



## Application of PRECEDE model in education of nutrition and physical activities in obesity and overweight female high school students



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### ABSTRACT

**Background and objective:** Adolescence obesity and overweight is one of the most common health problems in Iran. This study aimed to determine the effect of education based on precede model in education of nutrition and physical activities in obesity and overweight female high school students of Fasa city, Fars Province, Iran in 2017–2018.

**Materials and methods:** This research is a quasi-experimental study performed on 200 overweight and obese high school female students who were randomly assigned to two groups of control and experimental. The data collecting tool was the precede model based and physical activity and nutrition performances questionnaire that was completed before and 3 months after the education. Educational intervention was performed in 10 educational sessions 50–55 min for the experimental group. Finally data was collected and analyzed by SPSS22 and by using Chi-square test, independent *t*-test and paired *t*-test and the meaningful level was considered 0.05.

**Results:** Before educational intervention there was no significant differences in experimental and control groups in knowledge, attitude, self-efficacy, enabling factors, reinforcing factors, physical and nutrition performances. However, 3 months after educational intervention, experimental group indicated significant enhancement in each of the mentioned factors, compared to the control group. Before educational intervention there was no significant differences in weight and BMI of the subjects of experimental and control groups, however, 3 months after intervention, significant differences were seen in experimental group, indicating the effect of educational intervention on weight and BMI of students, while control group had no changes.

**Conclusion:** The findings of this study revealed that design and performance of educational programs based on precede model has influence on the changes of predisposing factors (knowledge, attitude, self-efficacy), reinforcing and enabling factors of overweight students, comparing to the physical and nutrition performance of these students and caused the reduction of their weight.

### 1. Introduction

Obesity is a chronic disease and its side-effects involve most of body systems. The common factor of all obese people is the extra enhancement of fat deposits in body (Nasrzade, 2003). This problem has relationship with the changes of lifestyles and nutrition of people and gaining high amount of calories and overeating (Vahidinia and Sardarian, 2005). Previously, weight gain and obesity were only limited to adults, however, in the last two decades, it involved children and teenagers, too (Kelishadi, 2005). Hence, in two recent decades, the amount of obesity in children has become more than two times and the number of overweight teenagers has become 3 times further (Hassinks,

2006). According to the record of American Heart Association, one out of third American children and teenagers are fat and overweight. Hence it is estimated that in future Americans will encounter a generation who are in lower level of health and life expectancy than their parents (AHA, 2012). For example, a 13 years old fat teenager is 50% in exposure of obesity and an 18 years old fat teenager is 80% in exposure of obesity in future (Rezaei et al., 1393). Studies revealed that, in developing countries, shortness in childhood is an important factor for becoming overweight in adulthood and its possible mechanisms include low acidity of fat and its deposit in body, damaging food receipt settings and sensibility to a fatty diet (Rezazadeh et al., 1388). According to the World Health Organization, due to today's lifestyles and the reduction

