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Physical Activity on Osteoporosis Prevention in Women: A Randomized Clinical Trial.

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ABSTRACT

Osteoporosis is a common metabolic bone disease that causes bone fracture. The aim of this study was to determine the impact of physical activity to preventive behaviors of osteoporosis in women referring to health centers in Hamadan city, Iran, 2015. This randomized clinical trial was conducted among 80 women, which were allocated randomly into two forty-member groups of case and control. Written informed consent was obtained from all participants. Four educational session classes were performed in the case group. The through three stages (before intervention, immediately after intervention, and two month after intervention) these groups were evaluated. Analyzing the data was performed by SPSS/18, using T test, x^2, Fisher, repeated measurement test. P-value < 0.05 was regarded as significant. There was no significant difference between the two groups in demographic characteristics. No significant differences between the mean scores of the various structures of this model were observed among the two groups before the intervention. Mean scores of the various structures of the model about physical activity were increased significantly in the case group over time after intervention ($P < 0.05$). The present study confirmed the positive effects of education of physical activity on women's knowledge, beliefs and performances about prevention of osteoporosis. Further research is required to establish the role of physical exercise as protective factor on osteoporosis.

Keywords: Physical activity; Prevention; Osteoporosis; Women

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INTRODUCTION

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical inactivity (lack of physical activity) has been identified as the fourth leading risk factor for global mortality (6% of deaths globally). Moreover, physical inactivity is estimated to be the main cause for approximately 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of is chaemic [1, 2]

Regular and adequate levels of physical activity in adults: reduce the risk of hypertension, coronary heart disease, stroke, diabetes, breast and colon cancer, depression and the risk of falls; improve bone and functional health; and are a key determinant of energy expenditure, and thus fundamental to energy balance and weight control.

The term "physical activity" should not be mistaken with "exercise". Exercise, is a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective. Physical activity includes exercise as well as other activities which involve bodily movement and are done as part of playing, working, active transportation, house chores and recreational activities. Increasing physical activity is a societal, not just an individual problem. Therefore it demands a population-based, multi-sectoral, multi-disciplinary, and culturally relevant approach [3].

Regular physical activity is one of the most important things you can do for your health. It can help control weight, reduce risk of cardiovascular disease, reduce risk of diabetes, reduce risk of some cancers, strengthen bones and muscles, improve mental health and mood, improve ability to do daily activities and prevent falls, and increase chances of living longer. The moderate-intensity aerobic activity, like brisk walking, is generally safe for most people. Regular physical activity can reduce risk of developing type 2 diabetes and metabolic syndrome. Metabolic syndrome is a condition in which you have some combination of too much fat around the waist, high blood pressure, low HDL cholesterol, high triglycerides, or high blood sugar. Research shows that lower rates of these conditions are seen with 120 to 150 minutes (2 hours to 2 hours and 30 minutes) a week of at least moderate-intensity aerobic activity. As increasing age, it's important to protect bones, joints and muscles. Not only do they support body and help to move, but keeping bones, joints and muscles healthy can help ensure that able to do daily activities and be physically active. Research shows that doing aerobic, muscle-strengthening and bone-strengthening physical activity of at least a moderately-intense level can slow the loss of bone density that comes with age. Hip fracture is a serious health condition that can have life-changing negative effects. But research shows that people who do 120 to 300 minutes of at least moderate-intensity aerobic activity each week have a lower risk of hip fracture. Regular physical activity helps with arthritis and other conditions affecting the joints. If there was arthritis, research shows that doing 130 to 150 (2 hours and 10 minutes to 2 hours and 30 minutes) a week of moderate-intensity, low-impact aerobic activity can not only improve ability to manage pain and do everyday tasks, but it can also make quality of life better. Build strong, healthy muscles. Muscle-strengthening activities can help increase or maintain muscle mass and strength [2].

Osteoporosis is an osteometabolic disease characterized by substantial loss of bone mass and microarchitecture deterioration of bone tissue, affecting bone quality and strength and increasing fracture risk. Fractures affect the muscle and the skeletal systems, cause chronic pain, loss of functional capacity and compromise quality of life [4].

