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Research Article

Effect of Educational Intervention Based on Self-efficacy Theory and Self-regulatory Strategies on Physical Activity of Prehypertensive Individuals

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Abstract

Background: Considering the importance of healthy lifestyle education in the prevention and control of hypertension and the timely identification of pre-hypertensive individuals, the present study was conducted to determine the effect of educational intervention based on self-efficacy theory and self-regulatory strategies on the physical activity of pre-hypertensive individuals.

Methods: This quasi-experimental study was performed on 90 people aged 30 to 59 referred to urban health centers in Nehbandan in 2021. They were randomly selected and divided into two groups of 50 (intervention and control). Data were collected by questionnaires on demographic information, hypertension knowledge, self-efficacy of physical activity, and physical activity by the self-administered method. After the pretest, the intervention group received six training sessions in four weeks. The posttest was performed in two groups immediately and three months after the training sessions. Data were analyzed by repeated-measures analysis of variance, Bonferroni post hoc test, independent t-test, and chi-square test in SPSS version 21software.

Results: The mean age of the participants was 45.80 ± 8.31 in the control group and 44.95 ± 8.20 in the intervention group. Data analysis showed the equality of knowledge, self-efficacy, and physical activity between the two groups before the intervention ($P > 0.05$). After the intervention, a significant increase was observed in the mean scores of knowledge, self-efficacy, and physical activity in the intervention group immediately and three months after the intervention ($P<0.05$). Also, the levels of knowledge, self-efficacy, and physical activity were significantly lower in the control group than in the intervention group ($P<0.001$).

Conclusions: The present study showed the effectiveness of an educational intervention based on self-efficacy theory and self-regulatory strategies on physical activity of pre-hypertensive individuals. Therefore, this theory is proposed to design educational interventions to promote regular physical activity.

Keywords: Educational Intervention; Physical Activity; Prehypertension; Self-efficacy; Self-regulation

1. Background

Hypertension accounts for 6% of adult mortality and is the third leading cause of death globally, and is considered a growing health problem worldwide (1). This disease is easily identifiable and usually controllable. When left untreated, it often causes fatal complications such as myocardial infarction, cerebrovascular accidents, heart failure, visual impairment, kidney failure, and premature death (2). Hypertension has a very high prevalence worldwide. About 73 million adults in the United States have the disease (3, 4). There are also many statistics on the prevalence of hypertension in Iran. In a meta-analysis performed by Oori, the prevalence of hypertension was reported to be 25% (5). In this study, the prevalence of hypertension was 25% in women and 24% in men, which was not a statistically significant difference (5). In another study conducted by Kazemi et al. on adults in Birjand, the prevalence of hypertension was reported to be 20.1% (6).

The JNC 7 Report on Diagnosis, Evaluation and Treatment of Hypertension in 2003 presented the latest classification for hypertension and introduced a new classification called prehypertension. It has been emphasized that even small amounts above normal blood pressure increase the risk of cardiovascular disease. The risk of cardiovascular disease doubles with each increase of 20.10 mmHg from a blood pressure of 115.75 mmHg (7). Khosravi et al. reported a prehypertension prevalence of 33.6% in Shahroud. Also, the prevalence of prehypertension was 37.2% in men and 30.9% in women (8).

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Therefore, the prevention of blood pressure and its control in the normal range, and the prevention of hypertension in healthy people from reaching the prehypertensive stage, are significant public health goals (9). One of the most critical steps in controlling blood pressure is to increase people's motivation in the community, which can be achieved by raising their awareness of the importance of timely diagnosis and follow-up treatment of high blood pressure (7).

According to researchers, the treatment of prehypertension and preventing it from entering the hypertension stage is possible with physical activity and healthy nutrition education (components of a healthy lifestyle) (10). Brundtland, meanwhile, found it necessary to have at least 30 minutes of daily physical activity to reduce the significant health risks associated with misbehavior (11). Preliminary findings from the World Health Organization research suggest that a sedentary lifestyle is one of the top 10 causes of death globally. Data from this organization's research shows that between 60 and 85% of adults in different countries do not have enough mobility to improve their health. A sedentary lifestyle increases all the major causes of death and doubles the risk of cardiovascular disease, diabetes, and obesity (11).

Also, a study by Mohebi al. showed that inadequate mobility is widespread in Iran. Its prevalence in society was 54.7%, and a significant difference was observed between men and women (men 45.3% and women 61.9%). Another finding of this study was a 33.6% prevalence of at least four hours of continuous sitting in the participants (12). In another study conducted on adolescents in three provinces of Fars, Kurdistan, and Markazi, the prevalence of inactivity was 25.8% (13).

