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The Effects of Health Promotion Model on Preventive Behaviors of Osteoporosis during Premenopausal Period in Employed Women: A Quasi-experimental Study

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Abstract

Objectives: Osteoporosis is one of the major problems of the healthcare system and is a common debilitating metabolic disease among women. Pender's health promotion model which is a conceptual framework and describes a wide range of health behavior was selected to assess the behavioral changes in this study.

Materials and Methods: A total of 122 women aged between 30 and 45 were selected to take part in this quasi-experimental study. The samples were split into experimental and control groups using the block randomization method (block size of 4). The educational program, based on Pender's model, was performed weekly. Pender's questionnaire on preventive behaviors of osteoporosis was filled out before and two months after interventions by both groups. SPSS software version 18.0 was used for data analysis.

Results: In terms of qualitative and quantitative data (demographic characteristics), there was no meaningful difference between the two groups ($P > 0.05$). The mean difference (MD) in the score of the perceived benefits and barriers, perceived self-efficacy, programming, competing demand, and their commitment to a plan of actions increased in the experimental group after the intervention ($P < 0.001$). However, there was no significant increase in the mean score of social support in the experimental group after the intervention ($P > 0.05$).

Conclusions: It can be assumed that teaching preventive behaviors of osteoporosis through Pender's health promotion model was effective. Considering the findings, it is obvious that continuing this program can maintain and consolidate the changes which have been made in behaviors.

Keywords: Women, Health promotion, Human, Osteoporosis, Pre-menopause

Introduction

Osteoporosis is one of the major problems of the healthcare system and is a common debilitating metabolic disease among women and has been called the disease of the century by many researchers (1). The World Health Organization (WHO) declared that osteoporosis, heart attack, stroke, and cancer are the main threats to the lives of human beings (2,3). Additionally, osteoporosis is called a "silent disease" as it is known to be asymptomatic until fractures occur. One of the preventive methods against this disease is raising people's awareness of its control and treatment. Fractures can be prevented by early detection and proper care and treatment of this disease (4, 5).

Based on previous studies in the United States, about 12 000 000 people aged over 50 had osteoporosis and almost 40 000 000 people experienced bone mass reduction at the end of 2010. It is expected that the mentioned numbers would probably increase up to 14 000 000 and 47 000 000 by 2020 for osteoporosis and mass reduction, respectively (6).

Larijani reported that about 7 million of the 70 million Iranians are at risk of fracture. The Gland and Metabolism Research Center of Tehran University of Medical Sciences reported that among those above 50 years of age, roughly 70% of women and half of men suffer osteoporosis or bone mass reduction (7).

The number of women who suffer from osteoporosis is more compared to men (8). Women make up 50% of the world's population and they are the core of power in the family, therefore, meeting their health needs is of great importance (9). Based on this fact, when talking about energy and dynamism in the family, women's health would be reflected in the society. Based on this concept, it is vital that factors which lead to physical and emotional problems in women are identified and strategies to prevent them are also determined in order to improve the health status of women, families or communities (10). Muscle strength in women declines slowly, but around the menopausal period, following the reduction in the production of estrogen and progesterone, this loss of muscle strength becomes intensified (11-13). Peak bone mass is attained at about 30 years of age. With aging, however, the depletion in bone tissue increases and bones become weaker, bearing in mind that bone loss starts gradually (14). Therefore, the stage before menopause in women starts at the age of 35 to 39 and it can continue

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for 5 to 15 years. The incidence of vasomotor symptoms, severe bleeding, severe premenstrual syndrome, mood swings, osteoporosis, and breast cancer are the complaints before or during menopause (15, 16).

In 1986, the WHO defined the concept of health promotion as empowering people in order to increase control over their health and improve their lives (17). Pender stated that health promotion is an activity which enhances the level of well-being in people or groups (18).

Rationale

In this study, Pender's model was used for evaluating preventive behaviors of osteoporosis. This model is an important conceptual framework to describe a wide range of health behaviors.

This model has its roots in the theories of social cognition, nursing, and public health. It shows that people interact with their physical and interpersonal environment while trying to improve their health. The proper way of promoting healthy behaviors is a complex process affected by several variables. Pender's Health Promotion Model consists of 3 groups of factors:

- Personal characteristics and previous experience of the individual (personal factors, biological, psychological and social characteristics, and previous experience of the individual in relation to the desired behavior)
- Factors affecting specific behaviors such as cognitive and emotional feeling attached to them (the perceived benefits and barriers to perform a specific behavior, perceived self-efficacy, emotional feeling towards a behavior, and the effect of interaction with others such as families, friends, social patterns and supporting others as well as the influence of the location and time)
- The substituted activities for desired behaviors (activities that a person has little control over such as job and family responsibilities or the substituted behaviors which can be controlled by the person and has a chance of selection) (19).

