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The Effect of an Educational Program Based on Health Belief Model on Preventing Osteoporosis in Women

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ABSTRACT

Background: Osteoporosis is the most common metabolic bone disease. The study's objective is to investigate the effect of an educational program based on Health Belief Model (HBM) on preventing osteoporosis in women.

Methods: In this quasi-experimental study, 120 patients (60 experimental and 60 control) who were registered under the health centers in Fasa City, Fars Province, Iran, were selected in 2014. A questionnaire consisting of demographic information, HBM constructs was used to measure nutrition and walking performance for the prevention of osteoporosis before, immediately after intervention, and 6 months later. Bone mineral density (BMD) was recorded at the lumbar spine and femur before and 6 months after intervention.

Results: The mean age of women participated in the study was 41.75 ± 5.4 years for the experimental group, and 41.77 ± 5.43 years for the control group. The mean body mass index was 22.44 ± 3.30 for the experimental group and 22.27 ± 3.05 for the control group. The average number of women deliveries for the experimental group was 2.57 ± 1.47 and 2.50 ± 1.19 for the control group. There is no significant difference between the two groups in education level ($P = 0.771$), marital status ($P = 0.880$), occupation ($P = 0.673$), breastfeeding ($P = 0.769$), smoking ($P = 0.315$), history of osteoporosis in the family ($P = 0.378$), history of special diseases ($P = 0.769$), and records of bone densitometry ($P = 0.543$). Immediately and 6 months after intervention, the experimental group showed a significant increase in the knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, internal cues to action, nutrition, and walking performance compared to the control group. Six months after intervention, the value of lumbar spine BMD T-score in the experimental group increased to 0.127, while in the control group it reduced to −0.043. The value of the hip BMD T-score in the intervention group increased to 0.125, but it decreased to −0.028 in the control group.

Conclusions: This study showed the effectiveness of knowledge, walking, and diet on bone mass by HBM. Hence, these models can act as a framework for designing and implementing educational interventions for the osteoporosis prevention.

Keywords: Health Belief Model, nutritional status, walking

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INTRODUCTION

Osteoporosis is a disease characterized by decreased bone density and or loss of bone microstructure, which can lead to an increased risk of fracture.[1]

Women are 8 times more at risk of osteoporosis than men[2] so that about 200 million women worldwide suffer from the disease.[3] Bone mass in women in all age groups is significantly less than that of men of the same age and race.[4] Peak bone mass is achieved by age 30 and then the bone mass gradually decreases with the increase in age.[5]

In a meta-analysis study in Iran, the overall prevalence of osteoporosis in lumbar spine was 0.17 and that of osteopenia was 0.35.[6] A study carried out in Fasa demonstrated that 34.1% of the women had osteoporosis.[7] The study by Mahboub *et al*., showed that 24.8% of the premenopausal females had osteopenia. There was a significant correlation between having osteoporosis and increasing age, fertility period, parity, menopausal duration, and the presence of comorbidity, especially hypertension, and diabetes mellitus.[8]*

The findings of different studies suggest that exercise and adequate intake of calcium and Vitamin D have a significant effect on reducing the rate of bone density loss and improving bone mineral density (BMD).[9]

Osteoporosis is preventable, and an important point in preventing the disease is to modify thinking, lifestyle, and daily habits in such a way that they improve the quality of life and efficiency of individuals.[10] Thus, teaching preventive behaviors such as physical activity and correct nutrition as a simple and efficient method can help us prevent the disease and promote and maintain our health. One of the most important World Health Organization (WHO) goals is to increase the number of women trained in the area of osteoporosis.[11]

In line with such a purpose, identifying factors affecting behavior change can make changes easier. Therefore, in order to investigate factors affecting the adoption of osteoporosis preventive behaviors among women, it is essential to use models that identify factors affecting behavior. Based on Health Belief Model (HBM), people change their behavior when they understand that the disease is serious. Otherwise, they might not turn to healthy behaviors.[12] The structures of the HBM include perceived severity, perceived susceptibility, perceived benefits, perceived barriers, modifying variables, cues to action, and self-efficacy.[12]

Perceived susceptibility was used to evaluate women's perception about the extent to which they are at risk of osteoporosis. Also, their perceived severity of osteoporosis complications was measured. The sum of these two factors is the women's perceived threat of the disease. The perceived benefits and barriers that refer the individual's analysis about the benefits of adopting preventive behaviors of osteoporosis such as diet and walking and about potential barriers to preventive behaviors of osteoporosis were investigated. These, alongside women's perceived ability to carry out preventive behaviors, their cues to action (the incentives that affect women within and outside the family such as friends, doctors, healthcare providers, media, and educational resources), their fear of osteoporosis complications, and their sense of inner peace as a result of seeking preventive behaviors are factors affecting women's decision to comply with preventive behaviors of osteoporosis.