Osteoporosis is a global health issue, since there are around 200 million people with this disease in the World. Only in the United States, its prevalence will reach 14 million people in 2014. Pharmacological strategies as the use of anti resorptive and anabolic agents that may increase bone mineral density (BMD) and reduce the risk of osteoporotic fractures can be rather expensive. However, general measures of prevention and treatment such as calcium and vitamin D supplementation, the guidance for fall prevention and the practice of specific physical exercises, can be instituted before the manifestation of the disease and may promote other health benefits [4].

Bone tissue is continuously remodeled, and as a dynamic tissue, it adapts and responds to various stimuli, such as physical exercise and mechanical vibration. During physical activity mechanical forces can be

exerted on bones through ground reaction forces and by the contractile activity of muscles, resulting in maintenance or gain of bone mass. Studies have already pointed out many of the mechanical stimuli that are beneficial to bone tissue, including some physical activities as aquatic and ground exercises. However, it is not yet fully clarified which would be the best environment, activity type, intensity, frequency or duration of physical exercise to contribute with bone health of postmenopausal women. Moreover, the objectives of this article are to present the most important and latest findings on literature about physical activity in the prevention and treatment of postmenopausal osteoporosis [5].

Osteoporosis is a systemic skeletal disorder characterized by reduction of one mass, deterioration of bone structure, increasing bone fragility, and increasing fracture risk. Prevention of osteoporosis in women is one of the most important issues in World Health Organization. Osteoporosis is one of the recent century disasters. It is a disease that millions of people around the world suffer from it. This silent epidemic disease of present age has no symptoms before its first show with a bone fracture unless it is prevented and cured, and approximately one – fifth of women with osteoporosis are diagnosed through bone fracture [5]. The expanded health belief model appears to be useful in predicting osteoporosis prevention behaviors in adolescent girls. Interventions should focus on identifying barriers to calcium consumption and physical activity and increasing beliefs in the ability overcome them [6].