Objectives

According to studies, little attention has been paid to preventive behaviors of osteoporosis before menopause based on Pender's Health Promotion Model. Previous studies mostly have concentrated on people's lifestyles or exercises based on this model. Hence, we decided to investigate the effect of Pender's health promotion model on preventing behaviors of osteoporosis before menopause in women in 2015.

Methods

This quasi-experimental study with a control group was conducted using Health Promotion Model. It was registered in the Iranian Registry of Clinical Trials (identifier: IRCT201405267531N9; https://www.irct.ir/trial/8035).

The participants were employed women between 30 to 45 years of age. The inclusion criteria were: a) absence of menopausal symptoms in the past six months; b) no long-term use of corticosteroids; c) non-surgical removal of the ovaries; d) participation in at least 2 training classes.

The main purpose of this study was to compare the mean score of preventive behaviors of osteoporosis in both experimental and control groups. Regarding the mean difference (m_1-m_2) of 1.3, standard deviation (SD) of 2.5, power (1-β) of 80% and significance level (α) of 0.05, almost 59 females were considered for each group. Considering the possibility of a 10% reduction in participants, the number of women was increased to 65 (n=65).

Regarding the ethical issues, the researcher obtained a recommendation letter from the authorities of Fatemeh College of Nursing and Midwifery and then presented it to the central building of this university in order to receive permission. Moreover, this study was approved by the Ethics Committee.

Accordingly, to achieve the main goals of this research, the following steps were taken for sampling:

First step: 130 women were selected randomly from all employed women who aged 30-45 years in the central building of Shiraz university of Medical Sciences.

Second step: Then, using the block size of 4, they were organized into experimental (n=65) and control (n=65) groups. The number of women in the experimental group decreased from 65 to 60 women and it dropped from 65 to 62 women in the control group.

Third step: After explaining the goals and benefits of this research to the women, consent form and the part of the questionnaire related to demographic characteristics were filled out by both groups.

Fourth step: After the pre-test, 3 educational classes were held for the experimental group (one session per week) in the central building of Shiraz University of Medical Sciences. Additionally, an educational pamphlet which included proper behaviors against osteoporosis was given to them. Those classes were about preventive behaviors of osteoporosis based on the subscales of Pender's health promotion model including appropriate nutrition, regular exercise, getting exposed to sunrise, and using calcium tablets.

According to the goals, the employed women were instructed in the vital behaviors which were highly beneficial for preventing osteoporosis.

Fifth step: The questionnaire of ''preventive behaviors of osteoporosis" was designed based on Pender's Health Promotion Model and was filled out by both groups 2 months after the training classes.

Questionnaire

The questionnaire consisted of 2 parts.: The first part (demographic characteristics) was developed to measure

age, education, marital status, number of pregnancies, number of children, height, weight, body mass index (BMI), osteoporosis background in the family members, hypothyroidism or hyperthyroidism, oophorectomy, history of corticosteroid usage (hydrocortisone, dexamethasone, etc), supplementary calcium usage, smoking history, regular exercise (3 times a week), and daily exposure to direct sunshine. Further, the second part of the questionnaire included six subscales based on Pender's Health Promotion Model.

Part 1: Perceived benefits and barriers subscale was presented in 12 items. Items 1 to 5 were related to the benefits and the answers were evaluated based on a 4-point Likert scale: Completely Agree (4 scores), Agree (3 scores), Disagree (2 scores) and Completely Disagree (1 score). On the other hand, items 6 to 12 were related to the barriers of preventive behaviors of osteoporosis subscale and the answers were assessed using a 4-point Likert scale (which was completely opposite to the rating scale of perceived benefits): Completely Agree (1 score), Agree (2 scores), Disagree (3 scores) and Completely Disagree (4 score). Part 2: The assessment was made based on a 3-point rating scale for perceived self-efficacy subscale consisting of 7 items: Completely Sure (3 scores), Somewhat Sure (2 scores), and Not Sure (1 score). Part 3: The programming subscale was comprised of 5 items: Often (3 scores), Sometimes (2 scores) and Never (1 score). Part 4: The evaluation of the other subscales was as follows: a 2-point rating scale for the competing demand with 4 items: True (1 score) and False (zero score). Part 5: a 3-point rating scale for the commitment to a plan of action: Often (3 scores), Sometimes (2 scores) and Never (1 score). Part 6: a 3-point rating scale for social support with 5 items: Often (3 scores), Sometimes (2 scores) and Never (1 score). Eventually, the total scores of the subscales were calculated for each individual.