Considering what said above, this study aims to measure HBM constructs regarding eating behaviors and physical activity on bone density in the prevention of osteoporosis among women.

METHODS

Study design and participants

The study was a quasi-experimental, prospective intervention research in 2014. The population of this study includes 120 women 30–50 years old covered by health centers of Fasa, Fars Province, Iran (60 intervention group and 60 control group).

Among the six Urban Health Centers of Fasa, two centers were randomly selected that a center for the experimental group and another center for the control group. Simple random sampling was used at health center based on the numbers of health records of the mothers covered by the centers. The subjects were then invited to a meeting in a health center. They were explained about the study and the related purposes and their written informed consents were obtained.

Inclusion criteria

Women 30–50 years old covered by Health Centers of Fasa, lack of rheumatoid disease and mental illness, lack of fractures, and consent to participate in the study.

Exclusion criteria

Women with disability, diseases, and problems (such women with genetic early osteoporosis) that prevented them from participating in the study were excluded.

Figure 1 presents the flowchart of study participants.

After selecting the experimental and control groups, the pretest questionnaire was administered to two groups. These people were present from the beginning to the end of the study. Women's education by researchers and

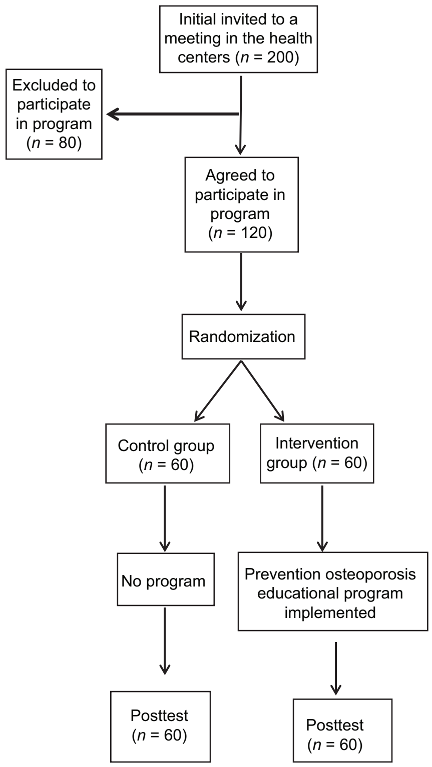

Figure 1: The study flowchart

five public health experts was done. Training sessions were held in the Hall Health Center. Participants did not know whether or not they are affected by osteoporosis.

Next, to measure bone density, the subjects were sent to Fasa bone densitometry center. After testing, the results were recorded. Bone density was measured by Hologic machine using dual energy X-ray absorptiometry method in L1 to L4 bones. The densitometry data including bone density in the lumbar spine and femoral neck was collected based on the WHO's T-score values.

The intervention for the experimental group included eight educational sessions of 55–60 min of speech, group discussion, questions and answers, as well as posters and educational pamphlets, film screenings, and PowerPoint displays. The details of the training sessions were as follows.

First session: Introduction to osteoporosis and its signs, complications, and diagnosis.

Second session: A 55-year-old woman who was diagnosed with osteoporosis and had a fracture was invited to show as a model and talk to the subjects about osteoporosis and its risk factors, symptoms, complications, and diagnosis with the help of a physician.

Third and fourth sessions: The role of nutrition in preventing osteoporosis, benefits, and barriers of diet, following dietary recommendations, self-efficacy in observing proper diet, and activities were recorded in specified forms.

Fifth and sixth sessions: The role of exercise, appropriate exercises, the role and importance of walking, benefits and barriers to walking, types of waking, self-efficacy in walking, and recording the duration of walking in specified forms were considered.

Seventh session: The session was held in the presence of at least one family member, and the role of family members in making, facilitating, and providing suitable food, walking program, and BMD testing was explained.

