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Research Article

Theory-based Osteoporosis Prevention Education and Counseling Program for Women: A Randomized Controlled Trial

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SUMMARY

Purpose: The purpose of this research was to investigate the effect of an osteoporosis prevention program based on the Health Belief Model for women between the ages of 30 years and 45 years at risk of osteoporosis.

Methods: This study was conducted with randomized control group pretest, post-test and follow-up trial. Intervention group ($n = 37$) and control group ($n = 36$) participated in the research. Data were collected using a sociodemographic data questionnaire, the Osteoporosis Knowledge Test, the Osteoporosis Health Belief Scale, the Osteoporosis Self-efficacy Scale, a monitoring form for estimated dairy calcium intake, and a monitoring form for estimated weekly exercise. Intervention program was composed of a 4-week education program and a 24-week counseling program. Data were collected pretest, post-test 15 days after the end of the education program, follow-up 1 after 3 months, and follow-up 2 after 6 months. Mann Whitney *U* test, chi-square test, Friedman test, Bonferroni test, two means test and Wilcoxon signed-rank test were used for statistical analysis.

Results: After the education and counseling program, a significant increase was seen in comparison with the control group in the mean scores of the intervention group on the Osteoporosis Knowledge Test and its subscales ($p < .001$), on the Osteoporosis Health Belief Scale and its subscales ($p < .001$), on the Osteoporosis Self-efficacy Scale and its subscales ($p < .001$), and in their daily calcium intake ($p < .001$) and duration of weekly exercise ($p < .001$).

Conclusion: The results of this study were evidence that showed the effects of Health Belief Model—based osteoporosis prevention education and counseling program conducted by nurses.

Introduction

Osteoporosis which changes bone density and quality is a devastating disease affecting public health. As bones become more porous and fragile, the risk of fracture is greatly increased [1]. It is estimated that more than 200 million people worldwide have osteoporosis, and that one in three women and one in five men are at risk of osteoporotic fractures [1].

In Turkey, there have been few studies on the prevalence of osteoporosis. The International Osteoporosis Foundation (IOF) [2], using data from a study in Turkey by Tüzün et al [3], came to the important conclusion in its Hip Fracture Map that the incidence of hip fracture was more than 300 per 100,000. The study by Tüzün et al [3], conducted in 12 regions of Turkey with 1,965 individuals aged 50 years and above, found that approximately 24,000 hip fractures, caused by osteoporosis occurred in 2009 and that 73.0% of these were in women. They also estimated that by 2035 the number would rise to approximately 64,000 [3]. Also, although the rate of hip fracture was lower in Turkey than in other European countries, the incidence had been rising significantly in the last 20 years [3].

One of the most frequently encountered results of osteoporosis is bone fractures. These are most often fractures of the hip, vertebrae or wrist. Hip and vertebral fractures in particular increase with age in both men and women [1]. The number of women affected annually by osteoporosis-related fractures is greater than the total of those affected by heart attacks, stroke and breast cancer combined [4].

The main target of osteoporosis treatment is to prevent fractures. For this, calcium and vitamin D supplements, treatment with alendronate, risedronate and ibandronate, treatment with raloxifene (a selective estrogen receptor modulator) and treatment with parathyroid hormone are recommended [4]. Treatment of the

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complications of osteoporosis and replacement of lost bone are difficult and expensive, and take a long time. At the same time, the economic losses caused by osteoporosis-related fractures are disturbing. In the United States, 40 million dollars a day is spent on the treatment of osteoporosis-related fractures. If the costs of hospital and home care, nursing services and loss of manpower are included, the total approaches 14 billion dollars a year [4].

The risk factors for osteoporosis are various nonmodifiable factors such as gender (female), ethnic origin (Caucasian, Asian, Spanish), advanced age, and osteoporosis in the family or a history of fractures, as well as modifiable lifestyle-related factors such as insufficient calcium intake, a sedentary lifestyle, smoking, drinking alcohol, vitamin D deficiency, and caffeine intake [1,5].

The early diagnosis and treatment of people with osteoporosis can reduce the influence of the disease, and correction of aspects of lifestyle that may be risk factors can reduce the risk of the disease and secure a fall in its occurrence in society. For this reason, determining the risk factors which lead to osteoporosis and placing an early diagnosis are evaluated as a more effective, easier and more cost-effective approach than treating advanced osteoporosis [6].

In addition to the progressive increase in the number of people affected by osteoporosis, health improvement programs, seen as an economically effective way to prevent the development of this disease also seem to be increasing. The knowledge and skills gained in these programs will help to bring about changes in behavior to increase calcium intake and encourage weight-bearing exercises to prevent osteoporosis [7]. The literature emphasized that knowledge levels and awareness of osteoporosis must be increased in women, who are the most at-risk group, and that there is a need for research and education on developing preventive behaviors [8].

The IOF [1] states that nurses play a key role in providing information to individuals about the risks of osteoporosis and behaviors for protection, and cooperating with other professions on osteoporosis prevention. Nurses are responsible for providing information on the risks, prevention, diagnosis and treatment of osteoporosis to all individuals to whom healthcare is given [9].

The importance must be stressed of a theoretical basis for programs relating to osteoporosis and its prevention in order to improve bone health and to promote preventive behavior [10]. Indeed, many studies of educational programs in the literature on the prevention of osteoporosis are based on theory [11–14].

