The predictors of osteoporosis preventive behaviors in women based on health belief model

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Abstract

Osteoporosis, as a disease, is characterized by low bone mass and micro architectural deterioration of bone tissue. The aim of this study was to survey the predictors of osteoporosis preventive behaviors based on health belief model. This cross-sectional study was carried out on 401 randomly selected women referring to health centers. Data collection was based on health belief model. The employed instrument was confirmed by a panel of experts. Content validity ratio, content validity index, face validity, and exploratory factor analysis were used to determine the validity of the tool. Test-retest internal consistency was employed to determine the reliability. The mean age of women was 40.9±6.2 years. The variables of perceived susceptibility, motivation for walking behavior and variable of perceived sensitivity for nutrition behavior were predicted. The walking performance had a significant association with perceived susceptibility and motivation, the nutritional performance had a significant positive association with perceived susceptibility and self-efficacy and a negative correlation with perceived barriers. The variables under study explained 29.1% of the variance in walking behavior and 20.2% of the variance in nutrition behavior in osteoporosis prevention. This study indicated health belief model is capable to predict nutrition and walking behaviors for the prevention of osteoporosis. Hence, this model can be used as a framework for designing and implementing educational interventions for the prevention of osteoporosis in women.

Keywords: Behavior, Nutrition, Osteoporosis, Women

Introduction

Osteoporosis is a disease characterized by decreased bone density and loss of bone microarchitecture quality which in turn leads to an increased risk of fracture. Bone density and bone mass reduce very slowly and hence, most symptoms cannot be seen until the first fracture occurs. This disease is one of the main causes of disability and mortality in adults [1]. Nowadays, osteoporosis is considered an important health issue and has been called the silent disease of the century. It is an asymptomatic disease and its complications

(fractures) can impose high and irreparable physical and financial losses to the society and patients [2]. This disease is a serious health problem in health care facilities in developed and developing countries [3].

The years between 2000 and 2010 was entitled by World Health Organization as Bone and Joint Decade (BJD) which concerns BJD such as osteoporosis. It was also reported as the fourth main enemy of the human after heart failure, stroke, and cancer [4] and the most common cause of fractures in the world [5].

Women are 8 times more at risk of osteoporosis than men [6] so that, about 200 million women worldwide suffer from the disease [7]. Bone mass in women in all age groups is significantly less than men of the same age and race [8]. In both sexes, peak bone mass is achieved by age 30 and then bone mass gradually decreases with the increase in age. Therefore, the purpose of prevention programs is to maintain bone mass in the 30 to 50 year age group [9]. This group of people assumes the responsibilities of life and pays less attention to their health. They play a key role in managing their families' health; therefore, their mortality, disability, and behavior affect different aspects of health and behavior of their families [10].

In Iran, the national program for prevention, diagnosis, and treatment of osteoporosis reported that 70% of women and 50 percent of men over 50 suffer from osteoporosis and osteopenia [11].

In a study in Fars province, Iran, the prevalence of osteopenia and osteoporosis in a population based on T-score for spinal cord segments was recorded respectively as 42% and 24% in the back, 46% and 10% in femoral neck, and 48% and 6% in the entire femur [12]. A study carried out in Fasa demonstrated that 34.1% of women were with osteoporosis [13,14].

Good nutrition can maintain bone mass and strength in young people and adults. Varied and enjoyable diets that are rich in calcium can increase bone strength and improve quality of life at any time [15].

Regular physical activity not only contributes to bone health, but also it increases muscle strength, creates balance and harmony in the body and has a direct impact on the overall health of the body [16]. Exercises and physical activity are recommended as non-medical interventions that can increase bone density in young age and prevent loss of bone mass in middle age. The disease is preventable and curable. An important point in preventing osteoporosis is to take correct thinking, lifestyle, and daily habits in order to improve the quality and efficiency of individuals [17,18]. Therefore, teaching preventive behaviors such as physical activity and correct nutrition as a simple and efficient method can help disease prevention and health promotion and preservation. One of the most important global health goals is that of increasing the number of women trained in the area of osteoporosis [19].

To this end, identifying factors affecting behavior change can make changes easier. Therefore, investigation on factors affecting the adoption of osteoporosis preventive behaviors among women using models that identify factors affecting behavior is necessary. Researchers have used such models to change their subjects' behavior of the models. Among models effective in health education and promotion are the Health Belief Model (HBM) and Social Cognitive Theory. A common cause for rejection of preventive behaviors of osteoporosis is the false belief that the disease is not serious. Based on HBM, people change their behavior when they understand that the disease is serious, otherwise they might not turn to healthy behaviors [20]. The constructs of the HBM include perceived severity, perceived susceptibility, perceived benefits, perceived barriers, modifying variables, cues to action, and self-efficacy.

