

Effect of Health Educational Program on the Self- Efficacy of Elderly Females regarding osteoporosis

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Abstract

Background: Osteoporosis is an emerging geriatric condition with high morbidity and healthcare cost in developing nations, characterized by low bone mass, which increases bone fractures among elderly females. **Aim:** Evaluate the effect of health educational program on the self- efficacy of elderly females regarding osteoporosis. **Design:** A quasi-experimental research design was done on a convenience sample of, 30 elderly females from El-Amal elderly club at Mansoura city. **Tools:** Four tools were used; Demographic Data Interview Form, Osteoporosis Knowledge Tool, Osteoporosis Health Belief Scale, and Osteoporosis Self-Efficacy Scale. **Results:** Post-intervention, the overall knowledge score, benefits of exercise and Calcium intake, health motivation and perceived susceptibility and seriousness to osteoporosis, were improved significantly ($P \leq 0.001$) among the elderly females compared to pre-intervention ones. Also, perceptions of exercise and calcium intake barriers were decreased significantly ($P \leq 0.001$) post intervention compared to pre- intervention. Moreover, osteoporosis self-efficacy scale improved significantly ($P \leq 0.001$) post-intervention compared to pre- intervention. **Conclusion:** The health educational program based on health belief model is effective in improving the elderly females' knowledge regarding osteoporosis, health beliefs and osteoporosis self-efficacy. **Recommendations:** In future studies, more extensive interventions on the structures of calcium intake benefits and barriers, as well as other behavioral modification theories, should be used.

Keywords: *Elderly Females, Health Educational Program, Osteoporosis & Self- Efficacy*

Introduction

Osteoporosis is an asymptomatic disease marked by decreased bone mass and skeletal microarchitecture degradation. It is the most prevalent metabolic bone condition in the United States, impacting 25 million men and women. Every year, 1.5 million bone fractures are expected to occur because of osteoporosis (Sözen, et al., 2017). The prevalence of osteoporosis in women of the world was reported to be 23.1%, while in men was found to be 11.7% (Salari et al., 2021). In 2014, the National Osteoporosis Foundation (NOF) reported that 54 million of Americans population aged 50 and over were impacted by osteoporosis (Wright et al., 2014). The physical, emotional, and mental health of elderly women has been significantly negatively affected by osteoporosis. This can lead to serious secondary health issues, including fatalities (Cosman et al., 2014). Females with this disease are more likely to, sustain a fracture as a result of a serious slip, fall, or even a spontaneous fracture (Trevisan et al., 2020). Osteoporosis knowledge is one factor that influences osteoporosis prevention behavior, so prospective studies report that increase in osteoporosis knowledge are interrelated to the improvement in osteoporosis

preventive behavior. Knowledge about osteoporosis is a significant factor in increasing activity and calcium consumption habits. Patient education can help patients better understand their risks and stick to their treatment plans (Taghvaei et al., 2022).

Osteoporosis is a preventable and curable disease. Preventing the disease includes modifying thinking, lifestyle, and daily habits in such a way that improves individuals' efficiency and quality of life. Therefore, It is critical to employ models that identify the variables influencing behavior to study the factors influencing women's adoption of osteoporosis preventive behaviors (Fahmy et al., 2019 & Jeihooni et al., 2017).

Self-efficacy is a belief of individuals in their ability to conduct self-care actions in order to get perfect results (Khani et al., 2016). It's far a necessary precondition for behavior that can have an effect on one's lifestyles and fitness habits (Omidvar et al., 2018). In older people, increased self-efficacy has been linked to increased power, better sleep, reduced ache and soreness, increased happiness with life, and improved health (French, 2014). In elders, there is a strong link between self-efficacy and the adoption of osteoporosis health education (Doba, 2016); it

improves self-care confidence, health care management, and self-efficacy, as well as supporting older individuals' overall health (Shin et al., 2016; Ebrahimi, 2016).

The Health Belief Model (HBM) is a theoretical model that has been widely used to improve knowledge of healthy behaviors (Pinar & Pinar, 2020). HBM-based programs are a cost-effective and effective way to improve knowledge and practices needed to initiate behavioral changes, such as calcium supplementation and physical activity for prevention of bone loss. HBMs are based on the notion that people are willing to sustain their health by taking health-related actions to prevent an adverse health outcome (Rezaei et al., 2019).

