

**Effect of theory-based intervention to promote physical activity among adolescent girls: a randomized control trial**Fatemeh Darabi<sup>1,2</sup>, Mohammad Hossein Kaveh<sup>3</sup>, Fereshteh Majlessi<sup>4</sup>, Farideh Khalaj Abadi Farahani<sup>5</sup>, Mehdi Yaseri<sup>6</sup>, Davoud Shojaeizadeh<sup>7</sup>

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**Type of article:** Original

**Abstract**

**Background:** Physical activity (PA) rates decline among most high school female students, and due to cultural restrictions, the reduction of physical activity might be exacerbated in female Iranian adolescents.

**Objective:** To determine the effects of the physical activity education theory-based intervention to promote activity among adolescent girls.

**Methods:** This randomized clinical trial was conducted at public high schools in Tehran, Iran, from September 2015 to July 2016 on 578 girls. The subjects were assigned randomly to two groups of experiment and control (n=289 per group). All participants in the experimental group received an educational program based on a modified TPB. Measures were assessed before and 6 months after the experiment. The data were analyzed using SPSS version 23. We used descriptive statistics, multilevel analysis, Likelihood Ratio (LR) test, P-value less than 0.05 were considered statistically significant.

**Results:** Five hundred and seventy-eight participants with a mean age of 14.26±0.96 years were studied in two groups of experiment (n=289) and control (n=289). Moreover, adjusted for the baseline values, the mean of the scores of the knowledge (84.1±13.6), attitude (31.2±13.6), subjective norm (40.4±11.1), behavioral intention (34.3±14.7), perceived behavioral control (38.4±11.6), perceived parental control (42.9±14.2), behavioral (42.6±17.1) was significantly higher in the experiment group compared with the control group (p<0.001).

**Conclusions:** The results of this study implicate that theory based educational intervention is considered to be more effective in improving physical activity in adolescents. This result can be used to increase adolescent's health promotion.

**Trial registration:** The trial was registered at the Iranian Registry of Clinical Trials (IRST) with the identification number: IRCT2015070623089N2.

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**Keywords:** Theory-based intervention, Adolescents, Physical activity, TPB

