	0.74
Outcome Expectation	6	6-30	Five-choice Likert	0.86
Outcome value	5	5-25	Five-choice Likert	0.78
Observational learning	6	6-30	Five-choice Likert	0.81
Social reinforcement (family support)	3	3-15	Multiple choice	0.84
Social reinforcement (Peer support)	5	5-25	Multiple choice	0.76
Efficacy	6	6-30	Five-choice Likert	0.86
Self-regulation	7	7-35	Five-choice Likert	0.84

Table 2) Summary of the intervention sessions based on SCT concerning physical activity

Sessions	Objectives	A summary of activities	Time (minutes)
First	Promoting female students' knowledge and attitude of physical activity	Defining physical activity, types of physical activity, and the amount of physical activity required in adolescents; Explaining the importance of physical activity	60
Second	Improving expectation outcome and outcome value	Explaining the positive consequences of physical activity and negative consequences of inactivity in different dimensions of the quality of life	60
Third	Promoting self-regulation, self-efficacy, and behavioral skills of first-grade female students in physical activity	Discussing strategies for increasing self-regulation and self-efficacy in physical activity, doing proper physical activity at home, forming friendly groups, doing some exercises aided by training videos; Introducing appropriate strategies for increasing physical activity at the levels of planning, targeting, and self-monitoring;	60
Fourth	Improving the self-efficacy and skills of female students in physical activity and exercise in the schoolyard	Reviewing contents of previous sessions, doing warm-up exercise, playing volleyball, basketball, or badminton, and doing cool-down exercise	60
For officials & teachers	Engaging officials and teachers in creating a suitable school environment	Providing statistics, explaining the impacts of environmental factors and observational learning on physical activity, allocating time for morning exercise, providing sports equipment, scheduling for sports teams, and conducting sports competitions	90
For parents	Engaging parents aimed at providing an appropriate environment at home	Providing statistics, explaining the impacts of environmental factors and observational learning on physical activity, allocating time for physical activity with ones' children, and providing sports equipment	90

Findings

Finally, the data of 246 students (124 in the intervention group and 122 in the control group) were analyzed (Figure 1).

34.4% of fathers and 48.8% of mothers had an evidence educational diploma in terms of education levels. Considering employment status, 53.9% of fathers were self-employed, and 82.0% of mothers were housewives. In addition, 81.7% of the families had a good and mediocre income. Using a chi-square test, the homogeneity of the two groups was evaluated in terms of demographic variables, which showed that the two groups were almost identical concerning all mentioned demographic variables, and no statistical difference was observed (Table 3).

In all constructs, the mean scores of the two groups were not significantly different in the pre-test stage ($p>0.05$; Table 4). After the intervention program, the mean scores of all constructs increased in the intervention group compared to the pre-test stage.

The results of the Wilcoxon test and the paired t-test showed that the mean score of environmental factors ($p=0.027$), knowledge ($p<0.001$), family support ($p=0.001$), self-efficacy ($p=0.001$), and self-regulation ($p=0.008$) of students had a significant difference between the pre-test and post-test stages. In addition, the daily and weekly physical activity increased after the educational program; this difference between the two groups was significant ($p=0.001$). In the post-test stage, the intervention group had higher scores in most of the constructs than the control group; however, only the mean difference in knowledge ($p<0.001$), expectation outcome ($p=0.015$), as well as daily and weekly physical activity ($p<0.001$) of the students were statistically significant in the post-test stage between the intervention and control groups (Table 4).

Since the mean score of the intervention group was lower in the pre-test stage in some constructs, to investigate the effects of the educational intervention on the constructs of the students' theory of physical activity behavior questionnaire in the post-test stage, differences between post-test and pre-test scores were compared between the two groups. The Mann-Whitney test and the independent t-test showed that the difference between the post-test and pre-test scores between the two groups was significant in the constructs of knowledge, outcome expectation, and daily and weekly physical activity (Table 4).