The Health Belief Model (HBM) was developed to explain why some people show health-protecting behavior and some do not participate enough in disease protection and scanning programs [15]. The components of the HBM include perceived susceptibility, perceived severity, perceived benefits and perceived barriers. Perceived susceptibility refers to individuals' subjective perception of the risk of developing a health condition [11]. In a study by McLeod and Johnson [16] examining 22 research papers on osteoporosis health beliefs and osteoporosis inadequacy perceptions, they reported both in the study and in practice that inquiring about individuals' health beliefs was of benefit.

It has been found that with studies in which an osteoporosis prevention education program was conducted for women, there were positive developments in women's health beliefs towards osteoporosis [9,11,13]. Self-efficiency levels rose with regard to protective behavior against osteoporosis [10,12]. There was an increase in calcium consumption, which is a protective behavior against osteoporosis [9–11], and periods of physical activity were extended [9,11,17].

Aim

This study aimed to investigate the effects of an osteoporosis prevention education and counseling program based on the HBM and developed for women between the ages of 30 and 45 at risk of osteoporosis. The goals of the program were to increase women's knowledge of osteoporosis, their health beliefs, their self-efficacy and the frequency of osteoporosis preventing behaviors (OPBs), which are their daily calcium intake and weekly exercise.

Hypotheses

We examined five hypotheses, which were as follows:

H_1: After the program, there will be a difference between the mean scores on the osteoporosis knowledge test of the intervention and control groups. H_2: There will be a difference between the intervention and control groups in terms of mean scores on the osteoporosis health belief scale. H_3: There will be a difference between the intervention and control groups in terms of mean scores on the osteoporosis self-efficiency scale. H_4: There will be a difference between the intervention and control groups in terms of the daily intake of calcium. H_5: There will be a difference between the intervention and control groups in terms of weekly exercise.

Methods

Study design

This randomized control group pretest, post-test and follow-up trial was performed between August 2014 and April 2015 at a family health center (FHC) in İzmir, in the west of Turkey.

Setting and samples

There are 25 FHCs in the area where the study was conducted. One was selected using purposive sampling as an FHC where women with varying sociodemographic characteristics came for health services and would be able to take part in and continue with the prevention program. G*Power software was used to estimate the required sample size. At the beginning of the study, the research power was taken as 80% and the effect size of the study was taken as moderate (.5). A sufficient size for each group in the study was established to be 34 people. The inclusion criteria were women (a) aged between 30 and 45 years, (b) those at risk of osteoporosis, (c) of at least primary school education, and (d) participating voluntarily in the study. Exclusion criteria were (a) having a diagnosis of osteopenia or osteoporosis, (b) being in menopause or surgical menopause, (c) being pregnant or breastfeeding, or (d) having an impediment to taking exercise.

In women, maximum bone mass occurs at 30–35 years of age, and begins to decline afterwards [4]. With greater bone mass in early adulthood, women will be less affected by the decline of bone mass in the postmenopausal period. Therefore, it is of great importance to support the development of behavioral changes aimed at increasing bone mass and preventing osteoporosis in women in the postmenopausal period. For this reason, women between the ages of 30 and 45 were chosen for this study.

Randomization

Participants were randomly assigned to either intervention or control groups by drawing lots. They ($n = 171$) were examined to determine their potential risk of osteoporosis using a computerized instrument; 102 women with a potential risk of osteoporosis were invited to take part in the study. Those at-risk women who accepted to take part in the study ($n = 80$) were assigned to the intervention group ($n = 40$) or the control ($n = 40$) group by drawing lots. We established that the two groups were homogeneous with regard to age ($\chi^2 = 0.45$, $p = .798$), education level ($\chi^2 = 0.30$, $p = .960$) (Table 2), and osteoporosis risk potential scores ($Z = 0.32$, $p = .748$).

The final sample size was 73 women (intervention group $n = 37$, control group $n = 36$) (Figure 1).

Intervention

Osteoporosis prevention program based on the HBM

The program was prepared by examining the literature which had content relating to increasing women's perceived personal risk of disease and the seriousness of the disease and reducing perceived barriers to changing behavior [9,10]. The program consisted of 4 weeks of group education followed by 24 weeks of counseling and individual follow-up, totaling 28 weeks. The program was founded on evidence-based recommendations for protection against osteoporosis by the IOF [1].

Osteoporosis Prevention Education Program

Osteoporosis prevention education consisted of four lessons, each of which lasted for 1½ hours to 2 hours, with one lesson per week. Details of the education program can be seen in Table 1. The lessons, a slide show presentation supplemented by handouts, were performed by the researcher to groups of 10–15 people. In the third week, weight-bearing exercises were demonstrated and practiced repeatedly. During the program, a brochure on the symptoms of osteoporosis, a CD of the weight-bearing exercise, a magnet board for remembering OPBs and an education booklet were distributed. The content validity index of the booklet containing a summary of the education program was found to be .93 after assessment of the views of 10 experts.