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of physical activities, the composition of body tissue has been changed and this issue causes obesity and overweight of people (Pařízková, 2014). Obesity affects life quality and disability of people, therefore, it can have negative and indirect influences on society (Vafaei najar et al., 2015). Obesity is a dangerous factor in body resistance to insulin, high blood pressure, atherosclerosis, cancers and gallbladder diseases (Klyshady et al., 1382). If the weight of an individual is 20% more than the ideal weight, we call it obesity. In children, obesity is determined based on age, height and sex. Other concerns about obesity in childhood are its relationship with other health problems, continuity of obesity in youth, hospital costs and etc. (Seyed Amini et al., 1388). The most common method for evaluating obesity, overweight and slimming in teenagers is their BMI (Body Mass Index) which is calculated by dividing weight in kg by the square of height in meters (Mostafavi et al., 1384). Formation and changing of behavior in childhood and adolescence is easier than adulthood (Warschburger et al., 2013; Molero-Conejo et al., 2003). Continuous and regular contact with teenagers in learning environments and schools can play an important and efficient role in their health promotion (Story et al., 2006). Educations in which their purpose is preventing dangerous and unhealthy behaviors in initial years of life should emphasize on healthy lifestyles, because unhealthy lifestyle is the reason of lots of diseases and disorders (McKee et al., 2010). Healthy lifestyle is a way of living which causes security and promotion of health and prosperity of individuals. Having healthy lifestyle and healthy behaviors with the aim of preventing diseases, promoting life quality, increasing life expectancy and improving physical and mental health should start from fetal age (Eshaghi et al., 2011). In adolescence, foodstuffs should be available for quick growth of teenagers. This period of life is the time of changing attitudes, forming personality, independence and acceptance in society and its effect on nutrition is somehow possible. Irregular nutrition pattern, losing meals, especially breakfast, eating fatty snacks and fast foods are some of the nutrition behaviors of children who are under the influence of environments, friends and social-economic factors (Hoseinipourabdollahi, 1998). On the other hand, due to the physiologic changes in puberty and menstruation, girls are highly in exposure of anemia, iron deficiency and malnutrition and because today's girls are the mothers of future generation, educating them about nutrition is highly demanded. It is important to talk about some concepts such as general health and children health because most of the efforts of health officials are about the health of children (Rasanen et al., 2002). Most of the lifestyles and behaviors, such as regular exercising, start in this era, however, unfortunately nowadays the amount of physical activity continuously reduces in this period (Salahshoori et al., 2013). Numerous studies revealed that, as a health promotion behavior, physical activity in female students is insufficient (Piri et al., 2015). In spite of numerous advantages of physical activities, studies indicate the prevalence of inactivity among children and teenagers (Tamimi and Norozi, 2016). Investigations revealed that, more than 80% of Iranian people are physically inactive (Salahshoori et al., 2013). Although the advantages and positive effects of regular exercising on health promotion and general health are widely known, some educational interventions should be designed for promoting and retaining healthy behaviors in people (Yashio et al., 2006). Physical activity is a complicated behavior and changing and retaining this behavior is not easy. Therefore, using models or theories for changing physical activity behaviors is demanded (Noroozi et al., 2011). In order to promote nutrition and physical activities of female high school students, investigating factors related to their behaviors is necessary. So, employing models for investigating behaviors is recommended and one of the most useable and appropriate models in this field is the precede model. The constructs of this model are the predisposing factors (individual and social characteristics motivating people for taking healthy behaviors), reinforcing factors (material and spiritual rewards causing the continuity of healthy behaviors) and enabling factors (environmental factors facilitating healthy behaviors or any skills in individuals) (Jeihooni

et al., 2017). In economic and environmental determination and evaluation, predisposing factors are factors which are prior to the changing behavior and they provide motivation for changing behaviors (such as knowledge, attitudes, behaviors and values). Enabling factors are the preparations of behavioral or environmental changing realizing an attitude or environmental politics (such as the availability of sources, protocols and skills). Reinforcing factors are factors that follow behavior and provide continuous rewards for saving a particular behavior (such as families, teachers, managers and health officials) (Jeihooni et al., 2017). Studies of Nannah I Tak et al. (2008), Wind M et al. (Wind et al., 2006) and Glorian Sorensen et al. (2007) showed that, after educational intervention, the amount of consuming fruits and vegetables in students had significant enhancement. Charles Dabone et al. (Daboné et al., 2013) used precede model for consuming healthy foods in students. Other studies about nutrition behaviors based on precede model are the studies of Yue Weisun et al. (Fontaine and Cheskin, 1997), Cuy Castellanos et al. (2013) and Cole et al. (Cole and Horace, 2009). Shakerinejad et al. (2017) investigated the effect of educational intervention based on the theory of planned behavior for promoting physical activities of female high school students. His results showed significant differences in average scores of attitude, subjective norms, perceived behavioral control and intention in experimental and control groups after educational intervention and after educational intervention, the amount of physical activity of experimental group enhanced significantly. Khani Jeihooni et al. (Khani Jeihooni et al., 2017a) investigated the efficiency of education based on precede model on using fruits and vegetables in female students. Also, in his study, after educational intervention, the average score of predisposing factors, reinforcing factors and enabling factors of experimental group significantly enhanced, while there observed no changes in control group.

According to the mentioned constructs and the importance of nutrition and exercising behaviors in teenagers, especially in obese and overweight female high school students, present study aims to determine the efficiency of precede model on education of nutrition and physical activities of obese and overweight female high school students in Fasa city.

