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Education Program Using Health Belief Model on Osteoporosis Preventive Behaviors among Women Attending Primary Health Care Centers

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Abstract: Background:Women of all ages are a population at risk for osteoporosis; the key prevention method for osteoporosis is that of the educational programs using a behavior change model.
Aim: This study aimed to evaluate the effect of the education program using the health belief model on knowledge and health beliefs towards osteoporosis prevention among women attending primary health care centers.
The research hypothesis:The experimental group women who involved in the education program will be expected to demonstrate higher levels of knowledge and stronger health beliefs of osteoporosis than the control group women who not involved.
Design:A quasi-experimental study.
Methods: The purposive sample included 200 women who were assigned into two groups.Experimental (N = 100) and control (N = 100) were selected from two family health centers. Two tools were used. 1) Women Structured Interviewing Questionnaire involving demographic characteristics and osteoporosis knowledge test (OKT). 2) Osteoporosis Health Belief Scale (OHBS).
Results:Post and follow-up program implementation, a significant increment was found in comparison with the control group in the mean scores of the experimental group in the OKT and OHBS ($p < 0.000$).
Conclusion:The developed osteoporosis education program using the health belief model had a remarkable and significant impact on improving women's knowledge and their health beliefs regarding osteoporosis prevention behaviors.
Recommendation:Primary healthcare programs regarding osteoporosis preventive strategies using the health belief model should be implemented on a routine base in all healthcare centers.

Keywords: Osteoporosis; Women; Health Belief Model; Educational Program;Community Health Nursing

INTRODUCTION

Osteoporosis (OP) is a serious public health concern affecting millions of people around the world [(1)].It's ranked among the top five conditions causing disability and prolonged hospital stay [(2)]. OPis achronic progressive metabolic skeletal disease characterized by decreased bone mineral density (BMD) and loss of bone microstructure which leads to diminished bone strength and increased risk of fracture. Females are eight times more at risk of osteoporosis than males, it was estimated that 9 to 38% of women and 1 to 8% of men >50 years suffered from osteoporosis [(3)]. According to International Osteoporosis Foundation **(2017),** over 200 million women worldwide suffer from OP that is a reason of more than 8.9 million fractures annually, resulting in an osteoporotic fracture every three seconds[(4)]. The proportion of hip fractures and associated costs is expected to double or triple by the year 2040 because of the aging population [(5)].Regrettably, constructed BMD charts for **Egyptian** women showed that they have a lower BMD compared to their western counterparts. It was estimated that 53.9% and 28.4% of postmenopausal women in **Egypt** respectively have osteopenia and osteoporosis [(6) & (7)].

The skeletal system is in a continual state of self-regeneration, where the remodeling process between the balance of bone formation and resorption. During growth, Bone formation is greater than bone resorption, this balance helps to maintain bone mass and strength thus peak bone mass reaches within the first decade of adulthood. While the remodeling process shifts in a negative direction, among the middle-aged and the elderly, this imbalance in bone remodeling will lead to bone loss and eventually osteoporosis [(3)].

OP is a multi-factorial disease involving multiply modifiable and non-modifiable risk factors, such as gender, advancing age, family history, heredity, and race, as well as lifestyle, so that, OP is a serious yet preventable disease[(1)].Even though bone loss cannot usually be completely reversed, bone strength can be increased by maximizing peak BMD during skeletal growth, maintaining bone mass during adulthood, and minimizing bone loss during old age [(8)&(9)].Consequently, positive changes in lifestyle such as exercise and adequate intake of calcium and vitamin D, as well as, discouraging health risk behaviors such as smoking, drinking alcohol, and caffeine intake can prevent or delay OP by improving the people's BMD [(10)].Interestingly, many of the measures needed to prevent or minimize bone loss are within the scope of practice of nurses, the community health nurses can be instrumental in educating the public about life-long bone health, by

increasing knowledge about the risk factors and encouraging OP preventive behaviors [(9)].

The Health belief model (HBM) in its general sense is one of the most widelyused frameworks for understanding health behavior. This model avers to plan a successful educational intervention and motivates people to change their behavior to promote health or prevent disease through understanding the disease entity, their perceived susceptibility, and perceived severity of the disease to evaluate women's perception about risk factors of OP and its complications, as well as, the perceived benefits of adopting preventive behaviors' and potential barriers that interfere with behavior change such as time, cost and lack of knowledge. The model also investigates women's cues to action which means the incentives affecting women in and outside the family, and finally, self-efficacy that refers to women's confidence in their ability to adopt desired behaviorsuch as calcium intake and exercise [(11) & (1)].