Therefore, due to the chronic nature of prehypertension and the need to increase the patient's ability, it is necessary to design and implement educational programs to control risk factors, prevent recurrence and exacerbation of its symptoms and complications in patients, and promote their health (14). Research has shown that the most effective educational programs are based on theory-based approaches rooted in behavior change patterns (15). One of the theories of behavior change is the theory of self-efficacy, which is based on the assumption that people's belief about their abilities and talents has positive effects on their actions and is one of the most important determinants of behavior (16). Self-efficacy affects behavior choice and behavior change. Therefore, it plays a vital role in formulating effective interventions and educational programs (17). A study conducted by Peyman et al. used this theory on the physical activity of women after childbirth and showed increased mean scores of self-efficacy and physical activity after using this theory (18).

In addition to the perception of self-efficacy, self-regulation is also essential in the process of self-management of chronic diseases (19, 20). Concerning hypertension, the findings of the decision-making process for blood pressure self-regulation by the patient are rare, while the control of blood pressure also requires a certain degree of self-regulation (21). Self-regulation includes regular control of blood pressure and performing activities affecting blood pressure control, such as physical activity (22). Several studies have shown that self-regulation is a significant predictor of physical activity (18, 23). Self-regulatory strategies are an essential part of sports interventions (24), and their importance in promoting physical activity has been confirmed in various studies (24, 25). Umstattd suggests that self-regulatory strategies are essential for promoting physical activity. Understanding self-regulatory factors and using them are essential for designing and implementing physical activity interventions (26).

2. Objectives

Considering the importance of healthy lifestyle education in the prevention and control of hypertension, the timely identification of pre-hypertensive people, and the lack of studies on prehypertension, it is necessary to conduct a study based on the theory of self-efficacy. Therefore, this study was designed to determine the effect of an educational intervention based on self-efficacy theory and self-regulatory strategies on the physical activity of prehypertensive individuals.

3. Methods

This randomized controlled field trial was performed on 90 people aged 30 to 59 years with prehypertension in Nehbandan who were eligible to participate in the study in 2020 - 2021. For this purpose, both attached and non-attached urban health centers were included in the study. One center was considered the intervention group, and one center the control group. The participants aged 30 to 59 years were then listed at each extraction base, and their blood pressure was measured. The blood pressure of the participants in the prehypertensive range by practical definition was recorded. Then, the intervention and control groups were formed with these individuals on both bases by simple random sampling method.

Based on the study by Babaei et al. in which the physical activity scoreswere 10.35 ± 3.02 and 8.67 ± 3.67 in the intervention and control groups, respectively, and considering the error of 0.05 and power of 0.8, the sample size, considering the dropout in each group, was calculated to be 50 (27).

Inclusion criteria included the following: Prehypertension, willingness to cooperate in the study, informed consent, age of 30 to 59 years (middle-aged), at least primary education, no physical diseases such as cardiovascular disease, neuromuscular disease, and diabetes, no mental diseases preventing from participating in courses, not taking any medication affecting blood pressure and arteries and heart functioning (at least one year before the study), not using smoke or alcohol (at least one year before the study), and no pregnancy. Exclusion criteria included unwillingness to continue attending meetings,

absence from more than one session, illnesses preventing attending sessions, and participant death.

Blood pressure of the studied participants was measured according to the method used in the study of Khosravi et al. (8), with a Rasa mercury sphygmomanometer and a stethoscope (TebAbzar) in a sitting position after five minutes of rest with the person's right arm completely bare and the palm facing up on the table at the heart level. The pressure was measured twice, five minutes apart, by standard methods. If the difference in systolic pressure in the two stages was 10 mm Hg or more, the measurement was repeated for the third time. The mean systolic and diastolic pressures were calculated. If the mean of the two systolic blood pressure measurements, performed five minutes apart, was greater than or equal to 120 to 139 mmHg or the mean of diastolic blood pressure was greater than or equal to 80 to 89 mmHg (between 120/80 and 139/89), the person was diagnosed as prehypertensive (7).