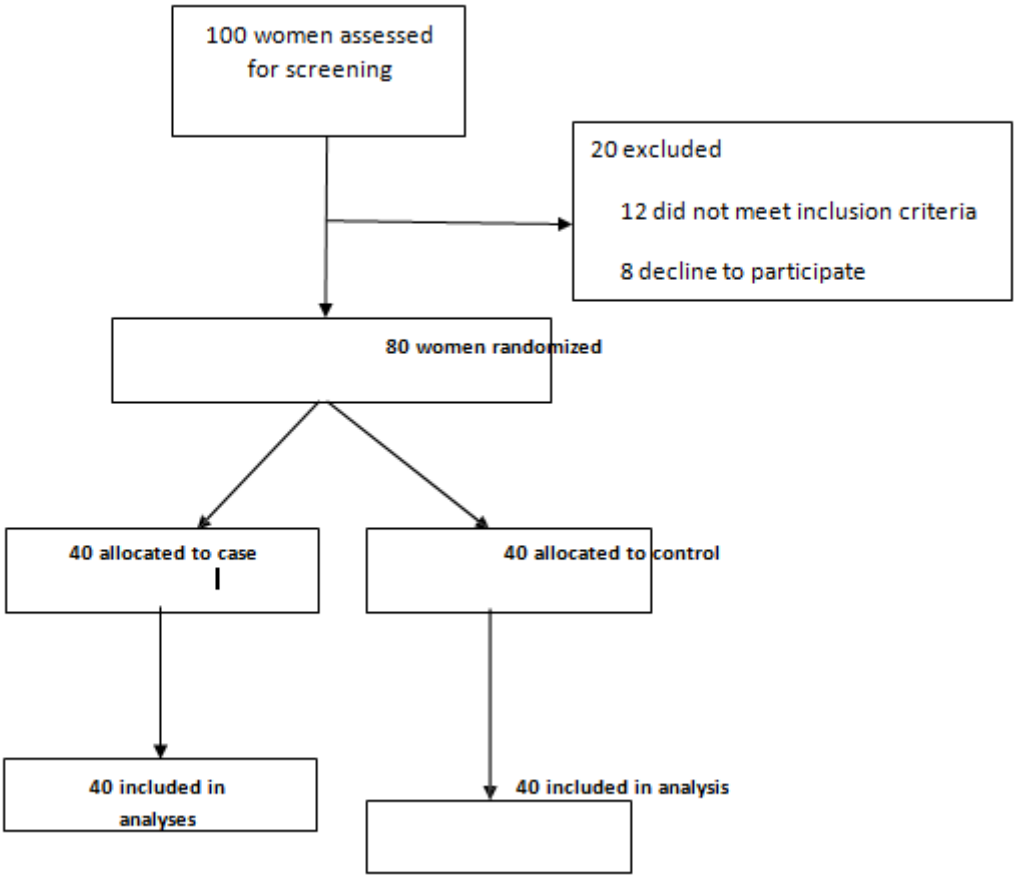

Figure 1: Flowchart of progress through the trial

A meta-analysis conducted in Iran by Irani et al. showed that, the prevalence of osteoporosis in lumbar spine was 0.17 (95% CI: 0.13, 0.20) and that of osteopenia was 0.35 (95% CI: 0.30, 0.39). The prevalence was higher in older age groups, in women, and in the northern areas of the country, with an increasing trend in recent years [7]. Today, osteoporosis is a major threat in the world and its annual deaths are more than that of various types of cancer [8]. Prevalence of the disease among women is on the rise; Roughly, one out of every three women and one out of every 12 men have osteoporosis [5]. Gender,

menopause, race, skeleton size, abuse of substances such as cigarettes, caffeine, alcohol, etc, reducing the amount of estrogen, early menopause (before age 45) , reducing calcium intake and physical inactivity are the main risk factors of this disease. Family history of bone fracture as well as taking glucocorticoids over 6 months, inherited diseases and mal absorption syndrome are secondary causes of osteoporosis [9, 10]. The World Health Organization announced that osteoporosis as the fourth main enemy of mankind after stroke and cancer and the leading cause of bone fractures in the world [9, 11]. Based on studies in the field of osteoporosis in different parts of the world, nearly 75 million people in Europe, Japan and America are suffering from this disease. Osteoporosis decrease quality of life as much or more than diabetes mellitus, arthritis and lung disease [12, 13]. This figure is very similar to heart disease [14, 15]. Statistics show that about 10 million people in America are affected by osteoporosis and 34 million American people suffer from low bone mass [16]. The annual cost of osteoporosis - related fractures spent in England and America is estimated to be about 18 million dollars [12]. Various studies reported that 20 to 50% of bone densities changes are affected by life style, nutrition and physical activity, female aging, body fat and family history of bone fractures [11, 17-19].

Analysis of knowledge attitude and performance of individuals of different age and sex groups in the field of osteoporosis in Iran and the world reflects the fact that the knowledge, attitude and performance of these people is not desirable [9, 20, 21]. One of the most important measures educational interventions is choosing a model or theory on the basis of alignment of and the goal of model or theory with the goal of training programs.

Conditions of problem recognition and health education without program will be useless or ineffective [22]. Selecting a training model will lead to start the program and continue it in the right direction. The more the theoretical support for health needs exist, the greater will be the effectiveness of health education programs [23]. Regarding the subject of osteoporosis, the effectiveness of theory – driven educational interventions will be higher than routine educational interventions.

One of the educational models that are on the carpet is the health belief model (HBM).

This model emphasizes that person's perception creates motivation, movement and behavior. According to this model, For the adoption of preventive behaviors, individuals must first perceive the danger of osteoporosis (perceived susceptibility), then perceive the depth of the risk and seriousness of its different effects in physical, mental, social and economical dimensions (perceived severity) until they believe usefulness and applicability of preventive programs (perceived benefits) and finally take preventive action against osteoporosis. HBM as the main framework used in this study is an individual model of health behavior study that was founded by Ho Chbaun and Rosen stock in the 1950s in America and amended by Backer and Maiman [6]. This model plays a role in the prevention of disease and according to it, the decision and motivation of the person adopting a health behavior is due to three categories: personal perception, behavior modification and the likelihood of that behavior likely to lead to action, personal perception affects the disease perception as well as the outcome of the health behavior. Possibility of action has to do with factors which affect the probability of adopting appropriate behavior whereas modifying factors including demographic variables, perceived threat and action guide, play their roles after the appearance of personal perception [24-26]. The cause of applying this model was to explain the behavior of people who thought they would never get sick, so they didn't accept health issues. This model was originally developed to explain health Related behaviors. Using this model, one can design change strategies [22].