Perceived susceptibility was used in this study to evaluate women's perception about the extent to which they are at risk of osteoporosis. In addition, their Perceived Severity of osteoporosis complications is measured. The sum of these two factors is the women's perceived risk of the disease.

Other constructs include the perceived benefits and barriers, i.e. 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. These factors alongside women's perceived ability to carry out preventive behaviors and cues to action, i.e. incentives that affect women within and outside the family such as friends, doctors, health care providers, media and educational resources, their fear of osteoporosis complications, and a sense of inner peace achieved in seeking preventive behaviors can lead women towards complying with preventive behaviors of osteoporosis. According to what mentioned above, the present study aimed to predict preventive behaviors of osteoporosis in women based on the health belief model.

Method

This study is a cross-sectional research. The participants included 401 women aged 30 to 50 refereeing to wellness centers in Fasa, Iran. To select the participants, two urban wellness centers in Fasa were randomly selected. Simple random sampling was carried out according to numbers of maternal health records in the centers. The subjects were invited to a wellness center and signed the informed consent. Women suffering from disability, disease, or any other problem that prevented them from participating in the study were excluded. The prevalence of osteoporosis in the study population was 34.1 [13]. Therefore, according to the significance level of 0.05 and confidence level of 95%, 401 participants were chosen as the participants.

In this study, a questionnaire was developed by the researchers according to the Health Belief Model and constructs of self-regulation and social protection from Social Cognitive Theory. The questionnaire consisted of the following parts:

The first part included demographic questions on age, BMI, education level, marriage, occupation, household income, delivery times, breastfeeding, smoking, as well as personal history of osteoporosis, familial history of osteoporosis, history of a special disease, and history of bone densitometry.

The second section included questions related to the constructs of Health Belief Model and social support and self-regulation. This section consisted of 23 questions on knowledge; 4 questions on perceived susceptibility (women's opinion about chances of getting osteoporosis); 6 questions on perceived severity (complications due to osteoporosis); 8 questions on perceived benefits (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 motivation (such as motivation to receive health advice and conduct periodic examinations for prevention of osteoporosis); 5 questions on self-efficacy (including the ability to do exercises and observe proper diet). The questions on self-efficacy included 1 question on external cues to action for prevention behaviors of osteoporosis from family and friends, doctors and health workers, mass media, books and magazines, the internet, and other patients with osteoporosis; and 3 questions on internal factors including the fear of suffering from complications of osteoporosis and a sense of inner peace following preventive behaviors). All questions were based on the standard 5-point Likert scale ranging from strongly disagree to strongly agree (scores of 0 to 4). Scores of questions on external support were calculated as cumulative frequency. The third section includes questions on nutritional performance and exercise, i.e. walking. Performance questions consisted of 10 questions about the type and amount of food consumed during the past week (score from 0 to 14). Exercise questions included 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. The overall reliability of the instrument based on

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, 0.77 for motivation, 0.79 for self-efficacy, and 0.77 for cues to action. Since the alpha values calculated for each of the constructs studied in this research were higher than 0.7, their reliability levels are acceptable. For ethical considerations, permissions were obtained from ethics committee of Fasa University of Medical Sciences and Fasa wellness centers. The aims and significance of the study were explained to the subjects and their written consents were obtained. The sample was assured that the information would remain confidential. Data analysis was carried out by SPSS 16 using descriptive statistics (mean and standard deviation) and inferential tests including Pearson's correlation coefficient, multivariate linear regression, ANOVA, and t-test. The significance level was set at 0.05. After an extensive literature review, the required instrument was developed and its validity and reliability were confirmed according to comments obtained from a panel of experts and specialists in health education and promotion, biostatistics, and orthopedics. Face, content, and construct validity were confirmed via calculating Content Validity Ratio (CVR), Content Validity Index (CVI), and exploratory factor analysis. Test-retest internal consistency method was used to determine the reliability. The final version of the instrument was used after ameliorating ambiguities. The validity was evaluated with an item CVI of higher than 0.15, and CVR of higher than 0.79 based on exploratory factor analysis divided into 7 factors.

Results

The mean age of women under the subject of study was 40.9 ± 6.2 years. The participants' average BMI was 23.47 ± 3.67; and their average number of deliveries was 2.93 ± 1.55. Eighty five percent of the subjects were homemakers and others were employed. Regarding education level, 50.1 percent had high school diploma or above and regarding marital status, 91.5 percent of them were married.