In this model, the nurse emphasizes the importance of design and preparation for an effective educational intervention. Females must be aware of the perceived vulnerability and severity of osteoporosis, its consequences, the potential benefits of reducing the risk by taking certain actions, the perceived obstacles (such as recommended action expenses), and the action cues (ways to encourage the "will" to take the health actions and activities) that are necessary (Rezaei et al., 2019 & Kassem, 2016).

To the best of our knowledge, no large studies have investigated the impact of osteoporosis health educational programs on, the self-efficacy of the elderly in Egypt. So, this study was done to evaluate the effect of a health educational program on the self-efficacy of elderly females regarding osteoporosis using the health belief model.

Significance of the study

Osteoporosis is characterized by a disabling condition that often results in premature death, as well as a high level of bone deformities, post-fracture quality of life, and mortality. It is prevalence estimated to be between 13-18% among women aged 50 years and above and as high as 70% among those aged 80. A decrease of one standard deviation in bone mineral density, or BMD, increases the risk of fractures by 1.5-3 times (Bowden and Foster, 2018).

Osteoporosis is a public health issue in Egypt, affecting a significant proportion of the population (approximately 30%). Recent studies have revealed that the prevalence of osteopenia among postmenopausal females in Egypt is 53.9%, while the incidence of fractures is 28.4%, according to (Elsbagh et al., 2015). Reducing the incidence of fractures in elderly individuals with pre-existing osteopenia will have a positive impact on public health, as it will reduce the financial burden on healthcare systems (Hirschfeld, et al., 2017).

Study aim

This study aimed to evaluate the effect of health educational program on the self-efficacy of elderly females regarding osteoporosis.

Study hypotheses

- Health education program will improve knowledge of elderly females regarding osteoporosis.
- Health education program will improve the health beliefs of elderly females regarding osteoporosis.
- Health education program will improve the self-efficacy of elderly females regarding osteoporosis.

Subjects and method

Study design

This study used a quasi-experimental (Pre and post intervention) design. It was conducted at the Mansoura City El-Amal elderly Club, which is a social club associated with the Ministry of Social Solidarity, where the study was conducted on a convenience sample of all elderly females registered in the above mentioned club fulfilling the eligibility criteria and agreed to participate in the study. These represented 60% (30 out of 50) elderly females.

Inclusion criteria

- Elderly females aged 60 years and more.
- Able to communicate and willing to participate in the study.

Exclusion criteria

Elderly females, who previously participated in an osteoporosis prevention education program, and those who were prevented from consuming calcium, vitamin D and dairy products.

Data Collection Tools

Tool I: Demographic and Health Related Data Interview Form: as age, education, occupation, marital status, residence, family history of osteoporosis and history of bone densitometry.

Tool II: Osteoporosis Knowledge Tool: It was developed and translated into Arabic language by Mohamed et al., (2009). It consists of 20 items that measure elders' knowledge toward osteoporosis. It includes questions about osteoporosis causes, signs and symptoms, risk factors, exercises, dietary calcium sources, recommended intake, calcium supplements and calcium absorption.

Scoring system

Responses are coded by a 0 score for "don't know" and a 1 score for "know". The score is determined by the total number of points received for all questions, resulting in a total score of 20. A higher score indicates a greater level of knowledge.

Tool III: Osteoporosis Health Belief Scale (OHBS): It was adopted from Kim et al., (1991) and translated into Arabic language by Mansour et al., (2017). It includes 42 items covering health beliefs formed by seven domains. The subscales are

associated with susceptibility 6 items, seriousness 6 items, benefits of exercise and calcium intake 12 items, barriers to exercise and calcium taking 12 items, and health motivation 6 items.

Scoring system

The scale uses a 5-point Likert scale, with 1 indicating severely disagree, 2 indicating disagree, 3 indicating neutral, 4 indicating agree, and 5 indicating strongly agree. The possible range is 6 to 30 for each subscale, and the overall scores range of 42 to 210. Lower score indicating lower health beliefs and higher score indicating higher health beliefs regarding osteoporosis.