HBM is appropriate for the design and implementation of educational interventions in order to prevent disease [19]. There are barriers in adopting preventive behaviors of osteoporosis that prevent people from actions such as taking calcium. So removing these obstacles in training interventions need serious attention and emphasis. HBM is one of the few models that explore the concept of perceived barriers for doing health behaviors [24, 25]. These facts dictate an urgent need to address issues relevant to the prevention of osteoporosis. The aim of this study was to determine the impact of nutritional counseling based on health belief model (HBM) to preventive behaviors of osteoporosis in women referring to health centers in Hamadan city, Iran.

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METHODOLOGY

This randomized clinical trial was conducted was conducted to review the effect of nutritional counseling intervention on the knowledge, attitude and performance of women referring to health centers, Hamadan city in west of Iran. Hundred women expressed interest in the study. Twenty women were excluded due to failure to meet inclusion criteria or declining interest. Eighty women were stratified randomly in to two forty – member groups of case and control, in order to access a uniform sample in terms of social, economic and cultural conditions (Fig. 1). The recruitment took place between October 2014 and March 2015. Also, in order to prevent the information exchange between the two groups, only a case group or a control group was selected from each health centre. Finally, four health centers were considered as case groups and the other 4 centers were considered as control groups. A standard questionnaire was used to collect data based on the Health belief model [21].

The first part of the questionnaire was associated with demographic questions such as age, family size, age of menarche, history of Tobacco consumption, body mass index, pregnancy and lactation status, contraceptive use, previous use of oral supplements employment status, education level, income, marital status and family history of disease. To measure the knowledge in the field of osteoporosis, a questionnaire containing 25 questions with (α =0.60) was used. To measure the perceived susceptibility, the standard scale contained 6 questions with (α =0.70), to measure the perceived severity, 6 questions were used with (α =0.80, to measure the perceived benefits of adequate calcium intake 6 questions were used with (α = 0.77), to measure the perceived benefits of adequate calcium intake 6 questions with (α = 0.70) were used. The questions were designed as 5 option Likert scale raging in 4 dimensions (susceptibility, severity, benefits and barriers) from strongly disagree (= 1) to strongly agree (= 5). Scores of questions were calculated as cumulative frequency.

Physical Activity Questionnaire Items used include walking, cycling, swimming, running, training, basketball, volleyball, fitness, yoga, exercise, stretching, tennis, watching TV, computer work, studying and mountaineering. In this part of the participants were asked to count the days and weeks to minutes of physical activity time in the respective columns to write. After completing the questionnaire, the coefficient of 1 sports such as walking and sports such as running, volleyball and basketball was a coefficient of 2. And then by multiplying the two houses on each table (number of days of the week and the time in minutes) was calculated level of physical activity activities in participants.

According to the score obtained for different parts of the questionnaire (knowledge, perceived susceptibility, perceived severity, and perceived benefits of adequate calcium intake) the educational content was designed in accordance with the structures of the HBM. Educational content was prepared tailored to the research objectives and participant's educational needs (based on the pre – test).

The intervention included four 45-60 minutes education sessions about physical activities in the form of consulting (27, 28). The training sessions were held every week in the form of 8 player groups. Each session included a combination of lectures, group discussion, questions and answers and power point displays. Moreover, educational pamphlets were given to the participants at the end of the last session. Both groups were assessed immediately after counseling sessions (Second stage of intervention). We evaluated the two groups two months after the intervention in order to examine the behavior continuity and endurance of the given trainings (the third stage of intervention).