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## 1. Introduction

Physical activity has a beneficial effect on overall health among adolescents (1). While in many industrialized countries, people and especially young people do not have enough physical activity. In Western countries, including America, a large portion of the population of young people are active, but according to evidence, physical activity decreases with increasing age (2). Based on evidence, young people, especially in the developed world, descend into an inactive lifestyle early on in life. In some developing countries they are undergoing patterns related to habits of non-physical activities and a greater intake of calories, and this, in part, is contributing to the worldwide obesity epidemic (3). In developing countries, the increasing number of overweight cases is leading to a higher rate of mortality in early adulthood. There are fewer opportunities for children and young people to take up a physical activity, especially in large cities and the rapidly growing cities of developing countries (4). In general, the amount of physical activity today, has been on the decline in adolescents especially in girls who mostly took up exercise at the earliest opportunity (2). Based on studies, there is lower physical activity in girls compared with boys. According to studies, 40 percent of girls and 27 percent of boys had no access to simple advice on physical activity (5). However, due to the rising epidemic of obesity in adolescents, interest in physical activity, is recommended as a part of general health promotion (6). Based on several studies, the amount of physical activity in girls decreases with increasing age, this issue is worrying for them (7). Based on other studies, girls' physical activity rates decrease dramatically between the ages of 9-18 years (8). In relation to this, there has been a documented increase in the prevalence of sedentary lifestyle among Iran's school children and it has shown to be significantly more prevalent in girls (36%) than in boys (61.5%) (9). Physical inactivity and obesity is a serious public health problem in many countries, and its prevalence is growing worldwide with changes in dietary behavior and activity levels. It is possible that as a consequence of these low physical activity levels, chronic conditions, such as high blood pressure, cardiovascular disease, digestive disease, respiratory dysfunction, cancer, rates of obesity, type 2 diabetes, psychosocial dysfunction, and indeed mortality are becoming more prevalent among all adolescent population groups, and are especially high among African American girls (10). Adolescent Iranian girls are particularly at high risk of assuming an inactive lifestyle because of cultural limitations, such as restrictions regarding exercising in public. In particular, more research is needed to identify the correlates of physical activity among girls, so it is essential to design an educational intervention for increased physical activity among them. According to problems in the field there is a need to adopt ways to increase physical activity in girls (9). In a variety of studies the researchers emphasized on the physical activity intervention in females and adolescents (11, 12). Physical activity education interventions in schools have the potential to reach a majority of adolescents (13). Therefore, development of effective interventions is needed, to promote activity in adolescents. Moreover, the school is a good place to implement interventions related to physical activity, because students spend the majority of their time in the school environment and also schools possess the necessary facilities and equipment to promote physical activity (14). Schools are one of the most important places for the promotion of physical activity among youth (15). Theory-based physical activity intervention studies in schools have been conducted and evaluated in a number of countries, including the US (16) and Africa (17). These experimental programs have led to promotion in PA knowledge, positive attitudes towards PA, self-efficacy for preventive high risk behaviors, intention to do preventive skills and greater communication with parents on PA issues. The interventions are usually guided by well-founded behavioral change models, such as the Preventive Health Model and Health Belief Model, or they are tailored for specific cultural or demographic characteristics (18). In this paper, we build a case for Theory of Planned Behavior (TPB). Relevance in the design of physical activity (PA) interventions. Physical activity was used in other studies from the TPB theory in the field of educational experiments (20). The effectiveness of applying TPB theory in promoting healthy behavior is emphasized in a studies by Chatzisarantis (19) and Kothe. Implementing educational interventions in schools is necessary based on an appropriate educational theory and one potentially useful theory is the TPB theory. Model-based interventions are used to guide health programs (18) According to the TPB, people's intention to exhibit specific behavior is affected or predicted by three determinants, namely attitude, subjective norm, and perceived behavioral control. However, in the current study, some potential distal variables i.e. parental supervision, which might influence PA behavior, have also been taken into consideration (21). It is believed that parents play a key role in the creation of knowledge and positive attitude toward their children's PA. Also in the study, the important role of parents in the control of children, especially in relation to high-risk behavior and sexual relationships has been shown (22). The current research investigated effects of perceived parental control on the TPB. An educational experiment based on theory of planned behavior in adolescents' physical activity has also been done in Iran. Therefore, the present study was conducted to determine the effectiveness theory based educational intervention on the physical activity of adolescent girls in schools.

## **2. Material and Methods**

### **2.1. Trial design and participants**

This study was a randomized control trial that was conducted from September 5, 2015 to July 25, 2016. This control trial was conducted in an Iranian governmental secondary-school in Tehran. Five hundred and seventy-eight girls were included in the study. The subjects were assigned randomly to two groups (n=289 per group experiment and control).

### **2.2. Selection criteria**

The inclusion criteria for participation in this study were: 1) adolescent girls in the 12-16 age range, 2) living in Tehran, 3) confirmed satisfaction with participating in the study. The exclusion criteria were 1) being absent for more than one session, 2) failing to participate in the post-test.

### **2.3. Intervention**

In this control trial, 578 (n=289 per group, experiment and control) female students in the 12-16 years age range participated. Training programs were conducted on the experiment group (including educational sessions and an educational booklet). Educational intervention was based on the theory of planned behavior. Thus, the participants were divided into groups of 5 to 10. Contents of the meetings were in the form of lecture, role play, slides, and educational pamphlets given to the participants who were allowed to hold group discussions. They were also provided with complementary media training. During the sessions, topics in the booklet were discussed and feedback was solicited from the students. Also, students in the control group had their conventional training programs in schools. Overall, the training program was held by a researcher in 2 parts for 45 minutes (90 min) with a 15-minute break. The control group did not receive any additional education or experiment material. A booklet was developed on a middle-school reading level, adapted for adolescents aged 12-16. Additionally, the content booklet using simple language, was approved by the school before its distribution to the experiment group (9). In conclusion, participants in both groups were compared in terms of the various structure theories, six month after intervention.

### **2.4. Outcomes**

Participants in both groups were compared in terms of mean scores of knowledge, attitude, subjective norms, perceived behavioral control, perceived parental control, behavioral intention and behavior six months after intervention.