Eighth session: The previous sessions were reviewed, and the subjects were provided with educational pamphlets.

Immediately after intervention, both groups completed the questionnaire. To preserve and enhance the activity of the experimental group, weekly educational text messages about osteoporosis were sent to them, and they attended monthly training sessions so that the researchers can follow-up their activities. Six months later, the questionnaire was completed by both groups (experimental and control), and the subjects underwent BMD tests, and the results were recorded.

Procedures and variables assessment

The researchers of this study after study texts and also with observing the principles of design tools data were designed and developed tool. In a cross-sectional study, 401 women between 30 and 50 years old who were covered by Health Centers of Fasa, to design and evaluate the reliability and validity of data collection tools were studied.

The questionnaire used in this study was developed based on the HBM. The questionnaire includes the following parts:

The first part includes demographic questions, including age, body mass index (BMI), education level, marital status, occupation, times of delivery, breastfeeding, smoking, history of osteoporosis, history of osteoporosis in the family, history of a special disease (any disease other than osteoporosis, such as thyroid disease, diabetes, cancer, and immunodeficiency diseases), and history of BMD.

The second section includes questions on structures of the HBM.[12,13] Questions include: Twenty three questions on knowledge; 4 questions on perceived susceptibility (the women's opinion about chances of getting osteoporosis); 6 questions on perceived severity (about complications due to osteoporosis); 8 questions on perceived benefits (about the benefits of preventive behaviors of osteoporosis, such as physical activity and calcium intake); 7 questions on perceived barriers (including barriers to physical activity and consumption of calcium-rich foods), 4 questions on self-efficacy (including the ability to do exercises and observe proper diet); 1 question on external cues to action (resources including family and friends, doctors and health workers, mass media, books and magazines, internet and other patients with osteoporosis that encourage the subjects toward prevention behaviors of osteoporosis); and 3 questions on internal cues to action (including the fear of suffering from complications of osteoporosis and a sense of inner peace following preventive behaviors); all questions are based on the standard 5-point Likert scale ranging from strongly disagree to strongly agree (scores of 1–5). Scores of questions on external cues to action are calculated as cumulative frequency.

The third section consists of questions on nutritional performance and exercise, that is, walking. The performance questions consist of 10 questions about the type and amount of food consumed during the past week (score from 0 to 14). The exercise questions include 7 questions on the duration and type of walking (easy, moderate, and heavy) during the last week based on received guidelines (score from 0 to 21). The subjects' performance was assessed via self-report method.

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, they were classified into nine factors. To determine face validity, a list of the items was checked by 30 women of 30–50 with demographic, economic, social, and other characteristics similar to those of the targeted population. To determine the content validity, 12 specialists and professionals (outside the team) in the field of health education and health promotion ($n = 10$), orthopedic ($n = 1$), and biostatistics ($n = 1$) were consulted. Then, based on the Lawshe's table, items with higher CVR value (than 0.56 for 12 people) were considered acceptable and were retained for subsequent analysis. The calculated values in this study for the majority of items were higher than 0.70.

To determine reliability, a list of the items by 30 women of 30–50 with demographic, economic, social, and other characteristics similar to those of the targeted population in two consecutive 20-day periods was completed. The overall reliability of the instrument based on the Cronbach's alpha was 0.87. Cronbach's alpha was 0.86 for knowledge, 0.71 for perceived susceptibility, 0.82 for perceived severity, 0.79 for perceived benefits, 0.82 for perceived barriers, 0.79 for self-efficacy, and 0.77 for cues to action. Since the alpha values calculated for each of the structures studied in this research were higher than 0.7, the reliability level of the instrument was considered acceptable.

The conceptual framework of the proposed model is illustrated in Figure 2.