Tool IV: Osteoporosis Self-Efficacy Scale (OSES):

It was developed by Horan et al., (1998), and translated into Arabic language by Mansour et al., (2017). This 12-item measure is divided into 2 subscales: one for osteoporosis self-efficacy exercise and one for osteoporosis self-efficacy calcium. Six questions were used to assess Exercise self-efficacy.

Scoring system

Each participant answers based on a five-point scale (1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree). The calcium and exercise scores were calculated through taking average of the responses on the six linked items and multiplying them by 5, with ranges from 0 to 30.

Validity and reliability of the study tools

The tools were evaluated for content validity by five jury experts and university professors specializing in gerontological nursing. The study tools, in their judgment, were clear and practicable, and no changes were suggested. The tools' reliability for internal consistency was statistically examined using Cronbach's alpha coefficient, which revealed that tool II ranged from 0.81 to 0.87, tool III ranged from 0.68 to 0.85, and tool IV ranged from 0.90 to 0.94, indicating that the tools were very reliable.

A pilot study

It was carried out on 5 older females from the El-Saada elderly club to test the applicability, feasibility, and completeness of the study tools and to estimate the required time to fill in. Based on the finding, no modifications were made as the tools were clear, understandable, and objective.

Ethical considerations

The research ethics committee of the Faculty of Nursing of the Mansoura University approved the conduct of the current study, P.0342. Verbal consent has been obtained from elderly females. Privacy, anonymity and the right to withdrawal at any time have been safeguarded.

Research process

This study was conducted throughout three phases: baseline assessment, implementation, and evaluation phase.

Baseline assessment phase

- In order to obtain the necessary authorization to carry out the study, a letter was sent from the Faculty of Nursing at Mansoura University to the Director of El-Amal elderly Club.
- The aim of the research was stated to the elderly club's administrator.
- The Arabic versions of tools II, III, and IV were utilized in the study to assess older females' osteoporosis knowledge, health beliefs, and self-efficacy.
- The osteoporosis health educational program was carried out in six sessions in plain Arabic language and the researchers created this program after conducting a review of the current literature (Rezaei et al., 2019; Nuti et al., 2019; Phelan et al., 2015; Shuler et al., 2012 & Ozturk & Sendir, 2011).
- The content validity of the program booklet was checked by faculty members who confirmed its clarity and comprehensiveness.
- Teaching methods: A variety of instructional methods were determined, including group discussions, demonstrations, and visual aids such as PowerPoint and posters, were used. Handouts and booklets were distributed.

Implementation phase

- The researcher interviewed each elderly female individually to acquire the relevant data using study instruments, which took around 30 to 45 minutes.
- The elderly females attended the educational sessions after conducting a personal interview with the researchers to collect the necessary information.
- The elderly females were separated into groups of ten females each.
- The researchers began each session by emphasizing the highlights of the preceding session.
- The program sessions implemented over 6 weeks period, one session per week; the duration for each session took about 30 to 45 minutes approximately. The researcher visited the club twice a week on Saturday and Tuesday from 10 AM to 2 PM.
- Data collection took 5 months, from December 1st, 2022, to the end of April 2023.

The content of the program includes

First session (susceptibility) this session aimed to provide introductory information which targeted to enhance awareness of osteoporosis, its symptoms, disease progression, diagnosis, and treatment.

Second session (seriousness) it was conducted and aimed to provide information about the consequences of osteoporosis and their impact on various aspects of physical, mental, and economic life.

Third session (benefits and barriers of calcium intake) the researcher discussed the proper diet, nutrient sources to prevent osteoporosis, calcium, sun exposure, and vitamin D supplements. Providing an

example of how to change dietary habits by introducing some high-calcium meals.

Fourth session (benefits and barriers to exercise) the researcher discussed the types of exercises such as walking and weightlifting and introducing certain weight workouts and techniques as an example of modifying exercise behavior.

Fifth session it concerned in (a role playing) in problem-solving situations, calcium consumption and activity barriers were overcome. Females were shown pre and post pictures of affected individuals' bones to improve their understanding of vulnerability.