The control group did not receive any training and was only invited to the special sessions to fill out the questionnaires. However, due to ethical considerations, a training session on osteoporosis was held for this group after the completion of the study. At the end we compared the results obtained in these three steps and analyzed the collected data using.

The study was performed according to the Helsinki declaration protocol. The objectives of the study were explained to the women, and informed consent was obtained from all participants. Women could leave the study at any time. The study was approved by the Ethical Committee of Hamadan University of Medical Sciences (approval number: 9311205855).

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Analyzing the data was performed by SPSS/18, using T test, x^2, Fisher, repeated measurement test. P-value < 0.05 was regarded as significant.

RESULTS

Eighty participants were enrolled in this research. Table 1 demonstrates demographic and medical characteristics of participants. The two groups were similar at baseline. Kolmogorov-Smirnov test demonstrated that no significant differences were found between the groups on age, BMI, education, occupation, parity (P> 0.05). Mean age was 40.60±4.99 and 40.05±4.75 and mean menarche age was 13.18±0.98 and 13.18±1.21 years old in control and case groups, respectively.

Sedentary physical activities including yoga, Traction, Watching TV, Studying and Computer work were increased immediately and Two months after intervention (Table 1). Gym sports including Basketball, Volleyball, Aerobic, Tennis and fitness were increased immediately and Two months after intervention (Table 2). Physical activities including Mountaineering**,** Walking**,** Cycling**,** Swimming**,** Running and Exercising were increased immediately and Two months after intervention (Table 3).

No significant differences between the mean scores of the various structures of this model were observed among the two groups before the intervention (P> 0.05).

The results showed significant difference between the score of knowledge, perceived susceptibility, perceived severity, perceived benefits, and perceived barriers of people in the case group before and after intervention (p<0.001) whereas no significant difference was observed in control group.

The results show that the average energy in both test and control groups before intervention was not significantly different (P> 0.05). The results showed that immediately and two months after the intervention increased statistically significant in both case and control groups (P< 0.05). The expending energy in the control group before the intervention compared with immediately and two months later not no significant difference (P> 0.05). But the expending energy was in the experimental group immediately after the intervention (P <0.001) and two months after the intervention (P =0.002) in case group. The difference was statistically significant after intervention (P> 0.05).

However in performance, expending energy increased significantly two months after intervention in case group (p =0.002). This change was not observed in control group (Table 4). According to analysis of variance with repeated measures, the changes in mean score of women expending energy before, immediately after an 2 months after intervention was significant (p = 0.003, F = 26.47).

Table 1. Frequency of sedentary physical activity in participants

Sedentary physical activity	Before		Immediately after		Two months later	
	Case	Control	Case	Control	Case	Control
	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
yoga						
yes	2(5.0)	1(2.5)	2(5.0)	1(2.5)	1(2.5)	1(2.5)
No	38(95.0)	39(97.5)	38(95)	39(97.5)	39(97.5)	39(97.5)
Traction						
yes	13(32.5)	9(22.5)	16(40)	9(22.5)	21(52.5)	10(25.0)
No	27(67.5)	31(77.5)	24(60)	31(77.5)	19(47.5)	30(75.0)
Watching TV						
yes	38(95.0)	37(92.5)	39(97.5)	39(97.5)	40(100)	39(97.5)
No	2(5.0)	3(7.5)	1(2.5)	1(2.5)	0(0)	1(2.5)
Studying						
yes	29(72.5)	15(37.5)	27(67.5)	8(20)	1(2.5)	11(27.5)
No	11(27.5)	25(62.5)	13(32.5)	32(80)	39(97.5)	29(72.5)
Computer work						
yes	7(17.9)	9(22.5)	8(20.0)	8(20.0)	2(5.0)	6(15.0)
No	32(82.1)	31(77.5)	32(80.0)	32(80.0)	38(95.0)	34(85.0)

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Table 2. Frequency of gym sports in participants