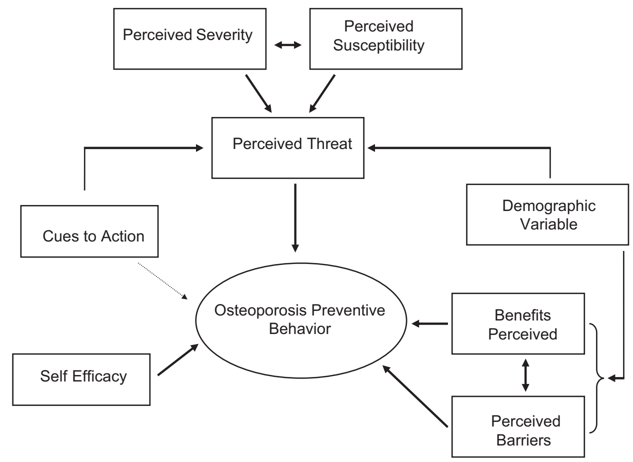

Figure 2: The study conceptual framework

Ethical considerations performed by obtaining from the ethics committee of Tarbiat Modares University. The aims and importance of the study were explained to the subjects, and their written consent was obtained. The participants were assured that the information would remain confidential.

Statistical analysis

Data analysis was carried out through SPSS 19.0 software package (SPSS Inc., IBM, Chicago, IL, USA). using the Chi-square test, independent *t*-test, Mann–Whitney, and repeated measurement ANOVA. Demographic variables were compared between two groups with the Chi-square test. Comparison between the constructs of HBM, nutrition performance, and jogging performance during the time was done with repeated measurement ANOVA, followed up with Bonferroni *post-hoc* test separately in groups. Constructs of HBM, nutrition performance, and jogging performance were also compared between two groups with an independent *t*-test. T-score of lumbar spine and femur were compared between groups with Mann–Whitney nonparametric test according to departed of the normal distribution. Significance level was 0.05.

RESULTS

Based on the results, the mean age of women participated in the study was 41.75 ± 5.4 years for the experimental group and 41.77 ± 5.43 years for the control group. The mean BMI was 22.44 ± 3.30 for the experimental group and 22.27 ± 3.05 for the control group. The average number of women deliveries (number of pregnant women) for the experimental group was 2.57 ± 1.47 and 2.50 ± 1.19 for the control group. In terms of menopause and birth control-estrogen use, calcium of Vitamin D supplements not show a significant difference between the two groups. The above parameters did not show a significant difference between the two groups based on the independent *t*-test. Table 1 shows the demographic data. Based on the Chi-square test, there is no significant difference between the two groups in education level ($P = 0.771$), marital status ($P = 0.880$), occupation ($P = 0.673$), breastfeeding ($P = 0.769$), smoking ($P = 0.315$), history of osteoporosis in the family ($P = 0.378$), history of special diseases ($P = 0.769$), and records of bone densitometry ($P = 0.543$).

The results showed that before intervention, there was no significant difference between the two groups in terms of knowledge ($P = 0.358$), perceived susceptibility ($P = 0.827$), perceived severity ($P = 0.196$), perceived benefits ($P = 0.707$), perceived barriers ($P = 0.293$), self-efficacy ($P = 0.965$), internal cues to action ($P = 0.262$), nutrition ($P = 0.481$), and walking performance ($P = 0.999$). However, immediately after intervention and 6 months later, the experimental group showed a significant increase compared to the control group in all of the foregoing scales except for perceived barriers ($P < 0.001$). On structural barriers, the experimental group showed a significant decrease compared to the control group [Tables 2 and 3] ($P < 0.001$).

Table 1: Frequency distribution of the subjects in terms of demographic information

Variable	Control group		Experimental group		P
	Number	Percentage	Number	Percentage	
Occupation					
Employed	10	16.7	12	20	0.673
Housewife	50	83.3	48	80	
Educational level					
Illiterate	2	3.3	2	3.3	0.771
Primary	9	15	14	23.3	
Secondary	22	36.7	17	28.3	
High school	17	28.3	18	30	
College	10	16.7	9	15	
Marital status					
Single	6	10	8	13.3	0.880
Married	48	80	46	76.7	
Divorced	2	3.3	3	5	
Widowed	4	6.7	3	5	
Breastfeeding					
No	54	90	53	88.3	0.769
Yes	6	10	7	11.7	
Smoking					
No	60	100	59	98.3	0.315
Yes	0	0	1	1.7	
History of osteoporosis in the family					
No	52	86.7	55	91.7	0.378
Yes	8	13.3	5	8.3	
History of a special disease					
No	53	88.3	54	90	0.769
Yes	7	11.7	6	10	
History of bone densitometry					
No	53	88.3	55	91.7	0.543
Yes	7	11.7	5	8.3	

Comparison of BMD T-score in the lumbar spine ($P = 0.973$) and femur ($P = 0.935$) in women before and 6 months after intervention showed that before intervention, there was no significant difference between the experimental group and the control group in this regard. Six months after intervention, the value of lumbar spine BMD T-score in the experimental group increased to 0.127, while in the control group it reduced to −0.043 ($P = 0.413$). The value of the hip BMD T-score in the intervention group increased to 0.125, while it decreased to −0.028 in the control group ($P = 0.420$) [Table 4].