Osteoporosis prevention counseling program

After the end of the education program, a 24-week period of monitoring and counseling was implemented. In this period, each woman in the intervention group was given telephone counseling twice a month to a total of 12 times. Each session lasted for 10–20 minutes. In the telephone counseling, the women's problems with changing their behavior were listened to and answered. They were encouraged to start and continue to change their behavior. According to the HBM, supporting and encouraging individuals raises their perceived sensitivity and develops their positive healthy behavior by reducing perceived barriers [11]. For this reason, a total of 24 encouraging motivational messages were sent to the women at the beginning of each week in order for them to initiate and continue their behavior changes. In addition, counseling was given by face-to-face interview at the end of the education period (T1), at the first monitoring session (T2), and at the last monitoring session (T3). At the last monitoring session (T3), the women were awarded a success certificate inscribed "I am preventing osteoporosis."

Ethical considerations

This study was approved by the institutional review board of Ege university (IRB approval no. 2012-19), and written permission was

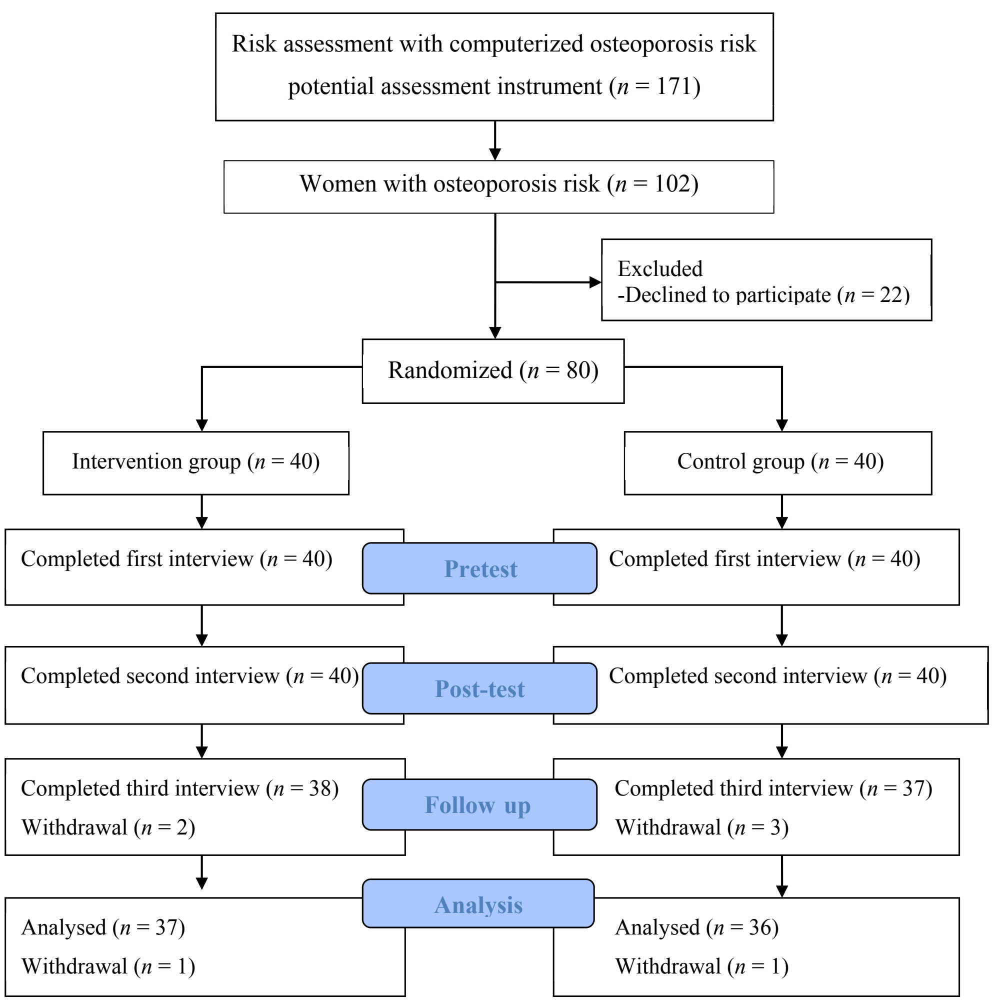

Figure 1. CONSORT flow diagram.

Table 1 *Osteoporosis Prevention Education Program.*

Topics for program	
1st week	Medical presentation of osteoporosis disease: Symptoms & disease process of osteoporosis Osteoporosis diagnosis, bone mineral density measurements Consequences & therapy of osteoporosis
2nd week	Osteoporosis prevention strategies – Nutrition: Benefits of calcium foods, effects on bone, Calcium containing foods served
3rd week	Osteoporosis prevention strategies – Exercise: Benefits of exercise & walking, effect on bone mineral density Weight bearing exercise demostration (the post-balance-heat-resistance exercises) & practice
4th week	Osteoporosis prevention strategies – Modifiable risk factors: Individual modifiable risk factors

obtained from the Izmir Public Health Directorate. The participants provided their written informed consent in accordance with the Helsinki Declaration. The participants discussed individual osteoporosis risks with the researcher and benefited from opportunities (knowledge, exercises, nutrition knowledge about osteoporosis) as compensation for their time and efforts.

Instruments

In this research, we used a sociodemographic data questionnaire (including age, education level, marital status and profession), a computerized osteoporosis risk potential assessment instrument, Osteoporosis Knowledge Test (OKT), Osteoporosis Health Belief Scale (OHBS), Osteoporosis Self-efficacy Scale (OSES), a monitoring form for estimated dairy calcium intake, and a monitoring form for estimated weekly exercise.