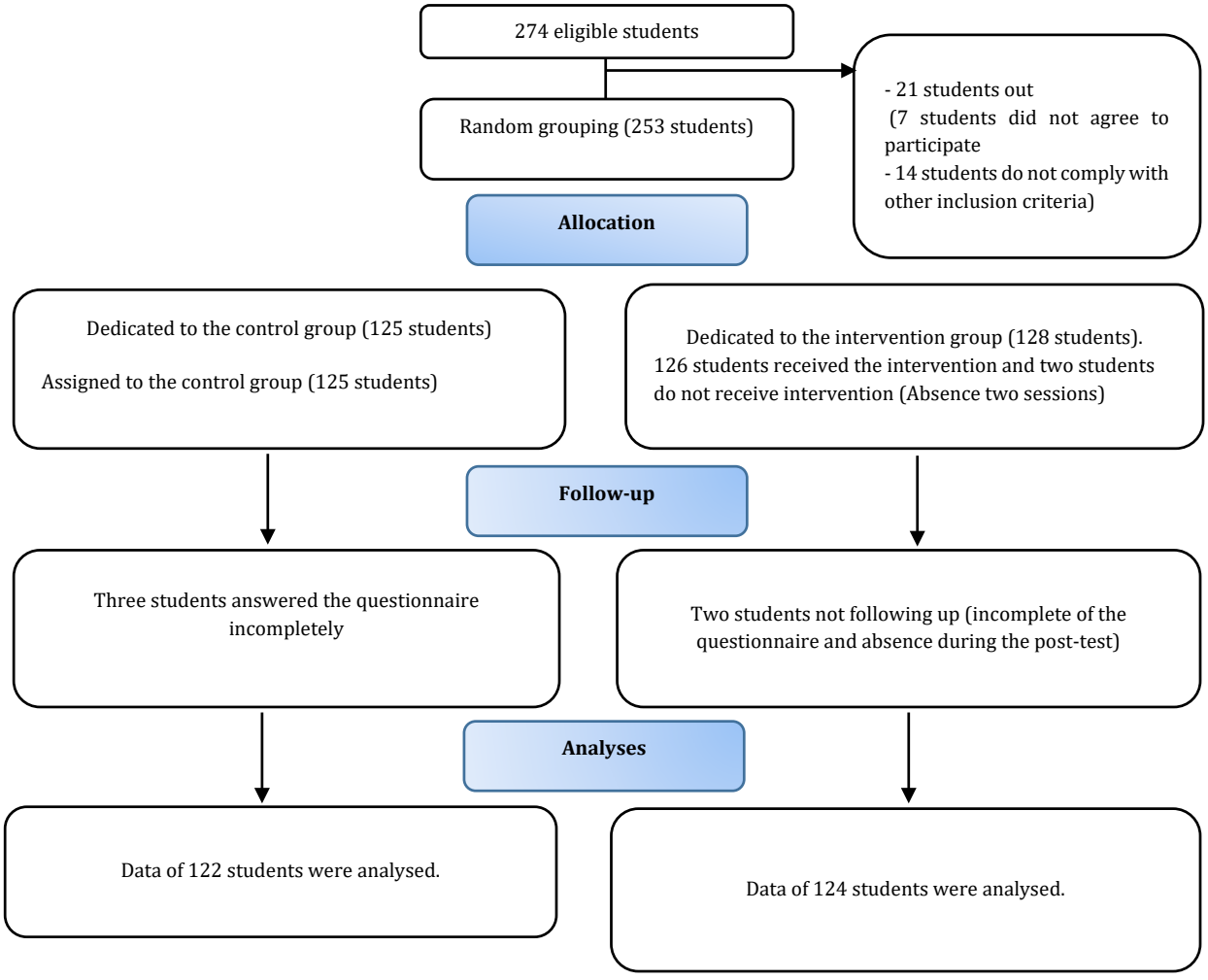

Figure 1) Consort flow diagram of SCT based intervention on physical activity

Table 3) Demographic characteristics of Rafsanjan female high school students before intervention