## 2. Methods and materials

Present research is a quasi-experimental study performed on 200 female high school students in Fasa city, Fars Province, Iran 2017–2018. 4 schools out of 22 female high schools with similar economic and social conditions were selected randomly in cluster sampling and subjects were randomly divided into two groups of experimental and control (100 subjects for experimental and 100 subjects for control groups). The studied subjects were students who were, based on BMI, in range of obese (higher than 95th percentile of rise chart) or overweight (85–95th percentile of rise chart). Based on the study of Amirzadeh et al. (Amirzadeh et al., 2016) and by using the average variable comparison formula, the sample volume was calculated 70 subjects. Finally, the 100 samples were allocated in each group. For determining BMI of students, their weight was calculated based on Kilogram by the squared of their height in meters (Fontaine and Cheskin, 1997). According to the health case of students, those with BMI higher than 85th percentile were selected for this investigation. For more confidence, the weight and height of students measured once more and their BMI was calculated. The inclusion criteria included having BMI higher than 85th percentile, not having disease related to obesity based on the diagnosis of specialist (health ID of student) and student's obesity and overweight should not be due to a particular disease. The exclusion criteria were lack of interest for participating in study and being absent in more than 2 sessions of educational program.

The tool used for gathering data was a questionnaire provided based on other studies (Shakerinejad et al., 2017; Khani Jeihooni et al., 2017a; Amirzadeh et al., 2016; Jafarzadeh et al., 2017; Peyman et al., 2013; Ebadi fard Azar et al., 2005; Mohammadi Zeidi et al., 2013)

including demographic information (age of student, educational level of father and mother of students, job status of parents, household income and family size). According to the precede model, 20 items were about the knowledge in multiple choice questions in which the correct answer had the score of 1 and the incorrect answer had zero score ranging from 0 to 20. 12 items were about attitude in five-point Likert scale from “completely disagree” to “completely agree” and the minimum score was 12 and the maximum score was 60. 15 questions were about self-efficacy in five-point Likert scale from “completely disagree” to “completely agree” and the minimum score was 15 and the maximum score was 75. Also, 15 questions were about enabling factors in five-point Likert scale from “completely disagree” to “completely agree” and the minimum score was 15 and the maximum score was 75 and 15 items were about reinforcing factors in five-point Likert scale from “completely disagree” to “completely agree” with minimum score of 15 and maximum score of 75.

A questionnaire was also used for examining the physical activity which included 20 items asking about the time and type of exercising in each day and the performance of subjects were scored from 0 to 20. Also, a questionnaire for examining nutrition performance of subjects included 20 items investigating type and amount of nutrition of individual in last week and the minimum score was zero and maximum score was 20. The activities of subjects were recorded based on their activities through self-reporting answers. To evaluate the validity of the questionnaire items, the item effect size higher than 0.15 and content validity ratio (CVR) above 0.79 were considered and based on the exploratory factor analysis. In order to determine the face validity of tools, the arranged items were proposed by 30 female high school students with similar demographic economic and social conditions with studied subjects. In order to determine the content validity, ideas of 12 specialists (out of research team) in health education and promotion field ( $N = 10$ ), nutritionist ( $N = 1$ ) and vital statistics specialist ( $N = 1$ ) were employed. Based on Lawshe's table, items with CVR value higher than 0.56 for 12 people was considered acceptable and retained for subsequent analysis. The calculated values were higher than 0.70 for most of the items. The total consistency of tools with the calculation of Cronbach's alpha was 0.87, knowledge was 0.82, attitude was 0.86, self-efficacy was 0.89, reinforcing factors was 0.86 and enabling factors was 0.87.

For measuring the weight of subjects, Beurer digital scales (made in Germany) with the accuracy of 0.1 Kg was used. For calculating BMI, the weight of subjects was measured with light cloths without shoes. For measuring the height of students, height gauge with the accuracy of 0.5 cm in standing mode without shoes with coupled foot and knees, hips, shoulder, back and head on straight direction and height gauge coincidence on head was used.

After selecting the subjects of control and experimental groups, the purpose of this research was explained to students, their parents, teachers and school officials. Questionnaire was filled out by two groups and their height and weight were measured.

According to the pre-test results, the educational contents were provided based on precede model. The educational intervention for experimental group included 10 educational sessions for 50–55 min by giving presentations, asking and answering questions, group discussions, using educational posters, pamphlets, films and PowerPoints held in high school salon twice a week. In these sessions, the effects and dangers of obesity and overweight, the importance of preventing chronicle diseases, food groups and encouragement for having proper diet were discussed. Also, each student was asked to explain her previous experiences about nutrition and physical activities and some behaviors that should be substituted, such as walking instead of using transportation, were mentioned. Also, healthy nutrition was explained by a nutritionist. In these sessions, the role and advantages of physical activities and modifying exercises were explained to the subjects. One session was held with the presence of parents and school officials as the effective subjective norms and families were asked to support the

modification of nutrition and exercising of students. With the coordination of feeding unit and education department, some observations were made on schools buffets and selling junk foods, such as chips, were prohibited. By using verbal encouragement and creating an exciting atmosphere, the self-efficacy of students about nutrition and exercising enhanced. For encouraging students to do exercises, rope and slimming loop were given to them.