Gym sports	Before		Immediately after		Two months later	
	Case	Control	Case	Control	Case	Control
	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
Basketball						
yes	1(2.5)	1(2.5)	1(2.5)	1(2.5)	1(2.5)	-
No	39(97.5)	39(97.5)	39(97.5)	39(97.5)	39(97.5)	40(100)
Volleyball						
yes	4(10.0)	3(7.5)	6(1.0)	-	1(2.5)	1(2.5)
No	36(90.0)	37(92.5)	34(85.0)	40(100)	39(97.5)	39(97.5)
Aerobic						
yes	2(0.5)	1(2.5)	2(5.0)	-	1(2.5)	1(2.5)
No	38(95)	39(97.5)	38(95.0)	40(100)	39(97.5)	39(97.5)
Tennis						
yes	3(7.5)	2(0.5)	1(2.5)	1(2.5)	-	1(2.5)
No	37(92.5)	38(95.2)	39(97.5)	39(97.5)	40(100)	39(97.5)
Fitness						
yes	2(5.0)	1(2.5)	2(5.0)	-	1(2.5)	-
No	38(95.0)	39(97.5)	38(95.0)	40(100.0)	39(97.5)	40(100.0)

Table 3. Frequency of physical activity in participants

Physical activity	Before		Immediately after		Two months later	
	Case	Control	Case	Control	Case	Control
	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
Mountaineering						
yes	12(30.0)	1(2.5)	16(40.0)	-	9(22.5)	-
No	28(70.0)	39(97.5)	24(60.0)	40(100)	31(77.5)	40(100)
Walking						
yes	37(92.5)	35(87.5)	38(95.0)	37(92.5)	39(97.5)	39(97.5)
No	3(7.5)	5(12.5)	2(5.0)	3(7.5)	1(2.5)	1(2.5)
Cycling						
yes	1(2.5)	-	3(7.5)	-	-	-
No	39(97.5)	40(100)	37(92.5)	40(100)	40(100)	40(100)
Swimming						
yes	1(2.5)	5(12.5)	2(5.0)	8(20.0)	5(12.5)	7(17.9)
No	39(97.5)	35(87.5)	38(95.0)	32(80.0)	35(87.5)	32(82.1)
Running						
yes	6(15.0)	6(15.0)	12(30.0)	2(5.0)	8(20.0)	4(10.0)
No	34(85.0)	34(85.0)	28(70.0)	38(95.0)	32(80.0)	36(90.0)
Exercising						
yes	16(40.0)	11(27.5)	23(57.5)	21(52.5)	26(65.0)	20(50.0)
No	24(60.0)	29(72.5)	17(42.5)	19(47.5)	14(35.0)	20(50.0)

Table 4. The mean score of expending energy in women of case and control groups before and after intervention

Expending energy(Kcal)	Case group (n=40)	Control group (n=40)	P- Value [a]
Pre intervention	302.00±374.44	333.00±289.87	0. 68
Two months after intervention	488.30±381.81	388.67±351.55	0. 02
Paired t-test, P value	0.002	0.767	

[a] Comparison between experimental and control (Independent t- test).

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DISCUSSION

Physical activity is any body movement that works your muscles and requires more energy than resting. Walking, running, dancing, swimming, yoga, and gardening are a few examples of physical activity. According to the Department of Health and Human Services' 2008 Physical Activity Guidelines for Americans physical activity generally refers to movement that enhances health.

Exercise is a type of physical activity that's planned and structured. Lifting weights, taking an aerobics class, and playing on a sports team are examples of exercise. Physical activity is good for many parts of your body. This article focuses on the benefits of physical activity for your heart and lungs. The article also provides tips for getting started and staying active, and it discusses physical activity as part of a heart healthy lifestyle.

Osteoporosis is a disease characterized by decreased bone density and loss of bone microstructure which can lead to an increased risk of fracture. Females are eight times more at risk of osteoporosis than males. Bone mass in females is significantly less than that of the males of the same age and race. In both sexes, the peak bone mass is achieved by the age of 30 years and then, the bone mass gradually decreases with the age increase. In a meta-analysis study in Iran, the overall prevalence of osteoporosis in lumbar spine was 17% and that of osteopenia was 35% [22]. One of the main ways to prevent osteoporosis in communities is using community based intervention strategies to reduce risk factors. This kind of intervention requires knowing knowledge, attitude and performance of the women in society.