Variable	Variable status	Group		Group		p.
		Intervention N (%)	Control N (%)	Intervention Mean±SD	Control Mean±SD	
Educational grade	Seventh	37 (29.8)	45 (36.9)	-	-	0.187[a]
	Eighth	39 (31.5)	43 (35.2)	-	-	
	Ninth	48 (38.7)	34 (27.9)	-	-	
Father's education	Primary	12 (9.9)	18 (14.7)	-	-	0.853[a]
	Guidance	32 (26.2)	30 (24.6)	-	-	
	Diploma	47 (38.5)	37 (30.3)	-	-	
	Academic	31 (25.4)	37 (30.3)	-	-	
Mather's education	Primary	9 (7.4)	13 (10.6)	-	-	0.257[a]
	Guidance	20 (16.4)	29 (23.8)	-	-	
	Diploma	67 (54.9)	52 (42.6)	-	-	
	Academic	26 (21.3)	28 (23.0)	-	-	
Father's job	Self- employed	70 (56.9)	62 (50.8)	-	-	0.184[a]
	Employee	40 (32.5)	34 (27.9)	-	-	
	Worker	7 (5.7)	9 (7.4)	-	-	
	Unemployed	1 (0.8)	3 (2.5)	-	-	
	Retired	4 (3.3)	7 (5.7)	-	-	
	Other	1 (0.8)	7 (5.7)	-	-	
Mother's job	Housewife	100 (81.3)	101 (82.8)	-	-	0.762[a]
	Employed	23 (18.7)	21 (17.2)	-	-	
Family income	Excellent	14 (11.3)	20 (16.4)	-	-	0.555[a]
	Good	58 (46.8)	58 (47.5)	-	-	
	Medium	47 (37.9)	38 (31.1)	-	-	
	Weak	5 (4.0)	6 (4.9)	-	-	
Height	Height	-	-	158.99±7.12	158.32±5.83	0.429[b]
Weight	Weight	-	-	53.80±12.00	53.40±12.06	0.801[b]
BMI	BMI	-	-	22.57±5.19	21.11±4.40	0.320[b]

a: Chi-square test; b: Independent T-test

Table 4) Comparison of mean±SD of physical activity and SCT constructs in two groups, before and three months after intervention

Dependent variable	Groups	Pre-test	Post-test	p-value	Post-Pre test
Weekly physical activity	Intervention	167.25±196.53	229.42±219.168	0.001[d]	62.17±22.63
	Control	169.75±196.04	148.15±185.92	0.146[d]	-21.59±10.12
	p-value	[a]0.987	<0.001[a]	-	0.001[a]
Daily physical activity	Intervention	23.89±28.07	32.77±31.30	0.001[d]	8.88±3.23
	Control	24.25±28.00	21.16±26.56	0.146[d]	-3.08±1.44
	p-value	0.987[a]	<0.001[a]	-	0.001[a]
Environmental factors	Intervention	15.45±2.45	16.03±2.52	0.027[d]	0.58±0.07
	Control	15.88±2.77	15.85±3.32	0.839[d]	-0.03±0.55
	p-value	0.106[a]	0.832[a]	-	0.197[a]
Knowledge	Intervention	25.23±4.59	30.49±2.32	<0.001[d]	5.26±2.27
	Control	25.08±5.15	24.53±4.85	0.267[d]	-0.54±0.3
	p-value	0.597[a]	<0.001[a]	-	<0.001[a]
Behavioral skill	Intervention	8.68±2.21	8.95±2.47	0.187[d]	0.27±0.26
	Control	8.24±2.38	8.62±2.96	0.080[d]	0.37±0.58
	p-value	0.219[a]	0.565[a]	-	0.747[b]
Outcome Expectation	Intervention	25.88±2.80	26.26±2.60	0.149[d]	0.37±0.20
	Control	25.59±3.03	25.04±3.66	0.092[d]	-0.54±0.63
	p-value	0.506[a]	0.015[a]	-	0.048[a]
Outcome evaluation	Intervention	18.58±3.28	18.75±3.76	0.338[d]	0.17±0.48
	Control	17.99±3.90	18.40±4.04	0.131[d]	0.41±0.14
	p-value	0.203[b]	0.465[a]	-	0.637[b]
Observational learning	Intervention	17.15±4.43	17.46±5.32	0.471[d]	0.31±0.89
	Control	17.79±4.39	17.44±4.79	0.380[d]	-0.35±0.40
	p-value	0.159[a]	0.969[b]	-	0.300[b]
Social support (family support)	Intervention	6.37±2.76	7.24±3.10	0.001[d]	0.87±0.34
	Control	6.50±2.82	7.66±3.29	<0.001[d]	1.15±0.47
	p-value	0.726[a]	0.394[a]	-	0.599[a]
Social support (friend support)	Intervention	8.58±2.71	8.95±2.85	0.225[d]	0.36±0.14
	Control	9.06±2.60	9.21±3.01	0.518[d]	0.14±0.41
	p-value	0.066[a]	0.469[a]	-	0.624[b]
Self-efficacy	Intervention	18.57±5.35	20.08±5.33	0.001[c]	1.50±0.02
	Control	19.40±5.35	20.58±5.41	0.006[c]	1.17±0.06
	p-value	0.221[b]	0.465[b]	-	0.587[a]
Regulation	Intervention	25.59±5.08	26.89±5.07	0.008[d]	1.29±0.01
	Control	25.34±5.22	25.90±6.06	0.119[d]	0.56±0.84
	p-value	0.701[b]	0.214[a]	-	0.545[a]