Data collection tools were a Demographic Information Questionnaire, Blood Pressure Awareness Questionnaire, Physical Activity Self-Efficacy Questionnaire, and International Physical Activity Questionnaire. The Demographic Information Questionnaire included 14 questions on age, gender, education level, spouses' education level, monthly income, employment status, spouses' employment status, height, weight, body mass index, disease, drug status, and alcohol and smoking status. The Hypertension Awareness Questionnaire included 30 questions on individuals' awareness of hypertension, its symptoms, and complications. A correct answer was given two points, the answer I do not know was given one point, and a wrong answer was given zero points. In the end, each person's score was calculated from0 to 60 points. This questionnaire was designed by Ramezankhani et al. in 2016, and its Cronbach's alpha coefficient was 70% (28). In the present study, the reliability was evaluated using Cronbach's alpha, and its value was 0.95.

Self-efficacy was measured by the Iranian version of the Exercise Self-Efficacy Scale (ESES). This questionnaire consists of 18 questions. Each question is scored from 0 to 10, and each person's score is obtained by summing the scores of all questions. Each person's score ranges from 0 to 180, and higher scores indicate higher self-efficacy (18). In the present study, the reliability of this questionnaire was assessed using Cronbach's alpha, and its value was 0.98. The validity and reliability of this questionnaire were also calculated by Noroozi et al., who reported a 0.92 Cronbach's alpha coefficient for its internal stability and a 0.88 validity ratio (29). According to Abdollahi and Peyman, its reliability was 0.91 (18).

The International Physical Activity Questionnaire (IPAQ) was used to determine physical activity. This questionnaire has seven questions measuring physical activity intensity as severe, moderate, or mild and physical activity duration as hours and minutes per day over the past week. Using the metabolic equivalent of task (MET) index, the amount of energy consumed was determined according to activity intensity. The MET is a unit used to estimate energy expenditure in physical activity. To calculate the amount of total physical activity per week, the amount of energy consumed for walking and moderate and intense physical activities is added based on the minutes of physical activity per week, according to the scoring protocol of the questionnaire. Intense physical activity refers to activities that cause a person to breathe more intensely than normal, such as lifting heavy objects, digging gardens, aerobics, cycling, soccer, and running. Moderate physical activity refers to activities that require breathing a little faster than normal, such as carrying light loads, moderate cycling, or volleyball. Walking also includes walking at work, home, to get from one place to another, and any other type of walking done for fun, sports, exercise, or at leisure for at least 10 minutes continuously. According to this questionnaire, , if a person has not reported any activity or has performed activities that last less than 10 minutes are not considered (18). In the present study, the reliability of this questionnaire was assessed using Cronbach's alpha, and its value was 0.80. Also, the over-time reliability of this questionnaire was determined by re-testing in the study of Seyed-Emami et al. for measuring the physical activity of female liaisons in Tehran (0.74) (30).

Before measuring blood pressure and completing the questionnaires, the participants were given the necessary explanations about the research process, and their written informed consent was obtained. Participants were also reassured about the procedure of the meetings. Being free to leave the study at any time was another ethical consideration. The researcher did the training in six sessions of 90 min according to Table 1. Data were collected and analyzed with SPSS version 19 software. Central and dispersion indicators were used to describe quantitative variables, and frequency tables and appropriate graphs to describe qualitative variables. First, the normality of data distribution was checked by the Kolmogorov-Smirnov test for data analysis. The repeated-measures and Bonferroni post hoc tests were used to measure the changes of normally distributed variables over time, and the Friedman test and Wilcoxon test with Bonferroni correction were employed for variables with the abnormal distribution. The independent t-test and Mann-Whitney test were also used to compare the studied groups. The marginal model analysis method with the generalized estimation equation (GEE) approach was used to study the trend of changes over time and control for the confounding variables that were not homogeneous in the groups. In addition, $P < 0.05$ was considered the significance level for all hypotheses.

Table 1. Details of Training Program Designed for Intervention Group Participants

Session	Topic	Training Method	Self-efficacy Promotion Strategies
First session	Introduction and acquaintance of people with each other, the importance of hypertension and diagnosing and controlling prehypertension, the importance of physical activity in preventing prehypertension, expressing the situation of people in physical activity based on pretest questionnaire scores, and identifying perceived barriers to physical activity	Lecture, question and answer, group discussion	Raising awareness and self-awareness of individuals and self-monitoring
Second session	Determining long-term goals and short-term goals and reviewing various strategies to achieve the goals	Group discussion, question, and answer, class practice, homework	Target selection
Third session	Determining precisely the activities to achieve the goals, starting with simple tasks and then moving on to more complex tasks with small steps	Question and answer, lecture, giving exercises, and homework	Regular planning and formulation of step-by-step and graded tasks to achieve the goals
Fourth session	Teaching the techniques and principles of some types of physical activity and walking as the most widely used exercise, teaching physical activities that could be done at home and work, and performing the steps of a complete physical activity program in practice	Lecture and role-playing	Awareness-raising, skills development through mastery and vicarious experiences, and modeling
Fifth session	Examining the tasks assocfated with goal setting and strategies to achieve the goals, and talking and focusing on self-monitoring, self-reward, self-punishment, and feedback	Practice, homework, and group discussion	Self-monitoring, feedback, and self-awareness
Sixth session	The role of social support in the continuation of physical activity, inviting influential and important people to attract social support, summarizing, questioning, and answering	Lecture and group discussion	Support and emotional support