Computerized Osteoporosis Risk Potential Assessment Instrument: A computerized instrument was used to determine the risks of osteoporosis of women between the ages of 30 and 45 years. This was prepared by the researchers by scanning the relevant literature in such a way as to be usable by nurses in the polyclinic or home environment with the use of a computer and in a short time [1,4,18,19]. The instrument consists of 19 questions, 3 on the family history of osteoporosis (osteoporosis, fractures or spinal curvature in the parents), 8 on individual clinical factors (fractures, low weight, low body mass index, chronic illness, long-term use of medication, cessation of menstrual bleeding, late menarche, large number of pregnancies), and 8 questions on lifestyle and habits (smoking and use of alcohol, calcium consumption, physical activity, consumption of acidic soft drinks or drinks containing caffeine, sunbathing, use of vitamin D supplements). The presence of a risk was scored 1, and the absence of a risk was scored 0. Those who scored less than 9 were determined as not being at potential risk of osteoporosis, while those scoring 9 and above were placed in the category of potential risk of osteoporosis. The reliability coefficient of the instrument was KR-20 = .73.

Osteoporosis Knowledge Test (OKT): The validity and reliability of the Turkish version was established by Kılıç and Erci [20]. It consists of 24 items assessing knowledge of osteoporosis. It has two subdimensions, Exercise and Calcium Knowledge Test. Scoring on the test is from 0 to 24; scoring on the exercise subscale is from 0 to 16, and on the calcium subscale from 0 to 17. A high score gained on the scale indicates that the individual has good knowledge of osteoporosis. In this study, the reliability coefficient of the test was (KR-20) .66–.78.

Osteoporosis Health Belief Scale (OHBS): The adaptation of the OHBS to Turkish, and its validity and reliability were performed by Kılıç and Erci [20]. The OHBS consists of 42 items measuring individuals' health beliefs regarding osteoporosis. It has seven subdimensions on sensitivity perception, perception of seriousness, the benefits of exercise, the benefits of calcium taking, the barriers to exercise, the barriers to calcium taking and health motivation. The response for the items in each subscale range from *strongly disagree* (1 point) to *strongly agree* (5 points). The potential range for each subscale is 6–30. In this study, the Cronbach α reliability coefficient of the scale was found to vary between .59 and .80.

Osteoporosis Self-efficacy Scale (OSES): The adaptation of the OSES to Turkish, and its validity and reliability were performed by Kılıç and Erci [20]. The scale shows self-efficacy perception regarding calcium intake and weight-bearing exercise in the prevention of osteoporosis. It consists of 12 items and two subscales on osteoporosis exercise self-efficacy and osteoporosis calcium self-efficacy perception. The potential range for each subscale is 0 to 600. A high score on the scale means that the individual's self-efficacy perception is at a good level. In this study, the Cronbach α reliability coefficient was found to vary between .87 and .92.

Dairy Calcium Intake Monitoring Form (DCF): This form, prepared according to information from the literature [1,9] was used to calculate daily calcium intake. The first question asks how many portions of each of the seven calcium-rich foods were consumed on any 1 day in the last week, and in this way, daily calcium intake is calculated. The second question asks how many portions of each of the 10 calcium-rich foods were consumed in the last week, and in this way the weekly calcium intake is calculated. The calculated weekly calcium intake amount is divided by seven (7 days) and the result is added to the daily calcium intake amount from the first question. The total from the two questions was used as the daily calcium intake in the study.

Weekly Exercise Monitoring Form: This form asks duration (minutes/week) with which the participants have carried out the weight-bearing exercises (posture-balance-heat-resistance) and the recommended walking in the previous week, in order to determine weekly exercise.

Data collection

Data were collected immediately before the intervention program as pretest (T0), post-test (T1) 15 days after the end of the education program, follow-up 1 (T2) 3 months later, and follow-up 2 (T3) after 6 months. Details of the research process can be seen in Figure 1.

Data analysis

SPSS version 15 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. Descriptive statistical analyses were used (frequency, percentages, mean-standard deviation, median-interquartile range). In order to test the homogeneity of the groups, chi-square

Table 2 *Demographics and Homogeneity of Intervention Group and Control Group (N = 73).*

Demographics	Categories	Intervention (n = 37)		Control (n = 36)		Total		χ^2	p
		n	%	n	%	n	%		
Age group (yr)	30–35	6	16.2	7	19.4	13	17.8	0.45	.798
	36–40	17	45.9	18	50.0	35	47.9		
	41–45	14	37.8	11	30.6	25	34.2		
Education	Primary school	18	48.6	18	50.0	36	49.3	0.30	.960
	Secondary school	5	13.5	6	16.7	11	15.1		
	High school	10	27.0	8	22.2	18	24.7		
	University	4	10.8	4	11.1	8	11.0		
Marital status	Married	35	94.6	29	80.6	64	87.7	3.84[a]	.147
	Single	2	5.4	7	19.4	9	12.3		
Employment status	Working	11	29.7	8	22.2	19	26.1	0.53	.595
	Housewife	26	70.3	28	77.8	54	73.9		

Note. [a]Fisher χ^2 test.

analysis was used for all demographics and the Mann Whitney *U* test was used when osteoporosis risk potential scores were not distributed normally. Repeated measures analysis of variance were used to determine in which time period (T0, T1, T2, T3) the difference in mean scores within the groups originated. In order to assess the difference in mean scores in each time period of the intervention and control groups, the significance test of the difference between the two means was applied. Because the duration of weekly exercise was not distributed normally, Friedman analysis, Wilcoxon signed-rank test, and Mann-Whitney *U* test were used. A $p < .05$ was set as statistically significant.