### **2.5. Sample size**

The sample size was calculated to be 578 subjects. The main outcomes in the present study related to the scores of knowledge and behavior. The sample size was calculated on the basis of knowledge since it produced the maximum sample size. In this study, to have a power of 90% with a 10% attrition rate between experiment and control groups, the standard deviation for the scores of knowledge was considered to be between 22.9 and 25.2 according to previous studies (23). Therefore, 285 samples were needed for each group. Finally, considering that the design effect was 2 and rate of loss to follow-up 10%, 289 students were included in each group.

### **2.6. Randomization**

In this control trial, three regions of 22 districts in Tehran were first selected using proportional stratified random sampling. In each district, 4 schools were randomly selected using probability proportional-to-size sampling. Next, in each school, 3 classes were randomly selected. In each class, 16 subjects were randomly recruited. Randomization was based on the block permuted stratified cluster randomization method. The unit of randomization was each classroom (clusters). Randomization was performed separately in each district and all the classes of the schools were allocated randomly to the experiment and control groups. The block size was 4 or 2 and 10. Figure 1 demonstrates the process by which the potential participants were enrolled and placed in the groups.

### **2.7. Measures**

A self-administered questionnaire in relation to various issues of physical activity was developed using the direct measures of the TPB. A structured anonymous questionnaire was used as the main data collection instrument. Some parts of this instrument were founded on the questionnaire developed by the World Health Organization (WHO) (24). Another part of the instrument was developed on the basis of the literature review and a qualitative study which included 8 focus group discussions (FGDs) with 40 participants. Each FGD lasted 1 hour. A detailed

description of the development instrument can be found in a study by Darabi et al. (25); however, a brief description is offered below. The questionnaire was structured in 3 parts:

**2.7.1. The following socio-economic characteristics were evaluated:** age, economic situation, area Location, father's education, mother's education, mother's job, and father's job.

**2.7.2. Knowledge section:** A questionnaire with 10 items was used to measure the participants' knowledge about physical activity. The Cronbach's alpha coefficient was 0.86. Each item was scored using 3 categories, namely "True," "False," and "I do not know," and score of 0-100.