a: Mann Whitney Test; b: Independent t-test; c: Paired t-test; d: Wilcoxon Test

Discussion

The study results confirmed the effect of the SCT intervention on increasing the students' physical activity behavior participating in the study. It also significantly improved the constructs of knowledge, self-efficacy, family support, self-regulation, and environmental factors. Environmental factors are one of the SCT structures that addressed the physical and social conditions of the students in terms of physical activity. The educational intervention was designed to promote cooperation among parents, school authorities, and teachers to provide appropriate home and school support to enhance physical activity through discussion, brainstorming, sharing experiences. There was also a morning exercise program in the schools where sports teams were formed. The results of this section were consistent with the study of Shirvani *et al*. [8]. In the study of Lubans *et al*. conducted among Australian adolescents [27] and Xu's study among Chinese students [28], environmental factors were reported to have been direct and influential. Therefore, equipping schools with sports facilities or the availability and accessibility of these facilities near the home could play an important role in enhancing students' physical activity.

Behavioral ability refers to adolescents' knowledge and behavioral skills in performing physical activity. The discussion and introduction of sports sites were used in the educational intervention group. In addition, the students organized teams and exercised together. A short video was also presented about exercise, and they were asked to perform the movements displayed in the video forthwith. In the present study, the knowledge score increased significantly in the intervention group, which was similar to the study of Peyman *et al*. among adolescent girls in Mashhad [29] and that of Shirvani *et al*. [8]. In the study of Haß & Hartmann and Ghaffari *et al*., the level of knowledge was the most determining personal factor [24, 30]. Girls' poor behavioral skills could be due to the lack of responsibility for their health and being barred from doing activities, such as preparing sports facilities. Providing training in behavioral skills requires cooperation among students, parents, teachers, and school authorities. Therefore, providing schools and parents with training by sports coaches as well as assigning tasks such as organizing sports teams and providing sports facilities to adolescents can help improve physical activity.

Outcome expectation is a student's desired results from physical activity, and the outcome value is the value adolescents attach to physical activity results. The students were asked to join sports teams, and the benefits of physical activity and sedentary tasks were demonstrated through lectures, group discussions. At parent sessions, parents were asked to express their attitude towards their children's physical activity. However, no significant change was observed in this section, which was consistent with the study of Shirvani *et al*. [8]; in contrast, it was not consistent with the results of the studies of Abdi *et al*. [31] and Stacey *et al*. [32]. The results of the study of Mirzaei-Alavijeh *et al*. report outcome expectation as one of the major predictors of physical activity [23]. Despite the high willingness of students to achieve physical activity goals, they are sometimes denied the opportunity to do the physical activity because of their homework. Therefore, it is suggested that schools consider more time in educational planning for students' physical activity (exercise bell).