The results showed a significant relationship between nutritional behavior with age, number of deliveries, employment, level of education, and breast feeding status ($p<0.05$). However, it had no significant relationship with smoking, history of osteoporosis, family history of osteoporosis, history of especial diseases, history of bone densitometry, average household income, and BMI.

The results showed that there is a significant relationship between walking behavior and average BMI and history of osteoporosis ($p<0.05$), although it had no significant relationship with buttock size, marital status, smoking, education, family history of osteoporosis, history of especial disease, history of bone densitometry, average household income, job, number of deliveries, and status of breast feeding.

The mean score of nutritional behavior for preventing osteoporosis was 9.46 ± 3.28 and the mean score of walking performance was 13.48 ± 3.89. The mean score was 7.62 ± 2.25 for knowledge; 11.71 ± 2.12 for perceived susceptibility; 16.56 ± 4.43 for perceived severity; 4.49 ± 24.49 for perceived benefits, 17.13 ± 5.74 for perceived barriers; 13.02 ± 2.19 for motivation; 15.72 ± 2.68 for self-efficacy; and 9.47 ± 1.65 for internal cues to action.

Table 1 shows the relationship between health belief model (HBM) constructs and osteoporosis preventive behaviors among women under study. Regarding the relationship between the model constructs and walking and nutritional behavior, correlation coefficients show that there is a significant relationship between walking behavior and perceived susceptibility ($r=0.136$ and $p=0.007$), and motivation ($r=0.120$ and $p=0.016$). However, nutritional behavior had a significant positive relationship with perceived susceptibility ($r=0.068$ and $p=0.003$) and self-efficacy ($r=0.039$ and $p=0.042$) and a significant negative relationship with perceived barriers ($r=0.047$ and $p=-0.050$).

External cues to action among the subjects

Table 1 *Relationship between health belief model (HBM) constructs and osteoporosis preventive behaviors*

		Nutritional behavior	Walking behavior
Perceived susceptibility (0-16)	r	0.068	0.136
	p	0.003	0.007
Perceived severity (0-24)	r	0.047	-0.026
	p	0.351	0.599
Perceived benefits (0-32)	r	-0.029	0.012
	p	0.557	0.818
Perceived barriers (0-28)	r	-0.047	-0.077
	p	0.050	0.121
Motivation (0-16)	r	-0.005	0.120
	p	0.913	0.016
Self-efficacy (0-20)	r	0.039	-0.026
	p	0.042	0.607
Cues to action (0-12)	r	0.008	-0.040
	p	0.873	0.423
Knowledge (0-23)	r	0.003	0.047
	p	0.953	0.349

regarding nutritional and walking behaviors for prevention of osteoporosis included family (n=283; 70.6%), books (n=171; 42.6%); journals and periodicals (n=134; 33.4%); doctors and health care workers (n=100; 24.9 percent); TV (n=96; 23.9%); osteoporosis patients (n=20; 5%) and the internet (n=6; 1.5%). Multiple linear regression analysis was used to investigate the degree to which the subjects' nutritional behavior was predicted by the health belief model constructs and other variables. Overall, 29.1% of the variance in walking behavior and 20.2% of the variance in nutritional behavior directed at prevention of osteoporosis was predicted by these variables.

Table 2 *Regression analysis for predicting the osteoporosis preventive behaviors among women in Fasa*

Variable	P	B	Beta	Dependent variable	P	B	Beta	Dependent variable
Employment	-0.063	0.685	0.249		0.086	0.794	0.122	
Education	-0.022-	-0.173	0.685		-0.040	-0.26	0.473	
Marital status	-0.044	-0.621	0.382		-0.056	-0.66	0.280	
Age	-0.046	-0.029	0.365		-0.106	-0.05	0.044	
BMI	-0.126	-0.134	0.012		0.006	0.005	0.909	
Perceived Susceptibility	0.137	0.252	0.007	Walking behavior R^2= 0.291 R^2 Adjusted = 0.047	0.085	0.10	0.020	Nutritional behavior R^2= 0.202 R^2 Adjusted = 0.001
Perceived severity	-0.049	-0.043	0.340		0.064	0.047	0.224	
Perceived benefits	0.012	0.010	0.810		-0.036	-0.02	0.478	
Perceived barriers	-0.046	-0.031	0.366		0.026-	-0.01	0.613	
Motivation	0.132	0.235	0.009		-0.014	-0.02	0.780	
Self-efficacy	0.028	0.040	0.583		-0.040	-0.05	0.445	
Internal cues to action	-0.053	-0.125	0.304		0.013	0.026	0.807	
Knowledge	0.034	0.058	0.500		-0.005	-0.007	0.928	

The predictive power of perceived susceptibility and motivation was higher for walking behavior and the predictive power of perceived susceptibility was higher for nutritional behavior (Table 2). This study showed that age, number of deliveries, job, breast feeding

status, and educational level were associated with nutritional behavior; and mean BMI and history of osteoporosis were associated with walking behavior.