Table 5 shows the distribution of external cues to action for osteoporosis, before, immediately after, and 6 months after intervention. The number of cues used, especially family and friends, immediately after intervention and 6 months after intervention increased as compared to before intervention.

DISCUSSION

This study showed that a key prevention method for osteoporosis is that of community-based intervention strategies using behavior change models such as the HBM. Based on the results, there were significant differences between mean scores of knowledge before, immediately after, and 6 months after intervention in the experimental group. The knowledge scores in this group increased significantly after intervention. This is consistent with results of Ghaffari *et al.*,[13] Winzenberg *et al.*,[14] and Al Seraty and Ali Wafaa.[15] Although the mean score of knowledge significantly increased in the control group as well, there is a significant difference between the mean scores of knowledge for the two groups. The increase in knowledge and other constructs can be the participants' access to information as well as their participation in the training course held by the Fasa Health Center about diseases and health issues for women and health volunteers. The increase in knowledge score in the intervention group is significant and deserves consideration.

There was a significant difference between perceived susceptibility of the two groups 6 months after intervention. This can be attributed to the effects of intervention on the subjects perceived susceptibility. In other words, after intervention, most women believed they were at risk for osteoporosis. This is consistent with results of Tussing and Chapman-Novakofski,[16] Doheny *et al.*,[17] and Ghaffari *et al.*[13]

Table 2: Comparison between the mean scores of participants' knowledge, HBM components

Variable	Mean (SD)						RM ANOVA test results		
	Experimental group (*n*=60)			Control group (*n*=60)			Mean *P*		
	Pretest	Posttest	6 months later	Pretest	Posttest	6 months later	Pretest	Posttest	6 months later
Knowledge	7.65 (2.36)	10.82 (17.30)	18.33 (2.25)	8.07 (2.58)	8.67 (2.50)	7.17 (2.59)	0.358	<0.001	<0.001
Perceived susceptibility	22/7 (2.31)	10.50 (2.65)	15.82 (2.28)	7.13 (1.84)	7.65 (1.71)	8 (1.80)	0.827	<0.001	<0.001
Perceived severity	9.73 (2.34)	13.23 (3.54)	19.92 (4.31)	9.22 (1.99)	9.83 (1.95)	10.35 (2.05)	0.196	<0.001	<0.001
Perceived benefit	13.53 (3.76)	18.65 (4.72)	28.6 (5.01)	13.30 (2.98)	14.17 (2.85)	14.98 (3.01)	0.707	<0.001	<0.001
Perceived barrier	26.50 (4.01)	20.82 (4.02)	13.55 (3.95)	25.70 (4.28)	24.60 (4.40)	23.80 (4.46)	0.293	<0.001	<0.001
Self-efficacy	7.68 (1.90)	10.93 (2.37)	15.87 (2.60)	7.67 (2.18)	8.80 (2.19)	9.40 (2.47)	8.80 (2.19)	<0.001	<0.001
Internal cues to action	5.57 (1.91)	7.15 (1.91)	12.25 (1.46)	5.93 (1.65)	6.35 (1.70)	7.53 (1.56)	0.262	<0.001	<0.001

SD=Standard deviation, HBM=Health Belief Model, RM=Repeated measurement

Table 3: Comparison of mean scores of nutrition and walking performance regarding osteoporosis prevention

Variable	Mean (SD)						RM ANOVA test results		
	Experimental group (*n*=60)			Control group (*n*=60)			Mean *P*		
	Pretest	Posttest	6 months later	Pretest	Posttest	6 months later	Pretest	Posttest	6 months later
Nutrition performance	4.8 (1.87)	7.75 (1.87)	11.78 (1.49)	5.05 (2)	5.40 (1.79)	5.55 (1.67)	0.481	<0.001	<0.001
Jogging performance	6.93 (3.44)	11.83 (3.31)	18.72 (2.17)	6.93 (2.52)	7.85 (2.38)	8.45 (2.47)	0.999	<0.001	<0.001