At the end of educational sessions, an educational booklet was given to subjects. Students were divided into two groups of friends and helper with 15–20 members. A Whatsapp group was provided for following the activities of subjects and students were asked to record their nutrition and physical activities in determined forms. One and two months after educational intervention, two follow-up sessions were held. 3 months after educational intervention, both of experimental and control groups filled a questionnaire and again, their weight and height were measured. At the end of investigation, one educational session was held for control group and an educational booklet was given to them. For moral considerations, in addition to the permission of moral committee of Fasa University of Medical Science and explaining students and their parents and their consent, the aims, importance and demands of performing this research were explained to them and subjects were insured that their information would remain confidential. Obtained data were analyzed by SPSS 22 software through Chi-square test, independent *t*-test and paired *t*-test and the meaningful level was considered 0.05.

### 3. Results

In present research, 200 obese and overweight female high school students were investigated. The average age of experimental group was  $16.45 \pm 0.89$  years and the average age of control group was  $16.28 \pm 0.92$  years ( $p = 0.244$ ) and the average family size of experimental group was  $4.14 \pm 1.09$  and the average family size of control group was  $4.35 \pm 1.02$  ( $p = 0.185$ ). Based on independent *t*-test, there observed no significant differences in the ages of both groups ( $p = 0.244$ ). Table 1 indicates that there were no significant differences in demographic variables including educational level of father ( $p = 0.212$ ), the educational level of mother ( $p = 0.175$ ), father's job ( $p = 0.314$ ), mother's job ( $p = 0.294$ ) and household income in Toman ( $p = 0.384$ ) in both of the experimental and control groups.

Obtained results revealed that, before educational intervention there was no significant differences in experimental and control groups in knowledge, attitude, self-efficacy, enabling factors, reinforcing factors, physical and nutrition performances. However, 3 months after educational intervention, experimental group indicated significant enhancement in each of the mentioned factors, compared to the control group (Table 2).

Results of Table 3 showed that, before educational intervention there was no significant differences in weight and BMI of the subjects of experimental and control groups, however, 3 months after intervention, significant differences were seen in experimental group, indicating the effect of educational intervention on weight and BMI of students, while control group had no changes.

### 4. Discussion

Design and performance of proper pattern for controlling and managing weight of teenagers and youths depend on accurate awareness of issue and the analysis of condition through the viewpoints of community, otherwise, the designed interventions cannot be in accordance with real evidences and they have less chance for being successful. Therefore, in this research, for better understanding of issues related to obesity and overweight of female high school students, precede model was employed. By using this model, researchers can decide on demanded intervention (Airhihenbuwa, 2010). Results of present study indicate the efficiency of intervention based on precede model on

**Table 1**  
Demographic information of studied female students in experimental and control groups.

variables	Experimental group N = 100		Control group N = 100		P-value
Educational level of father	number		number		0.212
	illiterate	1	0	0	
	elementary	16	18	18	
	guidance school	24	28	28	
	high school	34	39	39	
Educational level of mother	number		number		0.175
	illiterate	2	1	1	
	elementary	18	15	15	
	Guidance school	27	31	31	
	High school	36	40	40	
Father's job	number		number		0.314
	Employee	21	18	18	
	worker	19	26	26	
	self-employment	45	42	42	
Mother's job	number		number		0.294
	Employed	14	22	22	
Household income in Tomans	number		number		0.384
	Less than 1 million Tomans	24	21	21	
	1-2 million Tomans	51	48	48	
	More than 2 million Tomans	25	31	31	

**Table 2**  
Comparison of average scores of knowledge, attitude, self-efficacy, enabling factors, reinforcing factors, physical and nutrition performances of students in experimental and control groups before and 3 months after educational intervention.