Discussion

This study showed that age, number of deliveries, occupation, education, and breastfeeding are associated with nutritional performance; and BMI and history of osteoporosis are associated with walking performance. These variables are important factors affecting the incidence of osteoporosis and behaviors that prevent this disease. This finding is consistent with the results of studies by Lesan [21], Hatamzadeh [22], Sayed-Hassan [23], Hsieh [24], and Chang [25]. The results of the present study showed that there is no significant relationship between nutritional performance and walking performance with marital status, smoking, familial history of osteoporosis, personal history of special diseases, record of bone densitometry, and the average household income. This is in agreement with the results of Hatamzadeh [22], Sayed-Hassan [23], and Lesan [21] that showed no significant relationship between marital status, family history of osteoporosis, and nutrition performance for the prevention of osteoporosis.

In this study, women had a moderate performance in nutritional and walking exercise performance for osteoporosis prevention. The results of this study are consistent with those of other researches [21,26,27]. The relatively good performance of women can be attributed to their high level of education. On the other hand, 30- to 50-year old women play a key role in managing the health of their families and are mainly responsible for cooking in the family. They mostly have good physical conditions for exercise.

Performance (nutrition and walking exercise) had a significant relationship with the subjects' perceived susceptibility. They felt susceptible to osteoporosis. In Doheny study, subjects had higher perceived susceptibility for bone mass density test [28]. In Edmonds' study,

individuals had low perceived susceptibility for calcium intake [29]. People will be successful in preventing osteoporosis if they have the motivation to change undesirable behavior and maintain good behavior. In this study, there was a significant relationship between walking behavior and motivation. Baumeister also suggests the important role of motivation in behavior [30]. In Mcleod's review study, motivation was an important factor in doing osteoporosis preventive behaviors [31].

The results of this study showed that high self-efficacy could lead to better nutritional behavior. The results of a study by Rachelle carried out to investigate the relationship between health beliefs and behaviors in the prevention of osteoporosis among postmenopausal women showed that self-efficacy was positively related to the amount of calcium intake [32]. Hsieh found a significant relationship between nutritional behavior and self-efficacy [24].

In this study, a significant negative association was found between nutritional behavior and perceived barriers. In other words, higher perceived barriers among subjects led to a worse performance. Major barriers to nutritional behavior include high prices and unavailability of calcium containing foods. In the study of Sayed-Hassan, a significant association was found between nutritional behavior and perceived barriers [23], conversely, in the study conducted by Edmonds, calcium intake had the lowest number of perceived barriers [29].

The highest level of cues to action came from families that played an effective role as a source of information as well as support regarding eating behaviors and walking. They provided the necessary resources and directed the subjects to conduct bone densitometry. They can also play a vital role in providing educational programs.

In this study, 29.1% of the variance in walking behavior and 20.2% of the variance in nutritional behavior for prevention of osteoporosis was predicted by health belief

model constructs.

In Hyejin's study on female students, 6.7% of the variance in the osteoporosis preventive behavior was predicted by health belief model constructs [33]. In another study conducted on students in Yazd, 29% of the variance was predicted by health belief model constructs [34]. Therefore, it can be concluded that the structure of the model can be used as a reference framework for designing educational interventions aimed at training osteoporosis preventive behaviors among women.

This study showed that perceived susceptibility and motivation are the most important predictors of walking and nutritional behaviors for osteoporosis prevention.

According to HBM, when people feel at risk of a disease, they will engage in preventive behaviors. Doheny showed that perceived susceptibility is an important predictor of behaviors such as exercise [28].

Conclusion

Due to the sensitivity and vulnerability of women and the importance of social support and self-regulation behavior, the need for providing a fundamental solution and proper planning to prevent osteoporosis is felt. Providing educational programs in this regard for family members, physicians, and other health personnel and also offering training programs in radio and television broadcasting is essential. One of the limitations of the study is that its findings are for 30 to 50 year old women referring to wellness centers in Fasa and cannot be generalized to all women, especially older ones who have a higher rate of osteoporosis.

Contribution

Study design: AKhJ, AH, MHK
Data collection and analysis: AKhJ, EH
Manuscript preparation: AKhJ, AH, MHK, EH

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