SD=Standard deviation, RM=Repeated measurement

Table 4: The mean T-score of lumbar spine and femur in women

Variables	Mean±SD		P^c
	Experimental	Control	
Spine			
Preintervention	0.118±1.254	0.108±1.220	0.973
6 months later	0.245±1.248	0.065±1.228	0.413
Paired *t*-test *P* value	<0.001	<0.001	
Hip			
Preintervention	−0.240±1.108	−0.222±1.114	0.935
6 months later	−0.115±1.087	−0.250±1.107	0.420
Paired *t*-test *P* value	<0.001	<0.001	

P^c=Comparison between experimental and control (Mann-Whitney U-test). SD=Standard deviation

After intervention, the perceived severity of the experimental group significantly increased compared to the control group. This is consistent with results of Khorsandi *et al*.[18] and Hazavehei *et al*.[19] However, the perceived severity in Tussing and Chapman-Novakofski[16] and Hormoz *et al*.[20] showed no significant increase after intervention.

The mean scores for perceived benefits showed a greater increase in the experimental group than in the control group immediately after and 6 months after intervention. Azar *et al*.[21] showed that the construct of perceived benefits of physical activity in the intervention group significantly increased after training, but this was not true for the control group. This is consistent with the findings of the present study. In the study by Beik on the prevention of osteoporosis among women with low socioeconomic status, perceived benefits showed a significant increase after intervention.[22] The increase in the perceived benefits can be the result of an emphasis in training on walking and diet, physical and psychological benefits of walking, and the role of nutrition in preventing osteoporosis.

The results of this study showed no significant difference between the two groups before intervention in terms of barriers. However, the difference was significant in immediately and 6 months after intervention for the experimental groups. In other words, the educational interventions significantly reduced barriers to proper diet and walking, thereby reducing the risk of osteoporosis. In the study of Anderson *et al*.[23] and Khorsandi *et al*.,[18] perceived barriers of the study population regarding calcium intake and physical activity decreased after intervention.

The mean scores of self-efficacy in the present study showed that before intervention, both groups had low ability to control diet and walk. After intervention, the mean score of self-efficacy increased significantly in the experimental group. This is consistent with the results of Sedlak *et al*.,[11] Tussing and Chapman-Novakofski,[16] Kaveh *et al*.,[24] and Piaseu *et al*.,[25] but is inconsistent with those of Jessup *et al*.[26] and Wu *et al*.[27]

External cues of action are social factors included in the HBM and refer to perceived social pressures leading to doing or not doing a behavior. These external cues alongside internal ones led the women toward osteoporosis prevention behaviors. In this study, external cues for the subjects included family, friends, doctors,

Table 5: Distribution of external cues to action regarding osteoporosis prevention

	Before intervention				*P*	Immediately after intervention				*P*	6 months after intervention				*P*
	Experimental		Control			Experimental		Control			Experimental		Control		
	Number	Percentage	Number	Percentage		Number	Percentage	Number	Percentage		Number	Percentage	Number	Percentage	
Physicians and health personnel	30	27.5	28	27.2	0.681	35	22	30	26.8	0.211	50	22.4	30	25.2	0.190
Families and friends	20	18.3	16	15.5	0.412	45	38.3	18	16.1	0.112	55	24.7	20	16.8	0.045
Books	15	13.8	13	12.6	0.626	20	12.6	15	13.4	0.222	28	12.6	16	13.4	0.111
Journals and publications	12	11	15	14.6	0.911	14	8.8	17	15.2	0.721	20	9	16	13.4	0.412
Radio and television	25	22.9	20	19.4	0.724	27	17	18	16.1	0.120	35	15.7	21	17.6	0.090
Patients	4	3.7	7	6.8	0.725	8	5	8	7.1	0.433	20	9	9	7.6	0.235
Internet	3	2.8	4	3.9	0.355	10	6.3	6	5.4	0.101	15	6.7	7	5.9	0.010
Total	109	100	103	100		159	100	112	100		223	100	119	100	

and health workers. In immediately after and 6 months after intervention, external cues increased. They have an influential role as a source of information and support for eating and walking behaviors and for providing resource and guidance people need to assess bone density. The mean score for the internal cues to action significantly increased after intervention in the experimental group compared to the control. This is consistent with results of Khorsandi *et al*.[18] and Azar *et al*.[21]