Results

Demographic variables of intervention and control groups

The mean age of the intervention group was 39.35 years ± 4.17 years (min: 30, max: 45); 45.9% were aged 36–40 years; 48.6% were educated to primary school level; 94.6% were married, and 70.3% were housewives. In the control group, the mean age was 39.41 years ± 3.82 years (min: 30, max: 45), 50.0% were aged 36–40 years; 50.0% were educated to primary school level; 80.6% were married, and 77.8% were housewives. A chi-square test showed that there were no statistically significant differences between the two groups for any of the demographic variables ($p > .05$) (Table 2).

Effectiveness of program on OKT

As shown in Table 3, no statistically significant differences were found in T0 comparison of the two groups on each OKT total score ($t = -0.82$, $t = -0.46$, $t = -0.38$, $p > .05$). The results showed statistically greater increases in the intervention group's T1, T2 and T3 for each subscale of OKT total score, OKT exercise and OKT calcium, than the scores in the control group ($p < .001$). Results showed that there were statistically significant increases in OKT total score ($F = 306.44$, $p < .001$), OKT exercise ($F = 209.50$, $p < .001$) and OKT calcium ($F = 279.12$, $p < .001$) in the intervention group. Statistically significant increases were found between T0 and T1, T2 and T3, and among T1 and T2, T1 and T3 for all scores. However, statistically significant increases were not found between T2 and T3 for all scale scores. For the control group, the results showed that there were no statistically significant differences in OKT total score ($F = 2.32$, $p = .079$) and OKT calcium ($F = 2.32$, $p = .712$). There were, however, significant differences in OKT exercise ($F = 2.92$, $p < .05$). We concluded that the program had a large effect on the women's OKT total score mean ($d = .90$).

Table 3 *Comparison of OKT Scores by Group (N = 73).*

Variables	Intervention (n = 37) $M \pm SD$	Control (n = 36) $M \pm SD$	t	p[a]	
OKT Total					Group
T0	9.00 ± 4.69	9.83 ± 3.90	−0.82	.413	$F = 183.82$, $p < .001$
T1	21.59 ± 1.70	10.13 ± 3.57	17.41	< .001	Time
T2	22.64 ± 1.33	10.25 ± 3.58	19.46	< .001	$F = 287.45$, $p < .001$
T3	23.08 ± 1.03	10.05 ± 3.77	19.96	< .001	Group × time
F	306.44, $p < .001$	2.32, $p = .079$			$F = 262.19$, $p < .001$
p[b]	a,b,c,d,e ($p < .001$), f ($p = .222$)[c]				
OKT exercise					Group
T0	5.62 ± 3.78	6.00 ± 3.23	−0.46	.648	$F = 136.38$, $p < .001$
T1	13.89 ± 1.34	6.33 ± 2.75	14.81	< .001	Time
T2	14.94 ± 0.91	6.41 ± 2.87	17.00	< .001	$F = 197.25$, $p < .001$
T3	15.21 ± 0.88	6.22 ± 3.06	16.95	< .001	Group × time
F	209.50, $p < .001$	2.92, $p < .05$			$F = 171.75$, $p < .001$
p[b]	a,b,c,d,e ($p < .001$), f ($p = .403$)				
OKT calcium					Group
T0	6.43 ± 3.33	6.16 ± 2.64	0.38	.708	$F = 222.50$, $p < .001$
T1	14.91 ± 1.42	6.22 ± 2.57	17.79	< .001	Time
T2	15.94 ± 1.02	6.33 ± 2.62	20.47	< .001	$F = 246.19$, $p < .001$
T3	16.13 ± 0.97	6.25 ± 2.73	20.42	< .001	Group × time
F	279.12, $p < .001$	0.46, $p = .712$			$F = 235.06$, $p < .001$
p[b]	a,b,c,d,e ($p < .001$), f ($p = .881$)				

Note. OKT = Osteoporosis Knowledge Test.
[a] Independent *t* test.
[b] Analysis of variance repeated measures; post hoc (Bonferroni) test.
[c] a: T0–T1; b: T0–T2; c: T0–T3; d: T1–T2; e: T1–T3; f: T2–T3.

Effectiveness of program on HBM concepts

Before the program, there was no significant differences between the two groups in terms of scores in OHBS and OSES subscales ($p > .05$). However, after the program (T1, T2, T3) the intervention group showed a significant increase compared to the control group in all OHBS and OSES subscales ($p < .001$) (Table 4).