SIGNIFICANCE OF THE STUDY

With the recent increase in women's life expectancy, the incidence of OP disease will grow.The problem is magnified where there is a deficiency in knowledge and poor application for the preventive actions of OP. Several studies from different countries showed that the women had inadequate knowledge of OP, also, levels of health beliefs and self-efficacy regarding OP were low, and younger women were at increased risk for low bone mass and premature OP[(12), (13)].The results of studies in Egypt didn't differ much from these studies that revealed, lack of awareness about OP in terms of its risk factors, preventive measures, and consequences[(2), (7)].Moreover, with society's limited resources, needs for health maintenance, and high cost of health services. The importance of health promotion and disease prevention are emphasized. All of these data highlight the need for planning educational interventions in this topic. Accordingly, the world health organization launch a goal to increase the number of women trained regarding OP prevention [(14)].In this regard, health education programs are an economically effective way to prevent the development of this disease that helps to promote healthy behaviors associated with the protection of bone health[(15)].Since engagements in OP preventive behaviors' are complex because they are influenced by personal and social factors. Therefore, if OP should be prevented, it is essential to use the models that helping women to change their behaviors. The community health nurses often have the responsibility of providing such educational programs in primary health centers which is the first level of contact that individuals, families, and communities have with the healthcare system [(16)].So the present study was conducted with the purpose to develop an osteoporosis educational program using HBM to improve knowledge and health beliefs towards OP among women.

Aim of the Study:

This study aimed to evaluate the effect of the education program using the health belief model on knowledge and health beliefs towards osteoporosis prevention among women attending family health care centers.

Research Hypothesis:

Two hypotheses were developed to be tested in this study:

H1: The experimental group women who involved in the education program will be expected to demonstrate higher levels of knowledge about risk factors and preventive measures of osteoporosis than the control group women who not involved.

H2: The experimental group women who involved in the education program will be expected to demonstrate stronger health beliefs of osteoporosis than the control group women who not involved.

METHODS

Design:

A quasi-experimental design (Pretest and Posttest control group) was utilized.

Research Setting:

The study was conducted in two family health centers affiliated to the directorate of health affairs in Cairo **(**Maser Elkadima Health center and Zeinhom, Elhadary Center**),** as the experimental and the control groups.

Sample Type and Size:

A purposeful sample was used. To estimate the required sample size, G*Power software was used, at the beginning of the study, the effect size of the study was taken based on osteoporosis HBM knowledge questionnaire in a similar study of **Jeihooni, et al., 2015**[(17)], using the formula" Cohen's d = (M2 - M1)/SD_{pooled}, which leads to an estimate of the size of the effect as (.4600) at final follow up assessment. Considering an alpha error of 0.05 and power was taken as 90%; the size for each group in the study was established to be 101 participants, While, one participant was excluded from each group,because of incomplete data and absenteeism during the program sessions, with a total of 200 women.Power analysis was carried out with G*Power 3.1.9.2 (http://www.gpower.hhu.de).

Theinclusioncriteria:Women from various social classes aged 25 to 45 years old and willing to participate in the study.

Exclusion criteria:Suffering disability, rheumatoid disease, mental illness, fractures, decision to withdraw from the study, and absence of more than two educational sessions without any other means for contact.

Instruments:

Two tools were utilized for the study.

1. **Tool No. (1): Women Structured Interviewing Questionnaire:** it was composed of the following parts**:**

♣ **1st part:**Demographic characteristics of studied women (age, educational level, marital status, occupation, menopausal history, family history of osteoporosis).

♣ **2nd part:**Osteoporosis Knowledge Test (OKT)**:** The original **OKT** was developed by **Kim et al., 1991**[(18)], thenrevised and updated by**Gendler etal., 2015**[(19)].Theupdated version of the test includes **32** multiple-choice items:The OKT risk factors consist of (11) items. OKT Preventive Strategies related to exercise and calcium consist of (21) items.For the total instrument, there was only

one correct answer for each multiple-choice question, which has (1) point; while the wrong answer or "I do not know" is scored as (0) zero. The level of knowledge was categorized according to this rate: 0-10 indicated poor knowledge; 21-11indicated moderate knowledge; and 22-32 indicated strong or high knowledge. The overall score is calculated as mean value, range from 0 to 32, the higher score is the better knowledge of the women.