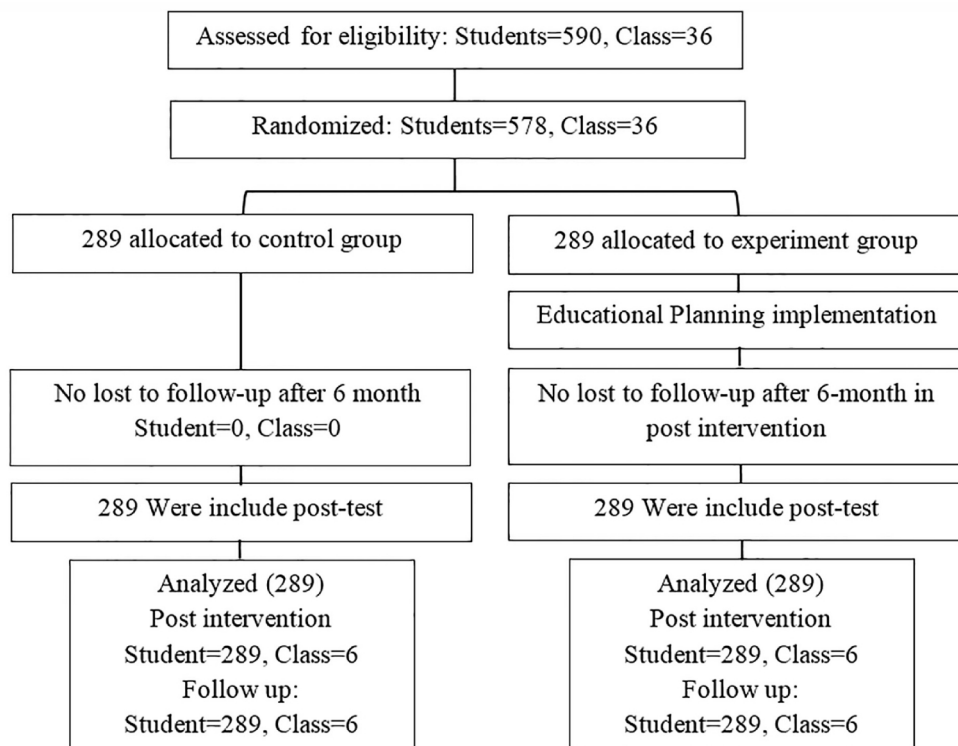
**2.7.3. Modified TPB section:** The participants completed a 45-item section. This section measured 6 constructs of the TPB model, attitude (5 items), perceived behavioral control (16 items), perceived parental control (2 items), behavioral intention (9 items), behavior (3 items), and subjective norm. The scores for each item ranged from 1 ("strongly disagree") to 5 ("strongly agree") and a score of 0-100. Negative items were reversely coded prior to computing the mean scale scores. To complete the questionnaires section, 30 minutes of pre-post experiment time was required. The questionnaires were completed after explanation of the purpose of the study, and voluntary consent. All the questions were transformed to the scale of 0 to 100 by the following formula (score of the question minus the minimum possible score of the question) divided by (the range of possible score of the question). The score of the dimensions was obtained from the average of the questions scored on those dimensions (so the dimensions' score would also, be a value from 0 to 100). To assess the validity of the scale, face, content and construct validities were assessed. To assess the reliability of the scale, the internal consistency and stability of the scale were measured. In the qualitative face validity, participants stated that they had no problems in reading and understanding the items. The numeric value of CVR is determined by the Lawshe table. The mean of content validity ratio (CVR) was 0.65. To obtain CVI for relevancy, simplicity and clarity of each item, ordinal scale with four possible responses was used. The responses include a rating from 1= not relevant, not simple and not clear to 4= very relevant, very simple and very clear. The number of those judging the item as relevant or clear (rating 3 or 4) was divided by the number of content experts. Also, the mean of the content validity index (CVI) was 0.78. Exploratory factor analysis (EFA) was used to evaluate construct validity. Bartlett's test and KMO illustrated that the data were appropriate for factor analysis (KMO=0.83,  $P<0.001$ ). Principal component analysis with varimax rotation identified six factors with eigenvalues greater than 1 and factor loading equal to or greater than 0.4, accounting for 67% of variance observed. CFA results confirmed the exploratory six factor construct (Attitude, subjective norm, perceived behavioral control, perceived parental control, behavioral intention and behavior). To determine the reliability of the instrument, the internal consistency was tested using the Cronbach's alpha coefficient. Cronbach's  $\alpha$  coefficient of 0.7 or above was considered satisfactory. Cronbach's alpha coefficient showed an excellent internal consistency 0.92 and ranged from 0.96 to 0.97 for different domains. ICC was computed for evaluating scale stability. A sub-sample of students ( $n = 45$ ) completed the questionnaire twice with a 2-week interval in order to examine the stability of the scale by calculating Intra-class Correlation Coefficient (ICC) where the ICC of 0.4 or above was considered acceptable. We compared the test-retest scores for each construct using Pearson correlation test. ICC values higher than 0.40 were considered as satisfactory. The test-retest of the scale with a 2-week interval indicated an appropriate stability of the scale (ICC =0.82).

## **2.8. Statistical methods**

Data were analyzed using the IBM© SPSS© Statistics version 23 (IBM© Corp., Armonk, NY, USA). To have a comparable measure, the scores of the TBP constructs (1 to 5) were converted to scores from 0 to 100. In order to consider the correlation of measurements in the clusters, multilevel analysis was used. To obtain the proper score of the analysis, the Likelihood Ratio (LR) test was employed. The comparison of the baseline values between the two groups was performed by a two-level multilevel analysis. To evaluate the changes in each group, a three-level multilevel analysis was conducted. In order to compare the changes in the scores of the dimensions between the two groups, the interaction between the groups and time in a multilevel analysis was examined. In the end, another multilevel analysis was carried out to compare the groups. P-value less than 0.05 were considered statistically significant.

## **2.9. Research ethics**

The proposal for this thesis research was presented to the Ethics Committee of Tehran University of Medical Sciences after its scientific approval by the Health Education and Health Promotion Department. The Ethics Committee approved the study with the number 29226; on April 25, 2015, and the enrollment of patients began on September 5, 2015, and continued to July 29, 2016. For ethical reasons, the participants in this study were informed of the nature and objective of the study. Participants gave written consent in their native language (Persian) before the study. Furthermore, confidentiality was assured on all participants' information.