variables	group	Before intervention M±SD	3 months after intervention M±SD	P-value
knowledge	experimental	7.14 ± 3.15	16.14 ± 3.20	0.001
	control	7.27 ± 3.09	7.95 ± 3.12	0.119
	P-value	0.241	0.001	
attitude	experimental	25.14 ± 4.18	50.77 ± 4.38	0.001
	control	26.36 ± 4.08	27.14 ± 4.18	0.294
	P-value	0.128	0.001	
Self-efficacy	experimental	34.25 ± 4.98	65.12 ± 4.44	0.001
	control	35.19 ± 4.86	36.08 ± 4.92	0.205
	P-value	0.170	0.001	
Enabling factors	experimental	33.26 ± 4.25	60.18 ± 4.92	0.001
	control	34.71 ± 4.02	35.22 ± 4.24	0.173
	P-value	0.184	0.001	
Reinforcing factors	experimental	35.19 ± 4.26	63.14 ± 4.15	0.001
	control	34.84 ± 4.47	35.37 ± 4.50	0.224
	P-value	0.207	0.001	
Physical Activity performance	experimental	9.14 ± 2.36	16.55 ± 2.87	0.001
	control	9.37 ± 2.29	9.98 ± 2.37	0.182
	P-value	0.214	0.001	
Nutrition performance	experimental	8.09 ± 2.14	16.64 ± 2.24	0.001
	control	8.32 ± 2.25	8.96 ± 2.31	0.299
	P-value	0.118	0.001	

**Table 3**  
Comparison of changes of weight and BMI between experimental and control groups.

variables	group	Before intervention	3 months after intervention	P-value
BMI	experimental	29.02 ± 3.41	28.03 ± 3.29	0.039
	control	28.97 ± 3.45	29.07 ± 3.46	0.214
	P-value	0.124	0.042	
weight	experimental	76.08 ± 10.55	73.88 ± 10.58	0.038
	control	74.98 ± 10.98	75.12 ± 11.04	0.199
	P-value	0.108	0.045	

nutrition and physical activities of obese and overweight female students. Also, results revealed that, 3 months after educational intervention, the average score of subjects' knowledge had significant

enhancement in experimental group, while control group had no changes. Holding educational sessions for students, presenting educational contents through presenting films, small group discussions for exchanging information and giving educational booklet for experimental group caused the enhancement of their knowledge. Peyman et al. (2013) investigated the effect of educational intervention on promotion of nutrition behaviors of obese and overweight girls aging from 12 to 16 years. He performed educational intervention for experimental group in 4 educational sessions. After educational intervention, the average score of knowledge of experimental group enhanced, while control group had no changes. In study of Hosseini et al. (2014) educational intervention based on precede model caused the increase of subjects' knowledge. Results of other studies are in a good agreement with the results of this research (Kashfi et al., 2014; Shakouri et al., 2009; Diane et al., 2012; Kipping et al., 2010; May et al., 2010; Horne et al., 2009). After educational intervention, significant enhancement was observed in average score of attitude in experimental group, indicating the effect of precede model on the increase of positive attitude of subjects. In precede model, predisposing factors, such as attitude, have influence on behavior (Chiang et al., 2003; Hazavehei et al., 2008). In this research, positive attitude caused facilitation of taking nutrition and exercising behaviors. Khani Jaihooni et al. (Khani Jaihooni et al., 2017a) investigated the effect of educational intervention based on precede model on fruit and vegetable consumption of female high school students. After intervention, subjects' attitude enhanced. Shakeri Nejad et al. (Shakerinejad et al., 2017) investigated the effect of educational intervention based on the theory of planned behavior on promotion of physical activity of female high school students and after intervention, the average score of subjects' attitude increased. Also, their physical activity improved. Results of other studies are in a good agreement with the results of this investigation (Daboné et al., 2013; Shakerinejad et al., 2017; Peyman et al., 2013; Parrott et al., 2008; Quinn et al., 2008). In study of Dunn et al. (2011), attitude was one of the determining factors of fast food consumption and in study of Nejad et al. (2005), attitude was the strongest predictor of intention for nutrition behaviors and in study of Maghtaei et al. (Ma et al., 2016), there was a significant relationship between attitude and food consumption in subjects' aging from 12 to 18 years.

The results of this research indicated the increase of average score of self-efficacy in experimental group 3 months after educational intervention, while control group had no significant changes. Albert Bandura et al. (Rezaei et al., 1393) believed that, the main and important pre-condition of changing behavior, especially health

behaviors, is self-efficacy. Not only does self-efficacy directly affect human behavior, but also indirectly affects other variables such as ideas, aims, expectations, emotional tendencies and understanding barriers and chances in social environment (Bandura, 1995).