2. Tool No. (2):Osteoporosis Health Belief Scale (**OHBS**) developed by**(Kim et al., 1991)** [18]**,**then the Arabic version was validated by **Sahib, 2018**[20]. The scale includes 42-items and seven subscales (6 items for each), including perceived susceptibility, perceived severity, perceived benefits of exercise, benefits of calcium intake, barriers to exercise, barriers to calcium intake, and health motivation (self-efficacy and cues of action). The low scores of barriers to exercise and to calcium intake subscales and high scores of other subscales mean those positive health beliefs. Each item was rated by using a 3 point Likert scale (disagree 1, uncertain 2, and Agree 3). Accordingly, the potential range for each subscale is 6-18.

3. Tool Validity and Reliability:

The questionnaires were translated to the Arabic language by the researcher and retranslated to English, this version was compared with the original version, and accordingly, the anomalies were rectified by the same process. The content validity of the final Arabic version of the questionnaires was evaluated based on the feedbacks of research experts in community health nursing specialty and a medical consultant physician in primary health care centers.

The Internal reliability coefficients of the English version of OKT was (α= 0.85). While the test reliability of the translated Arabic version in the present study was Cronbach alpha coefficients α of 0.832 for OKT, and α= 0.78 for OHBS.

A pilot Study:

A pilot study was carried out, involving a groupofwomen (N= 20) who were not included in the study sample to test the feasibility and applicability of the study in terms of its setting, tools, the time required for the completion of each study tool.The results obtained were useful in appraisal and modification of the tools and framework.

Fieldwork:

The actual fieldwork for this study was carried out within seven months, starting from the beginning of November 2018 to the end of May 2019 for data collection, implementation, and evaluation phases. After securing official permissions to carry out the study, the experimental and control groups were selected from the previously mentioned settings based on the inclusion criteria to ensure similarities and that no significant difference existed between them in terms of demographic features. The researcher was available in the previously mentioned setting by rotation two days weekly, from 9.00 Am to 1.30 Pm. the interviewing questionnaire and OHBS; was filled by the two groups in about 25 to 30 minutes.

Program Construction:

The OP education program was constructed on four phases include the followings:

Assessment Phase*:*

The educational program was designed by the researcher, based on the results of the assessment using the structured interviewing questionnaire.

Planning of the Educational Program:

This phase included analysis of the pre-test findings; the educational content was designed according to the predetermined needs and deficiencies about OP that were translated into the aim and objectives. The educational content designed based on the structure of HBM, aimed at increasing women's perceived personal risks and the seriousness of the disease and reducing perceived barriers to changing behavior. OP prevention program consisted of four sessions with one lesson per week for each group, each of which lasted for 1 hour to 1½ hours of group discussion, questions, and answers, as well as educational pamphlets, film screenings, and PowerPoint displays. The details of the training sessions were as follows.

First session:Introduction to OP, its symptoms, risk factors, complication, diagnosis, and treatment, as well as an illustrated video about an old adult woman diagnosed with OP and had a fracture, was used as a model.

Second session:OP prevention strategies (Nutrition): Benefits and barriers of calcium-containing foods served and self-efficacy in observing the proper diet and performing exercises.

Third session:OP prevention strategies (Exercise): The importance and barriers of exercise, weight-bearing exercise demonstration and practice, and self-efficacy in performing exercises, as well as using a CD of the weight-bearing exercise.

Fourth session:OP prevention strategies (cues of action),the role of family members and health professionals, as well as, necessary resources for OP information. Finally, the previous sessions were reviewed, and the subjects were provided with educational pamphlets.

Program Implementation Phase:

The present study implemented in two separate healthcare centers allocated as intervention and control to prevent the possible contact between the participants. The program was implemented in groups ranged from 5 to 18 women in each session, according to numbers of the participants, availability, and work circumstances. At the beginning of the initial interview, the researcher communicates friendly and professionally with the women to establish a mutual relationship of trust and respect, then the researcher explained the design, content, and objectives of the educational program in a brief introduction. If the women didn't attend one session of the program, for any reason, the content of the session was explained to them when they came for the next visit or via telephone conversation with women if available. To preserve and enhance the activity of the experimental group, weekly educational text, and voice messages about OP were sent.

Evaluation Phase:

The post-test of the educationprogram based on HBMwas done immediately after finishing the implementation phase, then after two months, the second evaluation (follow-up test) was done.