Validity and Reliability of the Questionnaire

Content and face validity were evaluated by ten specialists in the field at Shiraz University of Medical Sciences. They also assessed the content validity index (CVI) and content validity ratio (CVR) of this questionnaire. For assessing the face validity of the questionnaire, we requested the specialists to write their comments on the place of each item, accurate scaling and grammatical structure of each item, and also the importance of adding new items or removing existing items. Finally, the face validity of the scale was determined based on an impact score of ≥1.5 for all items. Regarding content validity, we requested the specialists to review all parts of the questionnaire and assess each item based on four standard criteria including relevancy, clarity, simplicity, and necessity. CVR was determined using the formula: CVR = $(n_E\text{-}N/2)/(N/2)$. Lawshe's table was used to determine the cut-off point for CVR (20). Based on Lawshe's table, the minimum CVR value required for each item was 0.62. The CVR value for each item in this questionnaire was between 0.66 and 1. The CVI was also calculated using Waltz and Bausell method (21). Through dividing the number of specialists who ranked the items as compatible or full compatible for each criterion (relevancy, clarity, and simplicity) by the total number of specialists, CVI was achieved for each item. The average score of 3 criteria was used as the total CVI for each item. The minimum CVI value required for each item was 0.79 (22). For this scale, it was reported to be 0.9-1 for each item and the S-CVI/Ave was reported to be 0.9 for this questionnaire. In order to assess the reliability of the questionnaire, through convenience sampling method, 130 employed women (30-45 years old) participated in a pilot study based on the inclusion and exclusion criteria. Cronbach's alpha coefficient for the second part of this questionnaire (total score) was 0.724. Therefore, the questionnaire entitled "preventive behaviors of osteoporosis based on Pender's Health Promotion Model" had a good reliability and validity.

Data analysis was performed using SPSS software version 18.0. Descriptive statistics including the frequency, percentage, mean and standard deviation were calculated. In addition, analytical data were computed for comparing qualitative variables between the 2 groups using chi-square and Fisher test. Moreover, independent *t* test was applied to compare the differences in quantitative variables such as age and BMI and compare the mean scores of subscales of the health promotion model between experimental and control groups before and after the training. Further, paired *t* test was applied for comparing the mean scores of subscales separately in each group before and after the training. Finally, covariance analysis was used to compare the differences between the 2 groups before training in commitment subscale.

Results

Totally, 122 women aged 30 to 45 were studied (Figure 1). Independent *t* test was used to compare the demographic characteristics (age, height, weight, BMI, etc) of both experimental and control groups. The results showed that there was no significant difference in terms of these characteristics between the 2 groups ($P>0.05$) (Table 1). Moreover, both groups were compared in terms of qualitative data using Chi-square and Fisher test. There was no significant difference in the other variables ($P>0.05$) except for marital status and family history of osteoporosis, i.e. the 2 groups were similar (Table 2).

The independent *t*-test indicated no significant difference in the mean score of the perceived benefits and barriers, perceived self-efficacy, planning, competing demand, and social support for preventive behaviors of osteoporosis before the intervention ($P>0.05$). However, the mean score of commitment revealed a significant difference ($P<0.05$). Covariance analysis after adjustment of the scores of commitment before intervention showed that the difference between the scores of both groups was