In this research, by encouraging and exciting students through development and gaining success in action and filling diet and exercising forms, the ability of students enhanced. Amirzadeh et al. (2016) studied the efficiency of self-efficacy in nutrition and controlling weight in obese and overweight female students. In his study, educational intervention caused the increase of self-efficacy of experimental group and the availability of foodstuffs. Navidian et al. (Navidian et al., 1391) revealed that, the average score of self-efficacy in controlling eating in some conditions such as food availability, social pressure and positive excitements in obese people was significantly less than control group. Hoy et al. (2005) revealed that, the score of self-efficacy related to overweighting at the beginning of losing weight program was at its lowest level and by processing treatment, its level increased gradually. The study of Janathan Van et al. (Van T R. et al., 2013) indicated that, profit-driven and time-driven framing in nutrition attitudes cannot cause the changing of subjects' attitude, but this issue becomes effective along with self-efficacy, in this way that, for people with high self-efficacy, profit-driven messages with greater influence cause the creation of stronger attitude and tendency to have healthy nutrition than harmful messages. Stark et al. (2011) showed that, online and continuous education can cause the increase of self-efficacy, knowledge and nutrition skills of people for preventing obesity in childhood. Results of other similar studies are in a good agreement with this research (Ebadi fard Azar et al., 2005; Mohammadi Zeidi et al., 2013; Elliott et al., 2006; Perrin et al., 2005; Hejazi et al., 2017; MacNeil et al., 2012; Jae Soon, 2005; Lotfi Mainbolagh et al., 2012).

In present research, for following subjects' activities, exchanging information and increasing their self-efficacy in nutrition and exercising performances, a Whatsapp group was provided and subjects could easily exchange their point of views and gain information. In other studies, other novel technologies such as telephone, internet and SMS were used for increasing self-efficacy and performance of subjects. Some of these studies are the study of Abdi et al. (2016), Militello et al. (2015), Chow et al. (2015), Partridge et al. (2015) and Dallinga et al. (2015).

Results revealed that, 3 months after educational intervention, there observed significant differences between experimental and control groups in reinforcing factors, indicating the effect of using precede model on the enhancement of reinforcing factors. Holding educational sessions for teachers, officials of schools and health centers and parents as the subjective norms (reinforcing factors) and social supporters and also presenting educational contents in groups of friends and helper and Whatsapp group caused the increase of the score of reinforcing factors in experimental group. Social pressures from peer groups in schools can have positive or negative effects on choosing and continuing patterns and healthy lifestyles. By considering on group discussion and patterning from students with appropriate weight, this research could promote this fundamental aspect. Wright et al. (2013) studied 251 children with BMI higher than 85% aging from 8 to 12 years in elementary schools of America and revealed that, girls perform less physical activities than boys. In his study, the supportive role of nurses along with parents and teachers was used for losing weight and increasing physical activities and appropriate nutrition. In study of Peyman et al. (2013) for reducing the weight of students, mothers, fathers, peers and teachers had the most and least influence on them, respectively Patrick and Nicklas (2005) highlighted the effect of families and social supports on nutrition pattern of children. Results of Khani Jeihooni et al. (Khani Jeihooni et al., 2017a) showed the effect of educational intervention based on precede model on the enhancement of reinforcing factors score after intervention in experimental group. Results of other studies are in a good agreement with this research (Peyman et al., 2013; Jeihooni and Moradi, 2018; Khani Jeihooni and Rakhshani, 2018; Kashfi et al., 2012; Limbera et al., 2008; Sutherland

et al., 2004). According to the obtained results, with the participation of students' parents in group discussions and helper group or educational programs or private consultations, their supports increased.

Results of this research indicate significant differences in experimental and control groups after educational intervention in enabling factors. Providing educational booklet for students, availability of health officials, follow-up contacts after educational sessions, Whatsapp group for exchanging information, presenting contents by asking and answering questions, educational films and images and availability of educational sources in internet caused the augmentation of students' ability for taking nutrition and exercising behaviors. Results of this study are in a good agreement with the results of Hazavehei et al. (2011), Cuy Castellanos et al. (2013), Reyman et al. (Peyman et al., 2013), Hosseini et al. (2014) and Khani Jeihooni et al. (Khani Jeihooni et al., 2017b).