Sixth session (health and self-efficacy motivation) it is the last session and focused on health and self-efficacy motivation through lifestyle changes and review of the previous sessions. In the end, the researcher answered all elderly females inquiries related to the previously discussed sessions.

The sessions took place in the presence of a family member, and the role of family members in

producing, facilitating, and providing appropriate food, and walking program was explained.

Evaluation phase

Between the sessions, the researcher remained in contact with the elderly females by phone calls to answer any related concerns. Tools II, III and IV were used to test the program immediately after the educational program was implemented (posttest).

Data analysis

The SPSS program version 23 (IBM Corp., Armonk, NY: IBM Corp., 2015) was used to analyze the data. Numbers and percentages were used to represent qualitative variables. Qualitative variables were represented using numbers and percentages. Quantitative variables were presented as means (SD). $P \leq 0.05$ was considered statistically significant. Paired t-test was used to compare pre and post intervention scores.

Results

Table (1): Distribution of the elderly females according to their demographic data

Items	N= 30 (%)
Age(years):	
<70 year	12(40.0)
70 year & more	18(60.0)
Mean \pm SD	70.6\pm5.78
Marital status:	
Married	19(63.3)
Unmarried	11(36.7)
Education:	
Non-educated	11(36.7)
Educated	19(63.3)
Income:	
Enough	20(66.7)
Not enough	10(33.3)
Residence:	
Urban	27(90.0)
Rural	3(10.0)
Family history of osteoporosis	11(36.7)
History of bone densitometry	6(20.0)

Table (2): Comparison of total mean scores of elderly females' knowledge and health belief components pre and post intervention (N=30)

Items	Pre- Intervention	Post - Intervention	Significance
	Mean \pm SD	Mean \pm SD	
Knowledge score regarding osteoporosis	7.57 \pm 1.85	15.13 \pm 2.49	t=22.6, P \leq 0.001*
Osteoporosis Health Belief components:			
Perceived susceptibility	14.8 \pm 3.24	19.67 \pm 2.51	t=20.4, P \leq 0.001*
Perceived seriousness	15.03 \pm 3.51	21.13 \pm 2.93	t=2.93, P \leq 0.001*
Benefits of exercise	17.6 \pm 2.14	23.2 \pm 2.64	t=16.4, P \leq 0.001*
Benefits of Ca intake	19.87 \pm 2.93	24.37 \pm 2.76	t=17.2, P \leq 0.001*
Barriers of exercise	19.5 \pm 2.74	15.03 \pm 2.34	t=20.4, P \leq 0.001*
Barriers to Ca intake	19.8 \pm 2.66	14.7 \pm 2.45	t=22.0, P \leq 0.001*
Health Motivation	18.57 \pm 1.61	22.43 \pm 1.76	t=19.2, P \leq 0.001*
Total	125.17\pm8.42	140.53\pm8.17	t=19.6, P \leq 0.001*

*Statistically Significant Difference

Table (3): Comparison of total mean score of Osteoporosis Self-Efficacy Scale of elderly females pre and post intervention (N=30)

Items	Pre-Intervention	Post-Intervention	Significance
	Mean \pm SD	Mean \pm SD	
Osteoporosis Self-Efficacy Scale score related to practicing exercise	15.87 \pm 2.6	21.53 \pm 2.24	t=20.2, P \leq 0.001*
Osteoporosis Self-Efficacy Scale score related to intake of calcium	18.2 \pm 2.23	23.87 \pm 2.08	t=25.6, P \leq 0.001*
Total score of Osteoporosis Self-Efficacy Scale	34.07 \pm 4.14	45.4 \pm 3.94	t=32.99, P \leq 0.001*

*Statistically Significant Difference

Table (4): Variation of changes in Osteoporosis Knowledge score in pre & post intervention according to different demographic parameters (N=30)