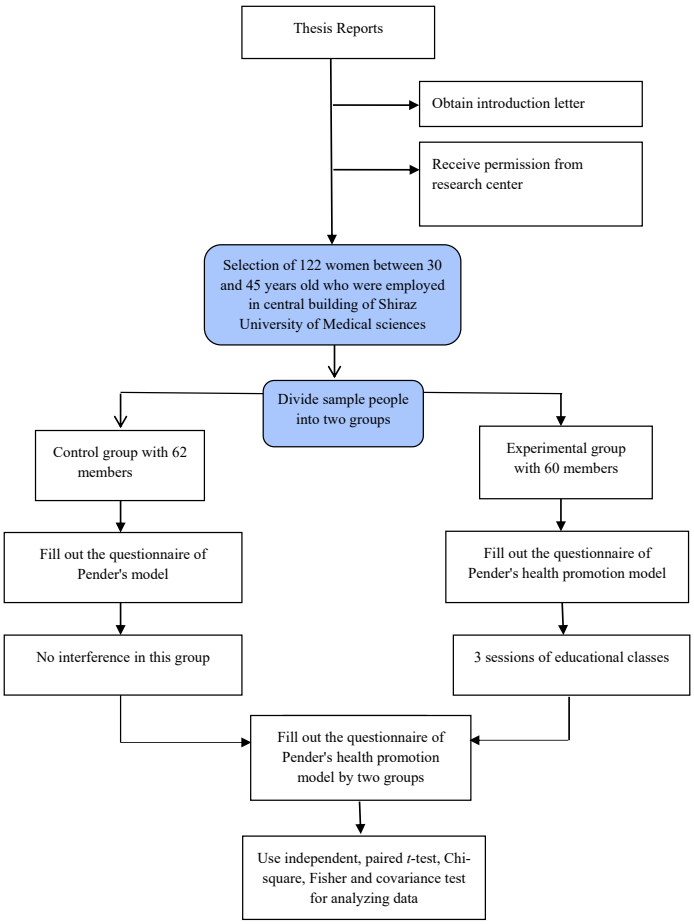

Figure 1. Flowchart of the Study Procedure.

statistically significant (P<0.001) (Table 3).

Further, independent t-test demonstrated that there is a significant difference between the mean score of the perceived benefits and barriers, perceived self-efficacy, planning, competing demand, and commitment after the intervention (P<0.05), except for social support (P>0.05) (Table 4).

The paired t-test measured the mean score of the sixth subscales of this questionnaire before and 2 months after the training separately in each group. It indicated that there was a significant difference in the mean score of the

Table 1. Comparison of the Demographic Characteristics in Experimental and Control Groups

Variable	Group		*P* Value
	Experimental (n=62) (Mean±SD)	Control (n=60) (Mean±SD)	
Age	37.38±4.52	37.58±4.37	0.8
Pregnancy	1.18±0.86	1.14±1.04	0.85
Children	0.93±0.86	1.11±1.04	0.3
Height	161.45±5.09	162.40±4.07	0.29
Weight	63.40±9.21	63.95±7.26	0.71
BMI	24.35±3.65	24.29±2.98	0.92

Table 2. Comparison of the Qualitative Data in Experimental and Control Group

Variable	Groups				*P* Value
	Experimental (n=60)		Control (n=62)		
	No.	%	No.	%	
Osteoporosis background in family members					
Yes	30	50	21	33.9	0.224
No	28	46.8	41	66.1	
Hypo or hyperthyroidism					
Yes	14	23.3	18	29	0.219
No	45	75	44	71	
Oophorectomy					
Yes	0	0	0	0	0.32
No	60	100	62	100	
Corticosteroids usage background					
Yes	16	26.7	14	22.6	0.52
No	42	70	48	77.4	
Supplementary calcium usage background					
Yes	18	30	26	41.9	0.53
No	41	48.3	34	54.8	

Table 3. Comparison of the Subscales of Pender's Model in the Experimental and Control Groups Before Intervention

Subscales	Groups		*P* Value
	Experimental (Mean± SD)	Control (Mean± SD)	
	Before Intervention	Before Intervention	
Perceived benefits and barriers	39.56 ±4.06	39.19± 6.35	0.69
Perceived self-efficiency	17.18± 2.65	17.79± 3.14	0.25
Programming	10.05± 2.15	10.64± 2.36	0.14
Competing demand	3.25± 0.79	3.22± 1.06	0.88
Commitment	8.78± 1.49	9.41± 1.51	**0.021**
Social support	11.15±2.52	11.46± 2.67	0.5

Table 4. Comparison of the Subscales of Pender's Model in the Experimental and Control Groups After Intervention

Subscales	Groups		*P* Value
	Experimental (Mean± SD)	Control (Mean± SD)	
	After Intervention	After Intervention	
Perceived benefits and barriers	42.63 ±4.67	38.59± 5.73	0.001
Perceived self-efficiency	18.76± 1.85	17.61± 3.08	0.01
Programming	12.23± 2.10	10.74± 2.11	0.001
Competing demand	3.81± 0.39	3.29± 0.98	0.001
Commitment	10.23± 1.53	9.50± 1.49	0.008
Social support	11.31± 2.30	11.58± 2.67	**0.056**

experimental group after training in comparison with the control group (P<0.001) (Table 5).