Ethical considerations and human rights:

Written permission was obtained from the training department of the doctorate of health Affairs in Cairo, as well as from the directors of health centers. Also, oral permission was taken from nurse supervisors in the health centers. Written informed consent was obtained from each woman at the first session after informing them about the importance and objectives of the research and they were assured that the information will be treated confidentially and used for research purposes only. Each participant was also informed that participation in the study was voluntary and she can withdraw at any time without giving any reason. Educational booklets were distributed for the control group after the end of the study.

Statistical Design:

Data were analyzed with SPSS, version 18. Descriptive statistical analyses were used, all qualitative variables were described as numbers and percentages while quantitative variables as mean ± standard deviation (SD). The paired-sample t-test was used to compare mean scores before and after the intervention. A chi-squared test was used to examine demographic variables between the experiment and control groups. Effect sizes (ES) were calculated using Cohen's d. The significance of association (p) was accepted as statistically significant at the level of <0.05.

RESULTS OF THE STUDY

Table (1):showed that the mean age of the experimental group was **33.02± 6.600** years, **35.5%** were illiterate, **86.0%** were married, **14.0%** had a family history of osteoporosis and **5.0%**had a history of early menopause. In the control group, the mean age was **34.27± 5.603** years, **40.0%** were illiterate, **88.0%** were married, **9.0%** had a family history of osteoporosis and **7.0%** had a history of early menopause.No significant difference was observed between the two groups regarding the demographic data.

Table (2) indicated that preprogram implementation **19.0%** and **16.0%** respectively of the control and the experimental groups had correct knowledge that having ovaries removed are among risk factors of osteoporosis, while it improved to **100.0%** and **96.6%** respectively post and follow-up program implementation in the experimental group. On the other hand, in the control group, it changed little to **20.0%** and **21.0%** respectively**.**

Table(3) indicated that preprogram implementation, **0.0 %**, and **1.0%** respectively of the women in the experimental group and control group had correct knowledge about recommended daily intake for calcium as preventive measures of OP. While immediately post and follow up program implementation, it improved in the experimental group to **80.0%** and **74.0%** respectively.On the other hand, for the control group, a slight change was observed, **2.0%** and **1.0%**respectively.

Table (4): showed that before the intervention, there was no significant difference between the two groups in terms of risk factors or preventive strategies and OKT total score (P = **0.808**), However, post and follow up program implementation the experimental group showed a significant increase compared to the control group for each subscale and total score of OKT **(P<0.000)**.

Table (5): revealed thatpreprogram implementation, no significant difference was found between the two groups in terms perceived susceptibility (P= 1.745), perceived severity (P = 0.745), perceived benefits of calcium (P = 0.465), perceived benefits of exercise (P= 0.220), perceived barriers of exercise (P= 1.199), perceived barriers of calcium (P = 0.784) and health motivation (P= 0.548). While post and follow up program implementation, the experimental group showed a significant increase in all of the OHBS subscales **(P<0.000) and (P < 0.001)** and a significant decrease for the perceived barriers compared to that of the control group **(P < 0.000).**

Table (1): Distribution of the Women According to their Demographic Characteristics (n= 200).

Demographic Characteristics of Women	Control Group (100)		Experimental Group (100)		P-Value
	N	%	N	%	
Age - 25 - 30.	22	22.0	26	26.0	0.729
- <30 - 40.	61	61.0	60	60.0	
- <40 - 45	17	17.0	14	14.0	
Range	20-45		20-47		
Mean± SD	**34.27± 5.603**		**33.02± 6.600**		
Social status - Married.	88	88.0	86	86.0	0.896
- Widow.	9	9.0	10	10.0	
- Divorced.	3	3.0	4	4.0	
Education - Illiterate.	40	40.0	35	35.0	0.593
- Write and read.	42	42.0	39	39.0	
- Junior school.	11	11.0	16	16.0	
- University.	7	7.0	10	10.0	
Occupation - Not working	86	86.0	83	83.0	0.557
- Working	14	14.0	17	17.0	
Family History of Osteoporosis					
- Yes	9	9.0	14	14.0	0.267
- No	91	91.0	86	86.0	
History of early menopause					
- Yes	7	7.0	5	5.0	0.551
- No	93	93.0	95	95.0	

Table (2): Distribution of the Women According to their Correct Knowledge about Risk Factors of Osteoporosis throughout Educational Program Phases