Items	Pre- Intervention	Post - Intervention	Significance
	Mean \pm SD	Mean \pm SD	
Osteoporosis Knowledge score	7.57 \pm 1.85	15.13 \pm 2.49	t=22.6, P \leq 0.001*
Age (years):			
<70 year	1.8 \pm 7.3	15.1 \pm 2.5	t=14.3, P \leq 0.001*
70 year & more	7.8 \pm 1.9	15.2 \pm 2.5	t=17.2, P \leq 0.001*
Marital status:			
Married	7.5 \pm 1.6	14.7 \pm 2.3	t=13.9, P \leq 0.001*
Unmarried	7.6 \pm 2.0	15.4 \pm 2.5	t=17.7, P \leq 0.001*
Education:			
Non-educated	6.3 \pm 1.1	12.5 \pm 1.2	t=19.01, P \leq 0.001*
Educated	8.3 \pm 1.8	16.7 \pm 1.5	t=21.4, P \leq 0.001*
Income:			
Enough	7.4 \pm 1.8	14.9 \pm 2.7	t=17.3, P \leq 0.001*
Not enough	7.8 \pm 2.0	15.5 \pm 2.1	t=14.0, P \leq 0.001*
Residence:			
Urban	7.4 \pm 1.7	15.1 \pm 2.6	t=22.8, P \leq 0.001*
Rural	9.0 \pm 2.6	15.0 \pm 1.0	t=5.2, P \leq 0.001*

*Statistically Significant Difference

Table (5): Variation of changes in Osteoporosis Health Belief score in pre & post intervention according to different demographic parameters (N=30)

Items	Pre- Intervention	Post - Intervention	Significance
	Mean \pm SD	Mean \pm SD	
Osteoporosis Health Belief score	125.17 \pm 8.42	140.53 \pm 8.17	t=19.6, P \leq 0.001*
Age (years):			
<70 year	125.1 \pm 9.8	137.8 \pm 7.8	t=11.2, P \leq 0.001*
70 year & more	125.2 \pm 7.7	142.3 \pm 8.1	t=20.0, P \leq 0.001*
Marital status:			
Married	125.0 \pm 8.8	139.3 \pm 7.9	t=14.5, P \leq 0.001*
Unmarried	125.6 \pm 8.1	142.6 \pm 8.5	t=14.8, P \leq 0.001*
Education:			
Non-educated	124.4 \pm 7.4	140.1 \pm 6.0	t=21.5, P \leq 0.001*
Educated	125.6 \pm 9.1	140.7 \pm 9.3	t=12.9, P \leq 0.001*
Income:			
Enough	125.1 \pm 9.4	140.0 \pm 8.5	t=14.5, P \leq 0.001*
Not enough	125.4 \pm 6.9	141.6 \pm 7.8	t=13.6, P \leq 0.001*
Residence:			
Urban	125.4 \pm 8.5	140.3 \pm 8.3	t=18.3, P \leq 0.001*
Rural	123.0 \pm 9.5	143.0 \pm 8.2	t=10.0, P \leq 0.001*

*Statistically Significant Difference

Table (6): Variation of changes in Osteoporosis Self-Efficacy score in pre & post intervention according to different demographic parameters (N=30)

Items	Pre- Intervention	Post - Intervention	Significance
	Mean \pm SD	Mean \pm SD	
Osteoporosis Self-Efficacy score	34.07 \pm 4.14	45.4 \pm 3.94	t=32.99, P \leq 0.001*
Age (years):			
<70 year	33.4 \pm 4.6	45.0 \pm 4.4	t=20.3, P \leq 0.001*
70 year & more	34.5 \pm 3.9	45.7 \pm 3.7	t=25.5, P \leq 0.001*
Marital status:			
Married	33.5 \pm 4.6	45.1 \pm 4.5	t=24.1, P \leq 0.001*
Unmarried	35.0 \pm 2.6	45.9 \pm 2.9	t= 25.0, P \leq 0.001*
Education:			
Non-educated	30.6 \pm 4.0	42.6 \pm 3.0	t=23.8, P \leq 0.001*
Educated	36.1 \pm 2.7	47.0 \pm 3.6	t=24.7, P \leq 0.001*
Income:			
Enough	33.7 \pm 4.1	45.2 \pm 3.8	t=27.1, P \leq 0.001*
Not enough	34.6 \pm 4.4	45.8 \pm 4.3	t=18.2, P \leq 0.001*
Residence:			
Urban	34.1 \pm 4.3	45.4 \pm 4.1	t=30.0, P \leq 0.001*
Rural	33.3 \pm 2.1	45.0 \pm 3.0	t=17.5, P \leq 0.001*

*Statistically Significant Difference

Table (1): Illustrates demographic data of the elderly females, which revealed that the age of the elderly females ranged between 60 to 80 years with a mean of 70.6 \pm 5.78. Regarding marital status, 63.3% of them are currently married and educated and 66.7% have enough income, 36.7% reported family history of osteoporosis and only 20.0 % has a previous history of bone densitometry.