4. Results

In the present study, 90 participants were studied, of whom 51 (56.7%) were females. The mean age was 45.80 ± 8.31 in the control group and 44.95 ± 8.20 in the intervention group. The mean BMI was 26.70 ± 2.37 in the control group and 26.06 ± 2.45 in the intervention group, which was statistically significant between the groups (P<0.05).

In both groups, women comprised the highest number of participants. Participants often had high school and high school diplomas and reported moderate incomes. Most participants had no history of drug, cigarette, or alcohol use. The results showed that the studied groups were not homogeneous in terms of job variables, alcohol consumption, and spouse occupation (P>0.05) but were homogeneous in terms of other variables (Table 2).

Table 2. Differences in Qualitative Variables between Study Groups

Variables	Control	Intervention	P-Value
Gender			0.83
Female	26 (57.8)	25 (55.6)	
Male	19 (42.2)	20 (44.4)	
Education level			0.81
Illiterate	9 (20.0)	12 (26.7)	
Elementary or middle school	12 (26.7)	12 (26.7)	
High school or diploma	14 (31.1)	14 (31.1)	
University	10 (22.2)	7 (15.5)	
Spouse's education level			0.27
Illiterate	3 (6.7)	4 (8.9)	
Elementary or middle school	6 (13.3)	13 (28.9)	
High school or diploma	20 (44.4)	17 (37.8)	
University	16 (35.6)	11 (24.4)	
Income			0.35

Very low	3 (6.7)	0 (0.0)	
Low	9 (20.0)	9 (20.0)	
Medium	26 (57.8)	27 (60.0)	
High	7 (15.5)	9 (20.0)	
Job			0.04*
Housewife	22 (48.9)	16 (35.6)	
Employee	8 (17.8)	19 (42.2)	
Self-employed	15 (33.3)	10 (22.2)	
Spouse's job			0.02*
Housewife	18 (40.0)	8 (17.8)	
Employee	15 (33.3)	27 (60.0)	
Self-employed	12 (26.7)	10 (22.2)	
Concurrent disease			1.00
No	25 (55.6)	25 (55.6)	
Yes	20 (44.4)	20 (44.4)	
History of drug use			0.82
No	29 (64.4)	28 (62.2)	
Yes	16 (35.6)	17 (37.8)	
History of alcohol use			0.006*
Yes	3 (6.7)	15 (33.3)	
No	42 (93.3)	30 (66.7)	
History of smoking			0.064
Yes	24 (53.3)	24 (53.3)	
No	21 (46.7)	21 (46.7)	

[a] Values are expressed as No. (%).

As can be seen in Figure 1, the mean scores of variables in the intervention group before the intervention were as follows: Blood pressure awareness 26.53 ± 1.19, self-efficacy 47.18 ± 31.50, and physical activity 547.09 ± 385.79; but, they significantly increased immediately after the intervention (44.80 ± 5.97, 118.90 ± 25.03, and 1042.00 ± 604.53, respectively) and three months after the intervention (44.33 ± 5.76, 120.62 ± 20.10, and 1161.36 ± 747.51, respectively) compared to before the intervention.