Correct Knowledge about risk factors of Osteoporosis / The Educational Program Phases	Control Group (n=100)						Experimental Group (n=100)					
	Pre-		Post		Follow-up		Pre-		Post		Follow-up	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
1. Having a diet low in dairy products.	69	69.0	72	72.0	70	70.0	54	54.0	100	100.0	94	94.0
2. Being menopausal.	42	42.0	45	45.0	41	41.0	39	39.0	94	94.0	91	91.0
3. Having parents/grandparents with osteoporosis.	47	47.0	52	52.0	50	50.0	42	42.0	100	100.0	100	100.0
4. Being an elderly man.	28	28.0	29	29.0	31	31.0	33	33.0	97	97.0	96	96.0
5. Having ovaries removed.	19	19.0	20	20.0	18	18.0	16	16.0	95	95.0	90	90.0
6. Taking cortisone for a long time.	31	31.0	35	35.0	33	33.0	26	26.0	93	93.0	90	90.0
7. Being overweight.	39	39.0	48	48.0	46	46.0	39	39.0	94	94.0	92	92.0
8. Having an eating disorder.	69	69.0	71	71.0	70	70.0	55	55.0	95	95.0	90	90.0
9. Consuming alcohol daily.	68	68.0	70	70.0	68	68.0	59	59.0	97	97.0	93	93.0
10. Smoking daily.	67	67.0	69	69.0	68	68.0	61	61.0	100	100.0	93	93.0
11. Excessive intake of carbonated beverages	62	62.0	65	65.0	64	64.0	60	60.0	100	100.0	95	95.0

Table (3): Distribution of the Women According to their Correct Knowledge about Osteoporosis Preventive Strategies throughout Educational Program Phases

Correct Knowledge about Preventive Strategies / TheEducational Program Phases	Control Group (n=100)						Experimental Group (n=100)					
	Pre-		Post		Follow-up		Pre-		Post		Follow-up	
	N.	%	N.	%	N.	%	N.	%	N.	%	N.	%
1. Days per week of exercise.	24	24.0	27	27.0	25	25.0	20	20.0	87	87.0	83	83.0
2. Duration of exerciseper day.	39	39.0	44	44.0	40	40.0	33	33.0	90	90.0	87	87.0
3. Walking is the best activity.	51	51	54	54	52	52	44	44.4	97	97.0	95	95.0
4. Lifting weight is the best activity.	24	24.0	29	29.0	26	26.0	23	23.0	91	91.0	88	88.0
5. Jogging or running is the best activity	25	25.0	29	29.0	31	31.0	20	20.0	92	92.0	88	88.0
6. Aerobic dancing is the best activity.	28	28.0	29	29.0	28	28.0	21	21.0	91	91.0	90	90.0
7. Cheese as the best calcium	71	71.0	75	75.0	74	74.6	66	66.0	100	100.0	100	100.0
8. Sardine is the best calcium.	22	22.0	21	21.0	21	21.0	21	21.0	91	91.0	88	88.0
9. Broccoli is the best calcium.	4	4.0	6	6.0	6	6.0	6	6.0	83	83.0	71	71.0
10. Yogurt is the best calcium.	77	77.0	79	79.0	79	79.0	78	78.0	100	100.0	100	100.0
11. Ice cream is the best calcium.	55	55.0	58	58.0	57	57.0	48	48.0	92	92.0	90	90.0
12. Recommended daily intake (RDI) for Ca.	1	1.0	2	2.0	1	1.0	0	0.0	77	77.0	69	69.0
13. Glasses of milk daily	41	41.0	44	44.0	42	42.0	40	40.0	95	95.0	83	83.0
14. The best reason to take a calcium supplement	47	47.0	44	44.0	45	4.0	51	51.0	97	97.0	91	91.0
15. Vitamin calcium absorption	33	33.0	37	37.0	35	35.0	29	29.0	92	92.0	80	80.0
16. Source vitamin D.	40	40.0	42	42.0	41	41.0	41	41.0	100	100.0	100	100.0
17. Food to absorb calcium.	66	66.0	69	69.0	67	67.0	50	50.0	100	100.0	92	92.0
18. Vitamin amount to absorb Ca.	0	0.0	1	1.0	0	0.0	1	1.0	77	77.0	72	72.0
19. The best time to build strong bones.	61	61.0	64	64.0	65	65.0	60	60.0	100	100.0	97	97.0
20. Diagnosis of osteoporosis	16	16.0	18	18.0	17	17.0	12	12.0	87	87.0	82	82.0
21. Treatment of osteoporosis.	26	26.0	30	30.0	30	30.0	23	23.0	100	100.0	97	97.0