Table (2): Reveals that the score of knowledge of elderly females regarding osteoporosis was increased significantly 15.13 \pm 2.49 post the intervention compared to 7.57 \pm 1.85 in the pre intervention. Regarding Osteoporosis Health Belief scale it was noticed that elderly females' high level of perception about; susceptibility of osteoporosis was improved significantly 19.67 \pm 2.51 post the intervention compared to 14.8 \pm 3.24 in the pre intervention, their perception level about seriousness of osteoporosis was improved significantly 21.13 \pm 2.93 post the intervention compared to 15.03 \pm 3.51 in the pre intervention, their perception level about benefits of exercise was improved significantly 23.2 \pm 2.64 post the intervention compared to 17.6 \pm 2.14 in the pre intervention, their perception level about benefits of calcium intake was improved significantly 24.37 \pm 2.76 post the intervention compared to 19.87 \pm 2.93 in the pre intervention, their perception level about health motivation was improved significantly 22.43 \pm 1.76 post the intervention compared to 18.57 \pm 1.61 in the pre intervention and in total health belief components from 140.53 \pm 8.17 post the intervention compared to 125.17 \pm 8.42 in the pre intervention. Also, elderly females' low level of perceptions about barriers to exercise and barriers to

calcium intake were significantly improved in the post-intervention compared to the pre-intervention.

Table (3): Demonstrates that the Osteoporosis Self-Efficacy Scale score has improved significantly in relation to practicing exercise 21.53 \pm 2.24 post the intervention compared to 15.87 \pm 2.6 in the pre intervention. Also, in Osteoporosis Self-Efficacy scale score related to calcium intake a significant improvement was observed 23.87 \pm 2.08 post the intervention compared to 18.2 \pm 2.23 in the pre intervention and in the total OSES score 45.4 \pm 3.94 post the intervention compared to 34.07 \pm 4.14 in the pre intervention ones and the differences were statistically significant (0.001).

Table (4): Shows that the overall mean osteoporosis knowledge score increased significantly from 7.57 \pm 1.85 pre- intervention to 15.13 \pm 2.49 post-intervention (P=0.001). This significant increase persists for all categories of the demographic parameters studied.

Table (5): Displays that the overall mean osteoporosis health belief score increased significantly from 125.17 \pm 8.42 pre-intervention to 140.53 \pm 8.17 post-intervention (P=0.001). This significant increase persists for all categories of the demographic parameters studied.

Table (6): Shows that the overall mean osteoporosis self-efficacy score increased significantly from 34.07 \pm 4.14 pre- intervention to 45.4 \pm 3.94 post-intervention (P=0.001). This significant increase persists for all categories of the demographic parameters studied.

Discussion

One of the most critical desires of WHO is to grow the number of females skilled in the region of osteoporosis. (**National Osteoporosis Foundation, 2018**). Teaching preventive behaviors as physical activities 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 elderly females trained in the area of osteoporosis. (**Barzanji et al., 2013**).

The researchers have used such models to change their subjects' behavior. Among of these models that effective in health education and promotion is the Health Belief Model (HBM). 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. So, this study was conducted to evaluate the effect of a health educational program on the self-efficacy of elderly females regarding osteoporosis using the health belief model (**Jeihooni et al., 2017**).