**Figure 1.** The trial flow chart

### 3. Results

In this control trial, 578 adolescent girls aged from 12-16 years participated. The adolescents were separately and randomly allocated to the experiment group or control group. There were no losses of participants during the study, and all of the participants were analyzed. Figure 1 shows the trial flow chart. Table 1 presents the demographic characteristics of the participants. As specified in Table 1, and the two groups (experiment and control) showed no significant difference in demographic variables.

**Table 1.** Baseline characteristics of experiment and control groups

Variables		Group			p-value
		Total	Experiment	Control	
Age	Mean ± SD	14.1 ± 1.0	14.0 ± 1.0	14.2 ± 0.9	0.473
Economic situation; n (%)	Very good	35 (6.1)	12 (4.2)	23 (8.0)	0.442
	Good	242 (41.9)	114 (39.4)	128 (44.3)	
	Average	254 (43.9)	131 (45.3)	123 (42.6)	
	Weak	47 (8.1)	32 (11.1)	15 (5.2)	
Area Location; n (%)	2	196 (33.9)	98 (33.9)	98 (33.9)	0.591
	4	143 (24.7)	95 (32.9)	48 (16.6)	
	10	239 (41.3)	96 (33.2)	143 (49.5)	
Father's education; n (%)	<6	57 (9.9)	34 (11.8)	23 (8.1)	0.291
	6-12	366 (63.8)	191 (66.1)	175 (61.4)	
	>12	151 (26.3)	64 (22.1)	87 (30.5)	
Mother's education; n (%)	<6	72 (12.5)	35 (12.1)	37 (12.9)	0.427
	6-12	379 (65.8)	204 (70.6)	175 (61.0)	
	>12	125 (21.7)	50 (17.3)	75 (26.1)	
Father's job; n (%)	Working	544 (94.1)	275 (95.2)	269 (93.1)	0.297
	Unemployed	34 (5.9)	14 (4.8)	20 (6.9)	
Mother's job; n (%)	Working	153 (26.5)	74 (25.6)	79 (27.3)	0.637
	Housewife	425 (73.5)	215 (74.4)	210 (72.7)	

The total mean age of students was  $14.1 \pm 1$  in the experiment group and  $14.2 \pm 0.9$  in the control group. Based on the results, Table 2 shows no significant difference between the two groups in terms of the girls' knowledge and each of the different aspects of TPB theory in the baseline. The changes in outcome vary across time for two groups. However, in each of the different aspects of TPB theory following six months after the educational intervention, the mean score of students in the experiment group was significantly more than in the control group (Table 2).

**Table 2.** Group differences in knowledge and the theory of planned behavior constructs at baseline and 6-month follow-up

Variable			Group		Diff	95% CI		p-value
			Experiment	Control		Lower	Upper	
Knowledge	Pre	49±20.5	49±20.5	49±20.5	0.0	-3.4	3.4	1†
	Post	68.5±24.5	84.1±13.6	52.9±23.1	31.2	28.1	34.3	<0.001§
	Change	19.5±28.3	35.1±23.9	3.9±23.5	31.2	35.0	27.3	
	P-within‡	-	0.000	0.005	-	-	-	
Attitude	Pre	15.1±13.5	6.9±7.6	23.4±13.1	-16.6	-18.3	-14.8	1†
	Post	31.2±13.6	31.2±13.6	31.2±13.6	0.0	-2.2	2.2	<0.001§
	Change	16±19	24.3±15.6	7.8±18.6	16.6	13.8	19.4	
	P-within‡	-	0.000	0.000	-	-	-	
Subjective norm	Pre	14.3±13.4	6±7.8	22.5±12.8	-16.5	-18.3	-14.8	1†
	Post	40.4±11.1	40.4±11.1	40.4±11.1	0.0	-1.8	1.8	<0.001§
	Change	26.1±17.2	34.4±13.5	17.8±16.5	16.5	14.1	19.0	
	P-within‡	-	0.000	0.000	-	-	-	
Behavioral Intention	Pre	15.3±12.7	6.6±6.6	24.1±11.2	-17.5	-19.0	-16.0	1†
	Post	34.3±14.7	34.3±14.7	34.3±14.7	0.0	-2.4	2.4	<0.001§
	Change	18.9±19.4	27.7±16.1	10.2±18.5	17.5	14.7	20.4	
	P-within‡	-	0.000	0.000	-	-	-	
Perceived Behavioral control	Pre	14.5±12.1	5.9±5.3	23.2±10.8	-17.2	-18.6	-15.8	0.982†
	Post	38.4±11.5	38.4±11.6	38.4±11.5	0.0	-1.9	1.9	<0.001§
	Change	23.9±16.8	32.5±12.7	15.2±16.1	17.2	14.8	19.6	
	P-within‡	-	0.000	0.000	-	-	-	
Perceived parental control	Pre	13.9±15.8	5.4±9.8	22.4±16	-17.0	-19.2	-14.9	0.026†
	Post	44.2±14	42.9±14.2	45.5±13.7	-2.6	-4.9	-0.3	<0.001§
	Change	30.4±21	37.6±16.8	23.1±22.3	14.4	11.2	17.7	
	P-within‡	-	0.000	0.000	-	-	-	
Behavioral	Pre	15.9±15.4	7.3±9.8	24.5±15.2	-17.2	-19.3	-15.1	0.968†
	Post	42.5±17.1	42.6±17.1	42.5±17.2	0.1	-2.7	2.9	<0.001§
	Change	26.6±23.1	35.2±19.8	18±22.9	17.2	13.7	20.7	
	P-within‡	-	0.000	0.000	-	-	-	