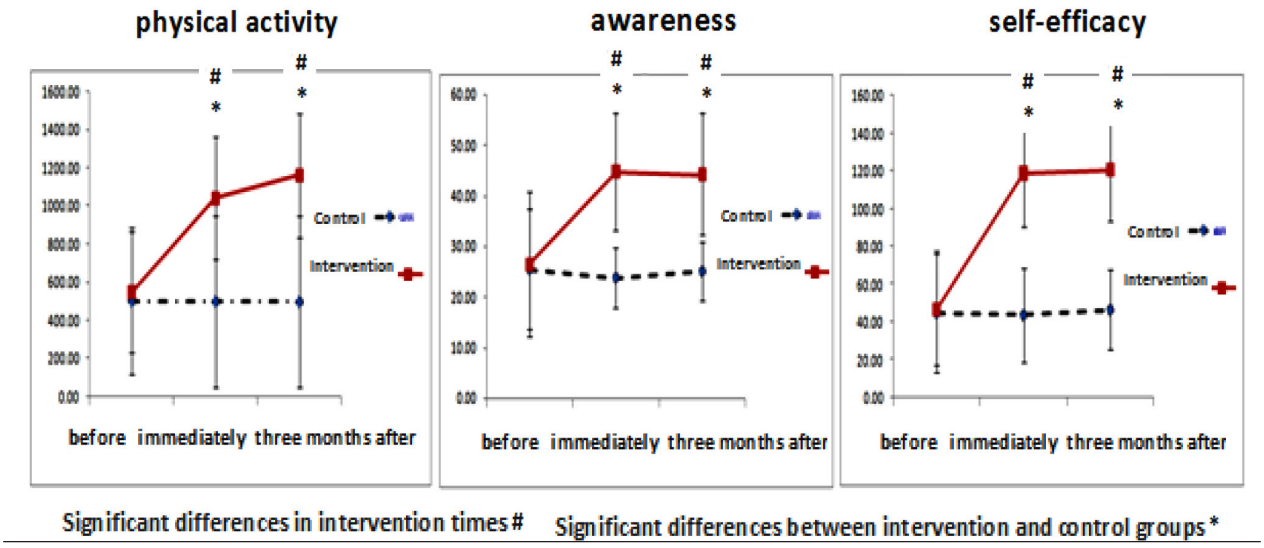

Figure 1. Mean scores of blood pressure awareness, self-efficacy, and physical activity in studied groups before, immediately, and three months after intervention

Table 3 shows that since job status, spouse occupation, and alcohol consumption were not homogeneous in the groups, the level of awareness, self-efficacy, and physical activity increased significantly over time after modifying for the effects of these variables (P < 0.001). Besides, awareness was significantly reduced in the control group compared to the intervention group by an average of 12.88 units (P < 0.001). Also, the average level of self-efficacy was 47 units lower in the control group than in the intervention group (P < 0.001), and the rate of physical activity was 354.27 units lower in the control group than in the intervention group (P < 0.001).

Table 3. Generalized Estimation Equation Test Results for Knowledge, Self-efficacy, and Physical Activity Scores

Dependent Variables	Independent Variable	Coefficients	Standard Error	Test Statistics	Significance Level
Awareness	Group	-12.88	1.98	42.15	P<0.001
	Time	4.34	0.81	28.60	P<0.001
Self efficacy	Group	-47.01	4.06	134.70	P<0.001
	Time	18.78	2.45	58.65	P<0.001
Physical activity	Group	-354.27	72.33	23.99	P<0.001
	Time	152.58	35.76	18.20	P<0.001

Modified variables: Occupation, spouse occupation, and alcohol consumption

5. Discussion

This study aimed to determine the effect of an educational intervention based on self-efficacy theory and self-regulatory strategies on the physical activity of 90 individuals with prehypertension.

The results showed that the blood pressure awareness score significantly increased in the intervention group immediately and three months after the intervention compared to before. The study of Ramezankhani et al. showed that after the educational intervention, the mean score of blood pressure awareness increased significantly in the intervention group (women aged 20 to 49 years) (28). In another study, Jalilian et al. performed educational interventions by lecturing on a group of patients with hypertension, which subsequently increased the scores of hypertension awareness (31). Also, the study of Kamran et al. showed that the knowledge scores of patients with hypertension increased significantly after the intervention (32). A study by Lu et al. aimed to examine community-based health education strategies in managing hypertensive patients with low socioeconomic status in Dongguan, China, which increased the hypertension knowledge score (33). The results of the above studies confirm the present study findings on increasing the level of knowledge and its positive effect on the physical activity of the intervention group. Bandura states that the awareness of threats and benefits of lifestyle-related habits is a prerequisite for behavior change, and if individuals lack the necessary knowledge, they will not have sufficient reasons to tolerate problems associated with previous behavior change (19).