In the present study, observational learning was defined as learning to perform physical activity through observing the behavior of others. Educational techniques, such as short video clips and participating in a group exercise program, were used at school to promote physical activity. In addition, the concurrent training session of parents and the students were emphasized during the parent training session; likewise, the adolescents' willingness to accompany the family for walking and other sports activities was emphasized. However, the above-mentioned training strategies were not effective in promoting this construct, which was different from the study of Shirvani *et al*. [8]. In the research of Hass and Hartmann, parental modeling and peer influence had a significant positive correlation with students' behavior [30]. Holding family sports conferences and sports competitions increased physical behavior, which was not considered in our intervention.

Encouragements and punishments teenagers receive from their family and peers for physical activity are known as social reinforcement. To increase the amount of physical activity at the sessions of parents and authorities, the need for encouraging students at home and school, holding sports competitions, and presenting awards to students were also discussed during the sessions. Family support increased significantly following the intervention after eight weeks, which is consistent with the studies of Stacey *et al*. [32] and Shirvani *et al*. [8]. In the study of Parsamehr *et al*., peer support was the most influential factor in physical activity [33]. After the educational intervention, parental knowledge and the cooperation and support of families increased for adolescents to do physical activity. The low level of peer support in the present study could have been due to its high mean score before the intervention, the lack of sports competitions in the schools, and the lack of encouragement by sports instructors to perform physical activity. Therefore, it is recommended to run training programs for parents and sports coaches on holding sports competitions at school between different grades and classes.

Students' self-confidence in their ability to perform physical activity is called self-efficacy. In the present study, short videos were presented to improve

educational self-efficacy. In addition, aided by role-playing, physical activity was practiced in the group in the schoolyard. After the intervention, the aforementioned construct improved significantly, which is consistent with the study of Peyman *et al*. [29] but inconsistent with the results of the research of Nematollahi & Eslami [34]. In the study of Lubans *et al*., self-efficacy had an impact on adolescent girls' physical activity [35]. Jalali *et al*. reported self-efficacy as the most important predictor of physical activity [36]. Given the high impact of this construct on physical activity, it is suggested that sports coaches identify students' sports talents and provide guidelines for the growth and flourishing of these talents and encourage youths to work in all disciplines by forming sports teams.

Self-regulation is defined as the setting of goals and programs by the student for physical activity. To increase self-regulation, discussion, reflection, role-playing, student experiences, and the organizing of sports groups and teams were used. In addition, the students were instructed to set plans and goals daily for a short time, then weekly, monthly, and at appropriate intervals. In the session for parents, there was also an emphasis put on the need for accompanying parents and assisting students in planning. Self-regulation showed a significant increase in contrast to the pre-intervention stage, which was similar to the results of the study of Lubans *et al*. [27]. In the study of Plotnikoff *et al*., self-regulation accounted for 11% of the variance in physical activity [37]. In the study of Nematollahi, self-regulation was the strongest determinant of physical activity [34]. The majority of the students carried out plans that their families devised and were dissatisfied with the process. Therefore, it is suggested that families be trained to encourage students and support them in designing and implementing sports programs.

The average daily and weekly physical activity of students before the intervention was 23.89 and 167.25 minutes, respectively, which was lower than the level recommended by the WHO (60 minutes per day), which has been undesirable. After the intervention, the average daily activity of the students was 32.77 minutes, and their average weekly activity was 229.42 minutes, which increased significantly. Similar results were also found in the study of Heeren *et al*. [38].

The limitations of the present study were examining adolescents' physical activity in the past week and completing questionnaires by them in a self-reporting manner. The positive points of the present study included the appropriate sample size in designing the intervention, random sample selection, the use of the SCT, the application of most of SCT constructs and its effectiveness in enhancing the adolescents' physical activity, and their satisfaction with participating in this study.

Conclusion

The intervention of physical activity based on the SCT affected knowledge, self-efficacy, family support, self-regulation, and environmental factors, respectively. The implementation of educational programs based on the SCT positively affected promoting physical activity in adolescents. Therefore, interventional studies based on SCT constructs are suggested to emphasize social support, self-efficacy, and self-regulation.

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