Table 4 *Comparison of OHBS and OSES Scores by Group (N = 73).*

Variables	Intervention (n = 37) $M \pm SD$	Control (n = 36) $M \pm SD$	t	p[a]	
OHBS susceptibility					
T0	19.00 ± 2.76	18.77 ± 3.03	0.33	.745	Group
T1	27.00 ± 2.76	18.94 ± 2.62	12.99	< .001	$F = 164.24$ $p < .001$
T2	28.08 ± 2.01	18.80 ± 2.78	16.32	< .001	Time
T3	28.43 ± 1.69	19.13 ± 2.88	16.87	< .001	$F = 166.13$ $p < .001$
F	197.78, $p < .001$	1.22, $p = .307$			Group × time
p[b]	a,b,c,e ($p < .001$)				$F = 152.18$ $p < .001$
	d,f ($p > .05$)[c]				
OHBS seriousness					Group
T0	18.35 ± 3.84	18.66 ± 3.08	−0.39	.701	$F = 132.23$ $p < .001$
T1	26.51 ± 2.72	18.55 ± 2.68	12.56	< .001	Time
T2	27.64 ± 2.05	18.97 ± 2.97	14.47	< .001	$F = 122.33$ $p < .001$
T3	27.91 ± 1.73	18.69 ± 2.99	16.04	< .001	Group × time
F	134.34, $p < .001$	2.06, $p = .110$			$F = 116.95$ $p < .001$
p[b]	a,b,c ($p < .001$), d,e ($p < .05$),				
	f ($p > .05$)				
OHBS benefits of exercise					Group
T0	21.70 ± 2.74	22.41 ± 2.12	−1.24	.220	$F = 176.09$ $p < .001$
T1	29.13 ± 1.29	22.66 ± 2.28	14.85	< .001	Time
T2	29.35 ± 1.05	22.27 ± 1.93	19.23	< .001	$F = 181.26$ $p < .001$
T3	29.54 ± 1.06	22.55 ± 2.11	17.72	< .001	Group × time
F	253.59, $p < .001$	1.19, $p = .316$			$F = 173.95$ $p < .001$
p[b]	a,b,c ($p < .001$), e ($p < .05$),				
	d,f ($p > .05$)				
OHBS benefits of calcium					Group
T0	21.27 ± 2.76	21.38 ± 1.87	−0.21	.831	$F = 281.76$ $p < .001$
T1	29.32 ± 1.29	21.83 ± 1.96	19.20	< .001	Time
T2	29.43 ± 1.25	21.13 ± 1.60	24.51	< .001	$F = 233.76$ $p < .001$
T3	29.40 ± 1.30	21.44 ± 1.85	21.15	< .001	Group × time
F	339.09, $p < .001$	3.61, $p = .016$			$F = 225.09$ $p < .001$
p[b]	a,b,c ($p < .001$), d,e,f ($p > .05$)				
OHBS barriers to exercise					Group
T0	15.51 ± 3.69	15.66 ± 2.79	−0.20	.843	$F = 78.29$ $p < .001$
T1	8.75 ± 3.12	14.91 ± 2.60	−9.15	< .001	Time
T2	8.00 ± 2.48	14.77 ± 2.88	−10.76	< .001	$F = 124.35$ $p < .001$
T3	7.54 ± 1.62	14.75 ± 2.86	−13.18	< .001	Group × time
F	126.72, $p < .001$	6.86, $p < .001$			$F = 78.22$ $p < .001$
p[b]	a,b,c ($p < .001$), d,e ($p < .05$),				
	f ($p > .05$)				
OHBS barriers to calcium					Group
T0	14.51 ± 3.85	13.94 ± 3.27	0.68	.500	$F = 45.71$ $p < .001$
T1	7.86 ± 2.48	13.00 ± 3.46	−7.29	< .001	Time
T2	7.45 ± 2.19	13.41 ± 3.15	−9.34	< .001	$F = 105.37$ $p < .001$
T3	7.10 ± 1.44	13.27 ± 3.29	−10.32	< .001	Group × time
F	110.42, $p < .001$	5.69, $p = .001$			$F = 71.31$ $p < .001$
p[b]	a,b,c ($p < .001$), d,e,f ($p > .05$)				
OHBS health motivation					Group
T0	21.83 ± 2.64	21.72 ± 1.64	0.22	.824	$F = 348.03$ $p < .001$
T1	29.10 ± 1.71	22.61 ± 1.84	15.62	< .001	Time
T2	29.51 ± 1.09	22.61 ± 1.57	21.70	< .001	$F = 161.67$ $p < .001$
T3	29.59 ± 0.98	22.52 ± 1.57	22.90	< .001	Group × time
F	199.77, $p < .001$	5.03, $p = .003$			$F = 102.66$ $p < .001$
p[b]	a,b,c ($p < .001$),				
	d,e,f ($p > .05$)				
OSES-exercise					Group
T0	340.27 ± 100.40	320.83 ± 88.81	0.88	.384	$F = 110.90$ $p < .001$
T1	513.51 ± 45.65	315.00 ± 81.88	12.75	< .001	Time
T2	537.56 ± 51.01	317.77 ± 85.69	13.27	< .001	$F = 91.73$ $p < .001$
T3	535.94 ± 46.03	318.88 ± 83.86	13.66	< .001	Group × time
F	102.93, $p < .001$	1.17, $p = .326$			$F = 98.19$ $p < .001$
p[b]	a,b,c,d,e ($p < .001$), f ($p > .05$)				
OSES-calcium					Group
T0	375.94 ± 74.77	365.83 ± 69.46	0.60	.552	$F = 156.25$ $p < .001$
T1	559.18 ± 37.59	360.27 ± 67.80	15.44	< .001	Time
T2	569.18 ± 39.11	358.05 ± 66.71	16.44	< .001	$F = 163.34$ $p < .001$
T3	564.59 ± 33.87	361.11 ± 69.72	15.79	< .001	Group × time
F	192.17, p < .001	3.05, $p = .032$			$F = 185.86$ $p < .001$
p[b]	a,b,c ($p < .001$),				
	d,e,f ($p > .05$)				

Note. OHBS = Osteoporosis Health Belief Scale; OSES = Osteoporosis Self-efficacy Scale.