Table (4): Comparison of the Women According to Total Mean Difference Osteoporosis Knowledge Parameter Score levels throughout the Educational Program Phases

Osteoporosis Knowledge Parameters	The Developed Educational Program Phases	Control Group (n=100) (mean ± SD)	Experimental Group (n=100) (mean ± SD)	Paired *t*-test P-Value
Risk Factors	Pre-	6.456±4.231	6.351±4.441	0.137
	Post	7.074±4.219	9.964±2.321	0.000*
	Follow-up	6.667±4.899	9.412±3.120	0.000*
Preventive strategies	Pre-	5.663±5.441	5.510±4.289	0.149
	Post	5.901±5.184	17.661±2.326	0.000*
	Follow-up	5.816±5.364	16.837±3.320	0.000*
Osteoporosis Knowledge Test (OKT) Total score	Pre-	12.119±7.754	11.861±7.136	0.808
	Post	12.975±7.978	27.625±2.262	0.000*
	Follow-up	12.483±6.820	26.249±3.320	0.000*

*Significant difference between the two groups

Table (5): Difference in Women's Health Belief Model Subscales thought Program Phases.

Osteoporosis Health Belief Model Subscales	The Developed Educational Program Phases	Control Group (n=100) (mean ± SD)	Experimental Group (n=100) (mean ± SD)	Paired *t*-test P-Value
OHBS Perceived Susceptibility	Pre-	10.767±2.419	10.845±1.972	0.899
	Post	10.920±3.936	15.128±1.507	0.000*
	Follow-up	10.416±3.786	14.950±1.848	0.000*
OHBS Perceived Severity	Pre-	12.095±4.305	11.974±3.948	0.745
	Post	11.482±4.947	14.654±2.175	0.000*
	Follow-up	11.566±4.951	14.837±2.251	0.000*
OHBS Perceived Benefits of Calcium	Pre-	14.650±2.043	14.860±2.013	0.465
	Post	14.529±2.127	16.843±1.341	0.000*
	Follow-up	14.445±2.046	17.158±1.522	0.000*
OHBS Perceived Benefit of exercise	Pre-	14.407±2.204	14.302±2.647	0.080
	Post	14.610±2.169	15.622±1.430	0.001*
	Follow-up	14.563±2.190	15.526 ±1.351	0.001*
OHBS Perceived Barriers of Exercise	Pre-	11.771±3.118	11.965±2.723	0.188
	Post	11.697±2.012	8.820±2.236	0.000*
	Follow-up	11.744±2.708	10.103±1.862	0.000*
OHBS Perceived Barriers of Ca.	Pre-	10.690±3.667	10.533±4.184	0.784
	Post	11.010±3.756	9.044±1.643	0.000*
	Follow-up	11.079±3.669	9.995±1.977	0.000*
OHBS Health Motivation (Self-efficacy and cues of action).	Pre-	10.930±2.434	10.843±1.701	0.548
	Post	11.112±2.407	15.288±1.136	0.000*
	Follow-up	10.850±2.307	14.726±2.152	0.000*

*Significant difference between the two groups

DISCUSSION

Women of all ages are a population at risk for osteoporosis. The key prevention method for osteoporosis is that of community-based intervention strategies using a behavior change model, like HBM to improve outcomes among this vulnerable group [(17)].

As regards the studied women's characteristics, findings of the present study showed that all women in bothexperimental and control groups had different levels of education. Moreover, more than three-quarters of the women attending health centers were married in both groups, this as similar to the Egyptian study conducted by **Erbil,** [(9)] who found that 75.9% of the studied women were married.

Knowledge of OP is vital in preventing or delaying the onset of OP. The results of the present study showed that there were significant improvements in mean scores from moderate to high knowledge related to risk factors and preventive measures including dietary calcium and exercise immediately post-program implementation in the experimental group and this increase was maintained two months later. The education pamphlets were given to the women after finishing the program, also, telephone consultation, via educational text and voice messages were helpful for the preservation of acquired OP knowledge. On the contrary, the OP's knowledge mean score in the control group increased somewhat, immediately post-program implementation, but this slight increment not maintained during the follow-up stage. These could be attributed to the participants' access to other sources of information or repeated confrontation to the test; however, the significant increase in the knowledge score in the experimental group deserves consideration. This result is in agreement with other Egyptian and Jordanian studies of **Sobeih et al.,**[(21)]**;El Meselhy et al.,** [(22)]**; and Malak & Toama**[(23)].