In the present study, the self-efficacy score of patients with prehypertension in the intervention group significantly increased immediately and three months after the intervention compared to before the intervention. The results of the study by Baljani et al. showed that self-efficacy promotion interventions had a positive effect on the overall and subscale scores of self-efficacy (physical activity, healthy eating, and weight control) and systolic and diastolic blood pressure of cardiovascular patients was significantly different before and one year after the intervention (34). The study results of Solimanian et al. showed that the structure of self-efficacy had a direct effect on physical activity, and each unit increase in self-efficacy increased physical activity by 25% (35). The study results of Kaveh Savadkooh et al. showed that educational intervention had a positive effect on the overall self-efficacy scores of hypertensive patients (36). Another study by Sol et al. in the Netherlands showed that nursing interventions based on patient participation in treatment and self-efficacy moderated systolic blood pressure and blood lipids (37). In a meta-analysis of 36 intervention studies, the significant effect of interventions on self-efficacy (d = 0.16) and physical activity (d = 0.21) was observed, and there was a strong relationship between self-efficacy and physical activity (rs = 0.69) (38). Research in some subgroups of healthy and even sick populations has shown that people with higher self-efficacy are more likely to engage in physical activity, and interventions focusing on improving self-efficacy have been more successful in increasing physical activity (18).

The present study results showed that the physical activity score of patients with prehypertension significantly increased in the intervention group immediately and three months after the intervention compared to before the intervention. Similar to the present study, in the Hortz study, utilizing goal-setting and planning strategies to promote self-regulation and physical activity, the educational intervention significantly increased self-regulation and physical activity (39). The study of Bahrami Nejad et al. also showed that the mean blood pressure

and physical activity were significantly different after the educational intervention (40). In Babazadeh et al.'s (2015) study, the educational intervention improved the lifestyle, promoted physical activity, and reduced the mean blood pressure in patients with hypertension (27). Simces et al. also showed that timely lifestyle modifications such as healthy eating could reduce salt intake and increase physical activity (41). In a study by Stefani et al., a group of overweight hypertensive patients was trained to perform a long personal exercise program for up to a month without supervision. After this period, the impact of the intervention on some lifestyle parameters, including some daily activities and physical activity, was analyzed, showing significant differences (42). Multiple analysis of variance in Anshel and Kang's study was performed to determine the effectiveness of a 10-week intervention. In this study, motivational interviewing techniques were used on fitness and blood lipids, showing changes in physical activity and eating habits, and adherence to exercise; besides, there was a significant improvement in fitness and blood lipid profile after the intervention compared to before intervention (43).

However, contrary to the findings of the present study, in the study of Ahmadi Tabatabaei et al., utilizing an educational intervention based on the theory of planned behavior to promote physical activity, no significant difference was observed in the physical activity of the case group after the intervention compared to before the intervention (44). This may be due to differences in the theoretical basis used in the two studies and the limitations of the theory of planned behavior in changing complex behaviors such as physical activity or differences in the intervention method. Considering that non-interactive methods were used in education in Ahmadi Tabatabai et al.'s intervention, this may have reduced the effectiveness of the planned intervention. The methods used in the present study, including role-playing and group discussion, provided the possibility of deep understanding of information and stimulation and encouragement of the learners. These educational methods have many advantages in achieving educational goals because the learners are actively involved in the learning process (18).

Physical activity is one of the most effective methods of non-drug control of blood pressure, which has the advantages of low cost and non-drug interaction. In general, those who do not exercise have 4 mmHg systolic blood pressure and 1.2 mmHg diastolic blood pressure more than those who exercise (45).

Bandura also emphasizes that self-regulatory strategies, including goal setting and planning, are necessary to adopt and continue a physical activity (16). The present study's findings also indicated the positive effect of these strategies on promoting physical activity. Self-regulatory behaviors in hypertension disease are a fundamental and special need throughout life. Therefore, it is necessary to emphasize the severity and seriousness of unhealthy sedentary behavior and its possible consequences for the individual in educational programs, considering the above issues.

5.1. Conclusions

The present study's findings showed that replacing traditional training methods with educational interventions based on self-efficacy theory can be effective in improving awareness, promoting self-efficacy, and enhancing regular physical activity. This study provides practical solutions for designing and implementing training programs for employees working in health centers. Health managers can also use behavior change theories in creating and shaping healthy lifestyle-related behaviors for target groups in disease management planning.

5.2. Limitations

One of the limitations of this study is the small sample size, the study's statistical population, interpersonal differences between study units, and various factors that may have affected patients' learning and self-efficacy, which were beyond the researcher's control.

Ethical considerations:

After the approval of the dissertation by the Research Committee of Birjand University of Medical Sciences (IR.BUMS.REC.1400.456041) and approval of the ethical aspects of research, the researcher was introduced to the health centers, and research permission was obtained from those centers. All participants also participated in the sampling consciously and voluntarily and were assured of the confidentiality of the information, and it was stated that they could leave the sessions at any time.

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