† Based on two level model; ‡ P-value for change based on three level model; § Comparison of the changes between two groups, based on interaction analysis in a multilevel analysis.

There were significant interaction effects between groups and time for TPB structure and knowledge, indicating that the groups differed across time. Moreover, adjusted for the baseline values, the mean of the scores of the knowledge ( $84.1 \pm 13.6$ ), attitude ( $31.2 \pm 13.6$ ), subjective norm ( $40.4 \pm 11.1$ ), behavioral intention ( $34.3 \pm 14.7$ ), perceived behavioral control ( $38.4 \pm 11.6$ ), perceived parental control ( $42.9 \pm 14.2$ ), and behavioral ( $42.6 \pm 17.1$ ) was significantly higher in the experiment group compared with the control group. The model analysis indicated that the improvement in attitude, perceived behavioral control, perceived parental control, behavioral intention, behavior, and subjective norm were significantly greater in the experiment group than in the control group ( $p < 0.001$ ), based on the interaction between the groups and time (in a multilevel analysis). According to the multivariate analysis of variance (MANOVA), the constructs of the TPB model, exhibited a greater improvement in the experiment group, compared to the control group ( $p < 0.001$  for all constructs).

#### 4. Discussion

The present study was conducted with the aim to determine the effects of an educational experiment based-TPB to promote activity among adolescent female students. Because students spend most of their waking hours in school,