This results showed that significant difference between the mean score of knowledge before and after the intervention in case group and their knowledge significantly increased after the intervention that was consistent with the other studies conducted by Khani et al. [29], Hazavehei et al. [30] Jeihooni et al. [22], and Gammage and Klentrou [6, 31]. The results also showed that perceived susceptibility, perceived severity, perceived benefits and perceived barriers of energy intake, significantly increased after intervention based on HBM. In the present study, the results were similar to the results of the research conducted by Ghafari et al., [5], and Naghashpour et al., [32].

Nikander and cols. (2014) observed that athletes who participate in aerobic non-weight bearing sports, as cyclists and swimmers, usually present lower BMD compared to the ones taking part in impact sports. The aerobic non-weight bearing sports generate high levels of muscle forces but with no impact forces, and this may be a sign that gravitational loading (impact) is really relevant to bone stimulation [33].

Several previous studies confirmed that implementing training programs could significantly affect people's beliefs regarding osteoporosis and its prevention [9, 34]. However, Tussing et al. [20] and Sanaeinasab et al. [24] presented that the perceived severity of the osteoporosis did not significantly develop after osteoporosis prevention education. Moreover, Jessup et al. [35] reported that exercise did not significantly affect the levels of self-efficacy regarding osteoporosis prevention in older women. A meta analysis of trials assessing lumbar spine bone mineral density showed no significant effects effects (weighted mean difference [WMD], 0.01 g/cm^2; 95% CI, −0.00 to 0.02; P = 0.05) regardless of the length of the intervention duration. Bone mineral density at the femoral neck increased after long intervention durations (6 mo to 1-2 y), although no significant effect could be seen when all trials assessing femoral neck BMD were taken into account (WMD), 0.01 g/cm^2; 95% CI, −0.00 to 0.01; P = 0.07). The effects of walking on the radius and whole body were not significant. Walking as a singular exercise therapy has no significant effects on bone mineral density at the lumbar spine, at the radius, or for the whole body in perimenopausal and postmenopausal women, although significant and positive effects on femoral neck bone mineral density in this population are evident with interventions more than 6 months in duration. This study confirmed that walking as a singular exercise therapy has no significant effects on BMD at the lumbar spine, at the radius, or for the whole body in perimenopausal and postmenopausal women, although significant and positive effects on femoral neck BMD are evident with interventions with more than 6 months in duration. It seems that only the impact of a brisk walking is not enough to stimulate spine BMD in ambulatory postmenopausal women [36].
Other study reported that HBM appears to be useful in predicting osteoporosis prevention behaviors in adolescent girls and interventions should focus on identifying barriers to calcium consumption and physical activity and increasing beliefs in their ability [6]. The findings of the present research are similar to those of the previously published studies and also support the effectiveness of physical activity education based on the HBM in improving the knowledge, attitude, and practice relating to energy expenditure among women.

The two key factors in preventing osteoporosis are to: increase peak bone mass that occurs prior to 20-30 years of age; and, decrease the rate of bone loss that occurs after the age of 40-50 years. Consistent evidence shows that weight-bearing exercise during youth contributes to increased peak bone mass1-3 and is important for the maintenance of bone health and minimizing the rate of bone loss later in life. The research suggests that peak bone mineral density (BMD) may be the single most important factor in delaying the development of the disease [3].

Other study reported that HBM appears to be useful in predicting osteoporosis prevention behaviors in adolescent girls and interventions should focus on identifying barriers to calcium consumption and physical activity and increasing beliefs in their ability [6]. The findings of the present research are similar to those of the previously published studies and also support the effectiveness of physical osteoporosis in women and revealed that policy makers should integrate osteoporosis prevention programs in the routine cares provided in all healthcare centers in Iran.

CONCLUSION

The present study confirmed the positive effects of education of physical activity on women's knowledge, beliefs and performances about prevention of osteoporosis. Further research is required to establish the role of physical exercise as protective factor on osteoporosis.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts interest in this article.

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