The current study reported that the score of knowledge of elderly females regarding osteoporosis was increased significantly from 7.57 ± 1.85 before application of the program to 15.13 ± 2.49 after application of the program. This improvement may be due to the beneficial effect of the educational program and the researcher in a non-judgmental way allowed elderly females to freely ask questions and clearly express their feelings in a confidential environment. This is consistent with **Khani et al., (2016)** who revealed that the knowledge scores in the study group increased significantly after the intervention. Also **Park, (2017)**, **Mohamed et al., (2016)**, & **Emam & Ahmed, (2013)** findings in these studies about an education and fitness program to promote older individuals' osteoporosis awareness indicated that the osteoporosis knowledge score improved following the intervention.

Other study has proven that employing a behavior modification model, such as the Health Belief Model, is an important osteoporosis preventive technique. According to the model, in order to plan a successful educational intervention, expertise in the target group's perceptions of susceptibility, severity of the condition, benefits of taking certain actions to reduce the risk, barriers, and cues to action are required (**Young, et al., 2017**).

This study revealed a statistically significant increase in the total mean score of perceived susceptibility after application of the program. The results of the study can be interpreted as a result of the intervention's impact on the subjects' perceived

susceptibility. In which after the intervention, the majority of elderly females were concerned about their osteoporotic risk. This is in accordance with **Pinar & Pinar, (2020)** who found following intervention, the women's perception of their susceptibility to osteoporosis increased significantly. This corresponds to the findings of **Emam & Ahmed, (2013)** reported the same results.

This study revealed a statistically significant increase in the total mean score of perceived seriousness following the application of the program, which may be attributed to the beneficial effect of the program which offered the elderly females support at a critical time and helped them to understand the implications of osteoporosis. This is in line with the findings of **Rezaei et al., (2019)** who found no significant change in perceived seriousness between the two groups prior to intervention. However, following intervention, the perceived seriousness of the study group raised much more than that of the control group. While, in contradiction **Nasab et al., (2013)**, & **Hormoz et al., (2013)** showed no significant increase after the intervention.

The current findings show a statistically significant improvement among elderly females in terms of perceived benefits of exercise and calcium intake. Also, their level of perception about barriers to exercise and calcium are improved after application of the program and the difference was statistically significant. This can be attributed to emphasizing the importance of exercise, a calcium-rich diet and the role of nutrition in preventing osteoporosis during the program's implementation. Also, an improvement in their knowledge score whereas these barriers are based on false beliefs that overcome by educational program that enable them to overcome it and increase their calcium intake regardless the perceived barriers. In the same context a study done by **Jeihooni et al., (2015)** & **Azar et al., (2012)** found that, the construct of perceived benefits of physical activity increased significantly following training in the intervention group but not in the control group.

Also, the results of a research conducted by **Khani et al., (2016)** indicated that the elderly females reported rise in perceived benefits of nutrition and increased significantly after intervention. The rise may be due to a focus on the function of nutrition in osteoporosis prevention at some point intervention. **Drieling et al., (2011)** also found that women in the intervention group showed fewer exercise barriers beliefs after intervention than women in the control group.

The elderly females' mean health motivation score increased significantly after application of the program, and the difference was statistically significant. This can be attributed that the elderly females are more likely to prevent developing

osteoporosis if they have a strong health motivation to alter unacceptable and maintain acceptable behaviors. The same findings were mentioned by **Ebrahimi, (2016)** who recommended for the importance of motivation and self-regulation in performing a behavior. Motivation was discovered to be a powerful factor in prevention of osteoporosis by **Khani et al., (2016)**.

The self-efficacy score related to practicing exercise improved from 15.87 ± 2.6 before application of the program to 21.53 ± 2.24 after application of the program and the self-efficacy score related to calcium intake improved from 18.2 ± 2.23 to 23.87 ± 2.08 , this shows the positive effects of the program on elderly female's performance. This is in the same line with a study conducted by **Khani et al., (2016)** found that there was no significant difference between the mean scores of women in osteoporosis prevention behaviors and maintaining healthy nutrition before the intervention; nevertheless, the mean performance score of women significantly increased immediately after the intervention. Also, **Pinar & Pinar, (2020)** reported an increase in calcium consumption in the study group following the intervention.

The improvement in osteoporosis self-efficacy score related to exercise is in the same line with **Zhang, (2017) & Mohamed et al., (2016)**, who revealed that their educational interventions improved osteoporosis self-efficacy scores.