the school setting is the best place for physical activity program implementation in adolescents. According to recent studies, it has been shown that in promoting physical activity, increasing physical activity during school is effective while the results in settings outside of school were less clear. The results revealed significant changes in attitudes, subjective norms, perceived behavioral control, perceived parental control, behavioral intention and behavior in this experimental group compared to the control group after experiment. The continuity of such an educational intervention can help to increase behavioral intention and behavior. In the current study, the total score of the experiment group in all constructs of the questionnaire was significantly higher than that of the control group. These results are consistent with similar studies (1, 26). In the present study, physical activity performance rates have increased from 7.3 to 42.6 in the intervention group, after the educational intervention. The effect of educational intervention on improvement of physical activity performance showed that regular PA may reduce frailty, especially in individuals at higher risk of disability (27). Taghdisi et al. (28) showed that educational intervention can promote fruit & vegetable consumption among the students. The school environment is a suitable place for the formation of appropriate PA skills for students. Therefore, it is necessary to design and implement programs in schools for students in order for PA improvement and promotion to take place. Attitude towards an important issue such as PA can be imagined in terms of perceived sensitivity. Creating a positive attitude is among the methods used in educational intervention to motivate a behavior. Sometimes, due to lack of necessary training, there may be a reduction to the extent of attitudes that reduce susceptibility to health threatened subjects. Therefore, is necessary to use educational interventions and rely on fundamental change of attitude in people with effective methods, provided there is motivation for healthy changes. In the present study, group discussion and workshops sessions were held to create positive attitude towards PA performance. Using group discussion methods, which stimulate people's minds, broaden their mental skills, and engage them in active participation in learning, can create positive attitude towards PA in secondary-high school students. The results of our study indicated a statistically significant difference between the intervention group's attitude scores before and after the educational intervention, which was in agreement with the findings of other studies, including Sallis' (29) study on predictors of adoption and maintenance of physical activity in a community sample. In contrast, in a study of Lubans et al. (30), there were no significant differences between the two groups after training. Therefore, it is recommended to emphasize improving attitude towards the behavior in educational interventions to increase PA performance in students. The subjective norms are related to the perception of social pressures on an individual to perform a task. Subjective norms are regulating the standards, either accepted or rejected by people. In this study, the subjective norms have been investigated from parents, teachers/advisors, and friends/classmates. A significant increase in subjective norm was indicated among the two groups after educational intervention. In the present study, it is likely that presence of students' parents, teacher/advisors, and friends/classmates enhance subjective norms associated with PA. Naturally, peer pressure is high among students who spend more time away in schools.. Numerous studies have been performed to increase subjective norms towards behavior using TPB such as the study by Hosseini (31). In this study, subjective norms significantly increased after 2 months following the intervention compared to before the study. Therefore, educational intervention should consider subjective norms as an important factor in health behavior changes and improvement. In this study, the mean score of perceived behavioral control in the experiment group had significant increase compared to the control group ( $P < 0.001$ ). This finding is consistent with the study of Barati et al. (32). The perceived behavioral control refers to one's voluntary control over doing - or not doing a task. Even when one's attitude and subjective norms are strong but have no voluntary control over the behavior, he or she may not perform that behavior. In fact, the perceived behavioral control indicates one's perceptions on the existence of advantages and opportunities. Also, based on literature, it was shown that people with high self-control are more likely to be influenced by PA performance (20). This can indicate that belief in control of a behavior could lead to a better performance in an individual. The results of this study showed that the mean score of behavioral intention in the experiment group significantly increased compared to the control group. That emphasized the effectiveness of the intervention implementation. Other studies, such as Bhatti et al. (33), also showed similar results, that behavioral intention significantly improved in the experiment group. This result is in line with Barati et al., (32) and Sohrabi et al. (34). In the TPB theory, the behavioral intention is regarded as the most important behavior predictor. Intentions are motivational factors that affect behavior and indicate the intensity of individuals' motivation and attempts to perform a task (20). The stronger the behavioral intention is, the more probable it is to perform a behavior. In fact, intention is required for behavior but is not sufficient. Educational intervention could positively affect the students' behavioral intention for health promotion. Also, based on the findings of this study, parents can play a major role in promotion. Parents usually influence their children's PA through care and control. The findings in the present study demonstrated that there was a significant difference between the two groups. The score of perceived parental control had a steeper upward trend in the experiment group, consistent with the findings of Borawski et al. (35). According to study results, families have accorded higher value to the education of their children in relation to PA (including;

motivate, the discovery of adolescents' talents in a particular exercise field) among children. Also, in this study, the mean scores of the control group increased in all studied constructs, but their increase in the experiment group was small. Since there are some kinds of physical activity-related training in high schools in Iran, it was not unexpected to see such an improvement in the control group. Furthermore, the questions in the pre-test phase aroused curiosity about these items among students in the long term. In various studies (36, 37), there are also significant changes in the control group. In the current study, one cannot rule out the possible role of the large sample size in determining the statistical significance of changes in the control group. The present study demonstrated that the school-based PA skills education could be a promising program for enhancing adolescents' PA. This model could be scaled up to national level for improving adolescent PA. In addition, this study has the potential to contribute to the development and implementation of programs at national level and in countries with similar situations. Therefore, these results can be generalized only to adolescent girls residing in urban areas of Tehran. Also, this study was not inclusive of other high school students such as males. Despite these limitations, the present study had several important strengths, including; the use of a standard questionnaire for gathering data, the use of face-to-face education, and use of a booklet and a pamphlet to minimize attrition.

### **5. Conclusions**

The findings showed that TPB-based educational intervention played a key role in improving the students' PA. The results of this study could be used by the Department of Education, adolescent health units, adolescent consultation centers, and schools.

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### **Conflict of Interest:**

There is no conflict of interest to be declared.

### **Authors' contributions:**

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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