Table 5. Caparison of the Mean Difference in the Scores of the Subscales of Pender's Model Before and After Intervention in Experimental and Control Groups

Subscales	Groups	
	Experimental (n=60)	Control (n=62)
	P-Value	*P*-Value
Benefits and barriers	0.001	0.18
Self-efficiency	0.001	0.48
Programming	0.001	0.54
Competing demand	0.001	0.1
Commitment	0.001	0.56
Social support	0.64	0.43

Discussion

As stated earlier, no significant difference was observed between the 2 groups in terms of demographic information. On the other hand, a significant increase was observed in the perceived benefits and barriers of preventive osteoporosis behaviors after the intervention. This study suggests that more women understand the benefits of preventive behaviors while a few of them understand the barriers of these behaviors in their lives. Amini et al stated that there is a certain relationship between perceived benefits and quitting smoking among the youth (23). In addition, in Australia, Fary et al stated that there was a significant relationship between perceived benefits and physical activities (24). Sharifirad et al revealed that by reducing perceived barriers, fewer teens started smoking (25). Indeed, most studies have shown the importance of perceived benefits and barriers in people's lifestyles or exercises, while the present study illustrated the significance of perceived benefits and barriers in preventive behaviors of osteoporosis.

The scores of perceived self-efficiency in the present study confirmed that its level was rather low for females to perform physical activities and have adequate calcium intake. However, after the training, the perception of females about their own self-efficacy increased significantly. The study conducted by Sedlak et al suggested that subjects in that study had a lower self-efficacy (26). In a study by Cho and Lee, there was a statistical difference in the perceived self-efficiency after intervention (P<0.001) (27). Therefore, our results are in line with previous studies in this regard. Obviously, the subjects had a low level of self-efficacy during their lives and they needed to improve their perception of their own self-efficacy through effective training.

It seems that educational interventions in planning for the preventive behaviors of osteoporosis such as using calcium or doing physical activities on a regular basis were beneficial in the experimental group. Tayari also reported that planning for exercises in the experimental group increased significantly after the intervention (28).

The results indicated that training could increase competing demand in the experimental group. However, Tayari reported that there was no significant difference in the experimental group before and after the intervention in behaviors substituted with sports (28). Accordingly, the present study revealed new results in this regard based on Pender's model.

The results of the present study suggested that before training, the level of commitment was low in individuals at high risk for developing osteoporosis, however, after the training, it increased substantially. Keegan et al reported that the commitment, which was related to physical activities, can predict damage which might occur after exercise. In addition, social support, self-efficacy and perceived benefits are the most powerful predictors of commitment to exercise and physical activity (29).

Social support, as a factor associated with physical activity level, is an important determinant of these behaviors in people (30). In this study, the mean score of this subscale

was average and indicated no considerable rise after the training. It seems that in our culture, preventive behaviors such as exercise and healthy nutrition, as part of healthy lifestyles, are not yet known. Accordingly, others do not recommend these behaviors to people. On the other hand, Cho and Lee conducted several analyses and found that the development of intervention strategies, which increase the awareness of others' culture and self-efficacy and enhance supports for immigrant women, can increase physical activity among Chinese immigrants (27). Further, Wu and Pender concluded that social support can both directly and indirectly affect the behaviors of physical activity (31). The results of other studies were incongruent with the findings of this study. Therefore, it can be concluded that if women's families are instructed as well, it is more likely to achieve similar outcomes. It can also enhance families' support to promote preventive behaviors of osteoporosis among females.

Conclusions

According to the findings of this study, it can be deduced that the design and application of Pender's health promotion model were effective and useful for preventive behaviors of osteoporosis before menopause in women. Considering the fact that a large body of research focused mostly on other parts of this model, the results of the present study are novel and different in this regard. Therefore, it is vital that people are aware of the significance of this model for behaviors which seem to prevent osteoporosis.

Limitations

The small sample size of this study was related to the few numbers of employed women who were at the age of 30-45. Moreover, since a great deal of research has been conducted mostly on other parts of Pender's model, there were few studies revealing similar results about preventive behaviors of osteoporosis by this model.

Conflict of Interests

Authors declare that they have no conflict of interests.

Ethical Issues

The ethical issues in this study involved receiving the informed consent of women in research, the approval of Shiraz University of Medical Sciences, confidentiality of data collected from women, and providing the training scheme for the control group after completion of the research. This study was derived from a Master's thesis conducted in Fetemeh College of Nursing and Midwifery. This study was approved by the Ethics Committee of Shiraz University of Medical Sciences (CT-9376-7416).

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