[a] Independent t test.

[b] Analysis of variance repeated measures; post-hoc (Bonferroni) test.

[c] a: T0–T1; b: T0–T2; c: T0–T3; d: T1–T2; e: T1–T3; f: T2–T3.

For the intervention group, results showed that there were statistically significant increases in OHBS and OSES subscales ($p < .001$). Statistically significant increases were found between T0 and T1, T2 and T3, and between T1 and T2 and T3 for seriousness, barriers to exercise and exercise self-efficacy scores. However, statistically significant increases were not found between T2 and T3. Statistically significant increases were found between T0 and T1, T2 and T3, and between T1 and T3 for susceptibility and benefits of exercise scores. However, statistically significant increases were not found between T1 and T2 or between T2 and T3. Statistically significant increases were found between T0 and T1, T2 and T3 for benefits of calcium, barriers to calcium, health motivation and calcium self-efficacy scores. However, statistically significant increases were not found between T1 and T2 and T3 or between T2 and T3.

For the control group, the results showed that there were no statistically significant differences in OHBS-susceptibility, seriousness, benefits of exercise, or OSES-exercise ($p > .05$). There were, however, significant differences in OHBS-benefits of calcium ($p < .05$), barriers to exercise ($p < .001$), barriers to calcium ($p < .01$), health motivation ($p < .01$), and OSES-calcium ($p < .05$). It was established that the program had a large effect on the women's mean OHBS scores ($d = .81$) and their mean OSES scores ($d = .82$).

Effectiveness of program on OPBs

Results for the intervention group showed that there were statistically significant increases in OPBs ($F = 37.36$, $\chi^2 = 62.39$, $p < .001$). For the control group, the results showed that there were no statistically significant differences in OPBs ($F = 2.62$, $\chi^2 = 1.54$, $p > .05$) (Table 5). It was established that the program's effect level for daily calcium intake ($d = .51$) was medium.

Discussion

Follow-up assessments showed that the OKT, calcium and exercise knowledge of the intervention group had increased and that this increase was maintained 6 months later. After the education program, the education booklets given to the women made remembering the knowledge easier and the telephone conversations in the counseling process were effective in making the women's knowledge of osteoporosis permanent. In the literature, HBM-based education on the prevention of osteoporosis given to women of different age groups has resulted in an increase in OKT [9,21], and knowledge of calcium and exercise [14,22]. However, in those studies there was no follow-up process, and so changes in knowledge levels over time are not known. The present study is one of the few to monitor the change over time of women's knowledge levels.

Similar to the results of this study, other studies [11,13,23] have seen that the sensitivity perceptions to osteoporosis of women in different age groups were developed through HBM-based education programs. Contrary to results of this study, there were studies in which there was no difference in sensitivity perception [10,22]. The researchers noticed that sharing information on the disease in the education program and follow-up discussion about cases, and providing information and counseling on individual risks raised the women's sensitivity perceptions. This outcome was maintained through the counseling program.

That osteoporosis appears in people at an advanced age, that it causes changes in the life of individuals, but that the perception of seriousness in young women is low is an expected finding. We saw that after the education program the perception of seriousness of the women in the intervention group increased with time. The researchers thought that telephone counseling, the use of an exercise CD or the use of magnet boards as part of an education and counseling program could be effective in raising perceptions. Studies [11,13,22,23] from the literature showed that HBM-based education programs were effective in developing the perceptions of seriousness of women [11,13,22,23].

It is known that there is a relationship between the perceptions of benefits in individuals and OPBs [14]. For this reason, increasing individuals' benefit perceptions is of great importance in research which aims to increase OPBs. After the education program, the mean benefit perception scores of the intervention group had increased, and this change was maintained with the counseling program. Studies conducted with an HBM-based education program also reported that the mean scores for exercise benefits [21–23] and the

Table 5 *Comparison of OPBs by Group (N = 73).*

OPBs	Intervention ($n = 37$) $M \pm SD$	Control ($n = 36$) $M \pm SD$	t	p[a]	
Calcium-rich foods (mg/day)					
T0	859.83 ± 111.95	910.50 ± 119.98	−1.87	.066	Group $F = 59.20$ $p < .001$
T1	1212.37 ± 276.09	893.05 ± 106.22	6.55	< .001	Time $F = 29.49$ $p < .001$
T2	1295.70 ± 279.62	877.61 ± 94.23	8.61	< .001	Group × time
T3	1274.02 ± 316.75	882.47 ± 87.27	7.24	< .001	$F = 38.82$ $p < .001$
F	37.36, $p < .001$	2.62, $p = .055$			
p[b]	a,b,c ($p < .001$), d,e,f ($p > .05$)[c]				
Weight-bearing exercise (min/week)	Median ± ID	Median ± ID	Z	p[d]	
T0	0.00 ± 35.00	0.00 ± 27.50	0.37	.714	
T1	120.00 ± 142.50		6.58	< .001	
T2	120.00 ± 145.00		6.23	< .001	
T3	200.00 ± 240.00		6.30	< .001	
χ^2	62.39, $p < .001$	1.54, $p = .673$			
p[e]	a,b,c,f ($p < .001$), e ($p < .01$), d ($p > .05$)				