In respect to OHBS, it was not surprising that women in both groups perceived alow susceptibility to OP preprogram implementation. The possible explanation could be due to the lack of knowledge about the disease, and importantly since OP is a silent disorder; there is an absence of symptoms, where the most individuals do not perceive themselves at risk of the disease until they begin to suffer from the manifestation and complications and get older. Otherwise, after program implementation, mean scores on perceived susceptibility and severity to the OP of the experimental group significantly increased compared to the control group. This result is in agreement with **Jeihooni et al.,**[(17)] and **Ghaffari et al.,**[(24)]. However, the perceived severity in the study of **Sanaeinasab et al.,**[(25)] showed no significant increase after the intervention, this could be due to approaches used during program sessions seemed to be successful in changing women's beliefs, such as an educational video about an osteoporotic fractured old female are helpful to increase women's knowledge about complications and thereby increased perceived severity.

It was also noticed that, preprogram implementation the mean scores for perceived benefits of calcium and weight-bearing exercise are high in both groups. While post and follow-up program implementation, the results showed a greater increase among the experimental group with statistical significance differences. Vice versa, this is not true for the control group. This could be due to the monitoring process after program implementation that could help to increase perceived benefits among the experimental group and make a significant difference compared with the control group. This result is in agreement with **Ibrahim and Hassan**[(5)].While contradicts with, **Sanaeinasab et**

al.,[26] who didn't found, a significant differencein mean scores on the benefits of calcium intake post-intervention.

No significant difference was found in the present study between the two groups' preprogram implementation in terms of perceived barriers,although, the difference was a significant post and follow-up the intervention for the experimental group. In other words, the educational interventions are successful in reduced barriers to calcium intake and exercise; it was helpful to provide information for women about dairy and non-dairy sources of calcium as a part of the education program, especially for those who don't do not enjoy the taste of milk or not eat dairy products to reduce barriers of calcium intake. Even though the mean score of the barriers' was increased somewhat during the follow-up stage of the program,the result still significant; these could be attributed to the cost of calcium diet as mentioned by the participants. This is consistent with studies of **Lein et al.,**[27] and **Khorsandi et al.,**[28]who found that perceived barriers regarding calcium intake and exercise decreased after the intervention.

The study findings showed significant differences between the two groups in health motivation immediately post and follow-up program implementation, where the women's self-efficacy for calcium intake and exercise increased significantly in the experimental group compared to the control group. Knowledge gained after the educational intervention led to increased self-efficacy. Therefore, women in the experimental group become more motivated for practicing physical exercises and taking calcium-rich food or sun exposure, to reduce the risk of osteoporosis. Cues of action increased also after the intervention, women in the experimental group have incentives for taking action and motivations to change behavior as well as, seek information and follow recommendations thereby reducing the risk of osteoporosis. In the study of **Jeihooni et al.,**[17] self-efficacy mean score increased significantly in the experimental group after intervention. Moreover, **Malak and Toama**[23]found that after the program implementation, health motivation was significantly increased among the intervention group.

LIMITATION

The data collected on knowledge and health behaviors toward osteoporosis depends on women's self-reporting based on their ability to accurately recall past behaviors'. So it is liable to recall biasand participants may over/under report. Furthermore, evaluation of the effectiveness of the education program was limited to two months and unavailability to be evaluated on a long term base.

CONCLUSION

In the light of present study findings, it can be concluded that the developed osteoporosis education program using HBM had a remarkable and significant impact on improving women's knowledge and their health beliefs about OP and its preventive measures. Therefore, the research hypotheses were proved and supported by the researcher.

RECOMMENDATION

- ♣ Community health nurses should develop and apply primary healthcare programs regarding OP preventive strategies based on the HBM on a routine base in all healthcare centers, with the focus on health promotion and healthful lifestyle to prevent osteoporosis.
- ♣ A longitudinal study is suggested for measuring the effect of an intervention program to improve and correct women's knowledge and health beliefs towards OP in different community settings.

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FOOTNOTES:

CONFLICT OF INTEREST STATEMENT

The author declared no potential conflicts of interest.

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