In this study, before intervention, there was no significant difference between the mean score of women on osteoporosis prevention behaviors and both groups had low performance in maintaining proper diet and walking. Immediately after and 6 months after intervention, the mean performance score of the women in the intervention group significantly increased compared to controls. This shows the positive effects of the education on women's performance. Hazavehei *et al*. also reported an increase in walking and calcium intake in the intervention group after intervention.[19] In a study by Al Seraty and Ali Wafaa on 100 female students using the HBM, the students' performance on calcium intake and exercise after intervention showed a significant increase compared to before.[15] This is consistent with Shirazi *et al*.'s study on the effects of physical activity education in the prevention of osteoporosis among women 40–65 years old based on Transtheoretical Model.[3]

The study by Tarshizi *et al*. showed that the subjects' physical activity levels before the training was not appropriate. However, by applying the HBM training in the experimental group, a significant difference was observed in this area.[28] In the study by Beik, a significant difference was reported between the level of physical activity after intervention in the experimental and control groups. This is consistent with the present study, but no significant difference was observed between the mean daily calcium and Vitamin D intake before and after training. The intake levels were unsatisfactory.[22] The results of this study are consistent with results of Khorsandi *et al*.,[18] Wallace,[29] and Azar *et al*.[21] Davoud *et al*.'s study showed that there was a significant increase in calcium intake in the second phase, but in the third stage (3 months after intervention) calcium intake decreased.[30] In a study by Plawecki and Chapman-Novakofski, an 8-week, bone-health community program addressed risks/lifestyle changes within the Health Belief Model and Theory of Reasoned Action frameworks in a randomized format (treatment group $n = 35$; control group $n = 34$). Median week 1 values for calcium (control, 963 mg; treatment, 1023 mg) and vitamin D (81 IU both groups) were below recommendations, increasing throughout the program for both control (1023 mg calcium, 128 IU vitamin D) and treatment (1005 mg calcium, 122 IU vitamin D) groups.[31]

Six months after intervention, the value of lumbar spine BMD T-score in the experimental group increased to 0.127, while in the control group it reduced to −0.043. The value of the thigh BMD T-score in the intervention group increased to 0.125, while it decreased to −0.028 in the control group. In a study, Huang investigated the effectiveness of an osteoporosis prevention program among women in Taiwan based on the HBM and the three factors of knowledge, self-efficacy, and social support. The results showed that in the intervention group, perceived barriers and benefits improved significantly. Self-efficacy and knowledge variables also increased because of the training program. BMD is improved in the intervention group, while it is reduced in the control group.[32] Zhao *et al*. showed that exercise and calcium intake improved bone density.[33]

Jessup *et al*., in a research on the effects of exercise on bone density, balance, and self-efficacy in older women, showed that in the experimental group, compared to the control group, BMD in the femur and balance improved significantly. However, no significant change was observed in self-efficacy in both groups.[26]

The results show the effectiveness of the intervention program and the importance of educational interventions to improve osteoporosis prevention behaviors. Results of the education based on the HBM showed that people with higher mean scores on these constructs performed better in activities for the prevention of osteoporosis and had better bone density.

The limitations related to this research include its sampling method. Simple random sampling is selecting research participants on the basis of being accessible to the researcher. Another concern about such data centers on whether subjects can accurately recall past behaviors. Cognitive psychologists have warned that the human memory is fallible, and thus the reliability of self-reported data is tenuous on some items.[34] The exercise questions only related to walking, which may not have a big impact on bone density.

CONCLUSIONS

The results of this study, the importance of ongoing investigations, epidemiology and education about osteoporosis in women reveal that policy makers should consider health-related field as a priority. The results of this study showed that health can enhance the knowledge, perceived susceptibility, understanding the risks of disease, and interests and obstacles to the proper conduct of the preventive role. Most importantly, but it seems to change behavior, especially long-term behaviors and the behaviors that socioeconomic factors are interdependent, and failure. To sort these issues, should also be considered.

It can be concluded from the results of this study that providing educational programs in this regard for family members, physicians, and other health personnel and offering training programs in radio and television broadcasting is essential. Further studies should have more comprehensive interventions on the structures of calcium intake benefits and barriers and use other behavioral change theories. It is advised that researchers explain social and behavioral barriers in calcium intake in different cultural contexts.

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