Note. OPBs = osteoporosis preventing behaviors; IR: Interquartile Range.
[a] Independent t test.
[b] Analysis of variance repeated measures; post hoc (Bonferroni) test.
[c] a: T0–T1; b: T0–T2; c: T0–T3; d: T1–T2; e: T1–T3; f: T2–T3.
[d] Mann-Whitney U test.
[e] Friedman test.

benefits of taking calcium [9,13,14,21,23] increased in the desired way. Contrary to results of this study, no significant difference was found in studies by Babatunde et al [10] and Sanaeinasab et al [12] between groups in terms of mean scores on the benefits of taking calcium. The researchers thought that the development of individuals' benefit perceptions was impeded because there was no monitoring process after the education program in these studies, which made them different from our research results.

Similar to results of the present study, others found that perceived barriers were reduced in comparison with the control group both after education and 6 months later [11,23] or after education [13]. A study in Turkey by Kılıç and Erci [22] found that after education, the mean score of the intervention group on exercise barriers was reduced and that there was a difference between groups. Contrary to our results, Babatunde et al [10] did not find a difference between groups after education. It is known that the perception of a barrier has a negative effect on OPBs [14]. In the light of this knowledge, we thought that learning the women's individual barriers regarding OPBs and the development of solutions to these barriers in the telephone counseling after the education program and the monitoring assessments was effective on the change in the intervention group. In addition, it can be said that handing out reminder magnets and sending out motivation messages each week were important in removing one factor, forgetting, which obstructed the development of OPBs.

Health motivation is an important factor affecting the necessary readiness in individuals to form health behavior [13,14]. A study by Wafaa and Wafaa [14] found that there was a relationship between individuals' mean motivation scores, and their calcium intake and weekly physical activity. It was seen that the health motivation mean score in the intervention group rose by the desired amount after the education program and that this increase was maintained. Similar to the results of this study, an increase is seen in the literature in women's mean health motivation scores with an HBM-based education program [13,14].

A study has shown that self-efficacy perception is the best indicator in the formation of osteoporosis preventive behavior [10]. In the intervention group after the education, exercise and calcium self-efficacy in time increased in the desired way. We thought that approaches during the education program such as showing osteoporosis weight-bearing exercises, giving information on the benefits of exercise on osteoporosis and handing out forms to monitor individual consumption increased self-efficacy. Studies have seen that the mean scores on exercise [12,22,23] and calcium self-efficacy of women in different age groups increase with an HBM-based education program [12,22,23].

After the education, the daily calcium intake of the intervention group increased, and in the monitoring period of the study, it continued without change. Examining studies with HBM-based education programs in the literature, we saw that Babatunde et al [10] and Huang et al [9] achieved similar results after education ($p < .001$). After the education, the time which the intervention group spent exercising each week increased with time ($p < .001$). In studies conducted with HBM-based education programs, Jeihooni et al [23], Huang et al [9] and Sanaeinasab et al [12] achieved similar results. Weight-bearing exercises or walking program and diet rich in calcium are important interventions to increasing bone density. In one study, the value of hip and lumber spine bone mineral density T-score of women increased after 6 months of the walking program in a HBM-based health promotion program [23]. Huang et al [9] found that osteoporosis prevention behaviors increased, and that 3 months after the intervention, bone mineral density increased. These results obtained from research show that interventions on prevention behaviors contributed significantly to the development of bone mineral density.

Significant differences were also found between the evaluations of the mean scores of exercise knowledge, benefits of taking calcium, barriers to exercise, health motivation and calcium self-efficacy in the control group. We thought that these differences were caused in relation to the amount of time passed between the pretest, post-test and follow-up evaluations. Most importantly, although differences were statistically significant, we felt that they were not significant from the point of view of expected behavior change. For example, the increase in exercise knowledge and health motivation scores was very small, and there was no sustained increase in benefits of taking calcium, nor was there a sustained reduction in barriers to exercise. Also, the calcium self-efficacy score fell in an undesired way.

Limitations

The study was conducted only in an FHC. For this reason the results of the study can only be generalized to individuals covered by the study. The women's osteoporosis risk score was calculated only based on 19 dichotomous risk factors, and did not adequately account for the severity of the risk factors. It is likely that the severity of risk factors such as duration/amount of physical inactivity or smoking could matter more in the development of osteoporosis. For this reason the measurement scale is limited. Evaluation of the effectiveness of the intervention was limited to 6 months. The unwanted drop out in the sample size in each group was approximately the same as the actual reduction, and so intention to treat analysis was not performed. The fact that the individuals' calcium intake behavior and physical activity behavior were assessed by means of their own written and oral statements were further limitations.

Conclusion

The study findings supported all our hypotheses. Women's knowledge of osteoporosis, their health beliefs, their self-efficacy and the frequency of OPBs increased in this study. The results of this study were evidence that showed effects of HBM-based osteoporosis prevention education and counseling program conducted by nurses.

We recommended that education and counseling program be applied to prevent osteoporosis based on different theoretical approaches; the program should be evaluated on an individual basis with home visits, and the program's effectiveness should be evaluated by long-term monitoring of efficacy and measurement of bone mineral density.

Conflict of interest

None of the authors of this study have personal, professional or financial conflicts of interest to declare.

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