The results indicated that mean scores of knowledge regarding osteoporosis, health belief and self-efficacy were significantly higher in the females that older than 70 years than in the young females and the differences were statistically significant after application of the program (Tables 4, 5, 6). This finding may be due to the elderly females tends to know about this disease more than the young elderly and they realize its seriousness and its great effect on them. Also, the fact that learning by doing, examples and role-play enhance learning outcomes. As good knowledge helps enhance elderly females health beliefs and self-efficacy related to osteoporosis. This result is supported by a study conducted by **Park et al., (2017)** found that the osteoporosis knowledge score has improved after the intervention of education and exercise program. Also, **Evenson & Sanders (2016)** who revealed that interventions increased osteoporosis knowledge, health beliefs and self-efficacy in older persons, in posttest.

The mean scores of knowledge regarding osteoporosis, health belief and self-efficacy were significantly higher among unmarried elderly females than those who are either married and the differences were statistically significant after application of the program. This can be explained by the fact that the unmarried elderly females are more interested in

knowing the disease than the married because they know the seriousness of the disease and there is no one to care of them if they develop osteoporosis or associated fracture. As good knowledge helps enhance elderly females health beliefs and self-efficacy related to osteoporosis. This result is supported by a study conducted by **Fahmy et al., (2019) & Park et al., (2017)** found that the osteoporosis knowledge score has improved after the intervention of education and exercise program. Also, **Evenson & Sanders (2016)** who revealed that interventions increased osteoporosis knowledge, health beliefs and self-efficacy, in posttest. In addition, **Gendler et al., (2015)** noticed that the studied osteoporosis education improves osteoporosis knowledge and dietary calcium.

The educational attainment level can be seen as a determining factor in the efficacy of an educational program; this study revealed that elderly women with higher educational attainment demonstrated greater mean scores in osteoporosis knowledge, health belief and self-efficacy than those with lower educational attainment and the differences were statistically significant after application of the program. This can be justified by the fact that elderly females who are more educated are more likely to acquire and process basic health data and services, and allowing them to make informed health decisions. Additionally, education can help them to gain a better understanding of their capabilities and gain a sense of control over their illness. These results in accordance with other researches done by **CHEN et al., (2019), & Evenson & Sanders (2016)** reported improvement scores on knowledge, self-efficacy, and health-related behaviors related to osteoporosis among elderly who have highest level of education and the difference was statistically significant.

The mean score of knowledge regarding osteoporosis, health belief and self-efficacy were significantly higher amongst elderly females having enough income and who resident in urban areas than those with non-enough income and resident in rural areas and the differences were statistically significant after application of the program. This finding can be attributed to that the higher income may facilitate paying for such services. Also, those with higher knowledge and income and resident in urban areas showed better accessibility to health care services, seek medical advices and enhance better health behaviors and self-efficacy related to osteoporosis than those with low income and resident in rural areas. Similar finding was stated by **CHEN et al., (2019), & Evenson & Sanders (2016)** reported improvement scores on knowledge, health belief and self-efficacy related to osteoporosis among older adults with low income were less likely to have health

coverage than wealthier older adults. In contrast, a study conducted in Egypt by **Fahmy et al., (2019)** stated that knowledge regarding osteoporosis and health belief mean score were significantly higher in elderly who resident in rural areas.

Conclusion

This study concluded that, the health educational program for osteoporosis based on health belief model was very effective, it had a significant effect on improve the elderly females' knowledge about osteoporosis, improving their health beliefs, and increasing their osteoporosis self-efficacy, and the scores were significantly higher than the pre-intervention ones.

Recommendations

This study recommended the following:

- Condensing the future studies on different barriers of calcium intake either social or behavioral barriers according to different cultural contexts.
- Continuing educational program in other different health care settings in order to enhance elderly females' knowledge, self-efficacy and health beliefs regarding osteoporosis.

Study' limitations

This study has some limitations, including a small sample size, the fact that it was not conducted in a community, the results cannot be generalized to all elderly females, and the absence of comparable studies in Egypt to compare with.

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Conflicts of interest

The researchers declare no conflict of interest.

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