Present research showed that, 3 months after educational intervention, the average score of nutrition and exercising performance of experimental group had significant enhancement while control group had no changes. The increase of performance score in experimental group indicated the effect of education, attitude, self-efficacy, supportive factors and enabling factors on promotion of nutrition and exercising behaviors. In this investigation, by using educational sessions, giving educational booklet, educating nutrition by a nutritionist, modifying nutrition and exercising behaviors and engaging supporters such as families, teachers and school and health center officials, significant enhancement was observed in nutrition and exercising behaviors of experimental group. Jafarzade et al. (Jafarzadeh et al., 2017) investigated the effect of health promotion program with collaborative approach on physical activity of 80 overweight female high school students in 6–8 educational sessions for 1 h. He concluded that, after educational intervention experimental group had better performance than control group in physical activities and their weight reduced.

Knopfli et al. (2008) investigated obese and overweight girls and boys. His educational program was for 8 weeks including physical activities and diet. He revealed that, educational intervention caused the increase of physical activity, life quality, physical readiness and losing weight of subjects. In studies of Schwimmer et al. (2003) and Quinn et al. (2008), educational intervention caused the promotion of physical activity and life quality of obese and overweight people. In study of Hosseini et al. (2014) educational intervention based on precede model caused the increase of physical activity and diet of subjects. In qualitative study of Walsh et al. (2014), he used precede model for managing the weight of people aging from 18 to 24 years who had insufficient consumption of fruits and vegetables. In his study, exercising, proper diet and managing stress were essential factors for losing weight. In study of Grammatikaki et al. (Manios et al., 2012), educational intervention based on precede-proceed model caused the increase of the performance of pre-school children in prevention from obesity. In studies of Fesharki et al. (Fesharaki et al., 2009) and Khelj and Mohammadi (Khalaj and Mohammadi Zaidi, 2006), educational intervention caused the enhancement of average score of nutrition performance of subjects. Results of other similar studies are in a good agreement with this research (Peyman et al., 2013; Mohammadi Zeidi et al., 2013; Jae Soon, 2005; Michael et al., 2009; Amaro et al., 2006; Sabet-Sarvestani et al., 2006; James et al., 2004; Kain et al., 2004; McMurray et al., 2002; Veugelers and Fitzgerald, 2005; Lea et al., 2006).

Results of present research showed that, after intervention, by increasing average scores of precede model constructs in experimental group and the improvement of their nutrition and exercising performances, significant differences in weight and BMI of experimental group were seen and their weight and BMI reduced, while control group had no significant changes. Amirzade et al. (Amirzadeh et al., 2016) investigated 154 overweight and obese female high school students aging from 15 to 17 years and his educational intervention caused the reduction of weight and BMI of experimental group. Cheng et al. (2005)

investigated the effect of diet education on Taiwanese overweight children and 6 months after educational intervention, significant reduction in BMI and significant enhancement in their healthy nutrition were observed.

Foster et al. (2008) educated physical activities and nutrition for students and indicated 50% reduction of weight in experimental group. Woo et al. (2004) showed that, educational program for nutrition and exercising caused the reduction of weight of children aging from 9 to 12 years. In study of Salinero-fort et al. (Salinero-Fort et al., 2011) educational intervention based on precede model did not cause significant changes in BMI of diabetic patients.

Some of the limitations of this study were these issues that this research was conducted only on female students and there is a need for another research for comparing sexual differences in nutrition and exercising performances. Also, gathering data was through self-reporting. The other limitations were lack of basic information about weight and type of diet and physical activities of female high school students in Fasa city. Characteristics, mental and physical issues and genetic and physiologic differences have influence on weight of people which was out of the control of authors.

## 5. Conclusion

The results of this research revealed that, design and performance of educational programs based on precede model has influence on the changes of predisposing factors (knowledge, attitude, self-efficacy), reinforcing and enabling factors of overweight students, comparing to the physical and nutrition performance of these students and caused the reduction of their weight. According to the importance of physical activity for following proper diet and controlling weight and its role as a health message transmitter and propagating healthy behaviors in family and society, especial attention should be considered on the performance of educational programs. According to the vulnerability and important role of girls as future mothers, some actions such as promoting culture, changing attitudes, increasing knowledge of families, presenting educational programs via radio, TV and internet can have great effect on changing their lifestyles. Based on precede model, the important role of supportive factors such as families, friends and school officials should be considered and also educational contents should be available for students.

## Conflicts of interest

All authors have no conflict of interest.

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