

Educational Program Based on Theory of Planned Behavior for Female Teachers regarding Osteoporosis Prevention

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Abstract:

Background: Osteoporosis is the most common metabolic bone disease. Preventive behaviors are simple and efficient methods that can help in osteoporosis prevention and promotion of health.

Aim: This study aimed to evaluate the effect of educational program based on theory of planned behavior for female teachers regarding osteoporosis prevention.

Design: A quasi-experimental research design was employed in this study.

Setting: The study was done at seven Preparatory Schools affiliated to Benha Educational Administration.

Sample: Simple random sample of 126 female teachers divided into study and control groups, each group had 63 female teachers.

Tools: Two tools were used **I:** A structured questionnaire to assess female teachers' demographic characteristics, reproductive history, family and medical history, female teachers' knowledge and reported practices about osteoporosis prevention.

II: Theory of planned behavior to assess female teachers' attitude, perceived behavioral control, subjective norms and behavioral intention regarding osteoporosis prevention.

Results: A highly significant difference on the total levels of knowledge, reported practices and planned behaviors of the study group was noticed post program. Also, planned behavior score post educational program implementation regarding osteoporosis prevention was best predicted among study group by marital status, residence, monthly income, family history, total knowledge and reported practices.

Conclusion: Educational program based on theory of planned behavior raised the studied female teachers' total levels of knowledge, reported practices, attitudes, perceived behavioral control, subjective norms and behavioral intention regarding osteoporosis prevention.

Recommendations: Design and implement continuous workshops for female teachers to enhance their knowledge, behaviors and practices regarding osteoporosis prevention.

Keywords: Educational Program, Planned Behavior, Female Teachers, Osteoporosis.

Introduction

Osteoporosis (OP) is currently a significant global public health issue. As it frequently manifests as a clinically evident fracture and is typically asymptomatic, it may place a great physical and financial burden on patients as well as on society. It is described as a systemic skeletal illness that causes low bone mass and microstructural bone tissue decline, which increases bone fragility and the risk of

fractures as a result. Primary and secondary osteoporosis are two different types of the disease. Primary osteoporosis is significantly more common in postmenopausal women. Certain drugs or illnesses, such as hyperthyroidism and celiac disease, can cause secondary osteoporosis (**Gregson et al., 2022**).

Osteoporosis is a serious health problem in the older population and more than 200 million people are considered to

have osteoporosis globally, and 8.9 million fractures happen each year due to this condition. An osteoporosis-related fracture is anticipated to occur in 50% of females and 20% of males worldwide over the age of 50. Females increased osteoclastic activity and gonadal insufficiency during menopause and aging cause low bone mineral density, which in turn causes bone loss, osteoporosis, and fractures (**Al Zadjali et al., 2023**).

Osteoporosis primary cause is yet unknown. Age, gender, genetics, nutrition, lack of exercise, long-term glucocorticoid use, insufficient calcium intake, vitamin D deficiency, and estrogen levels are thought to be factors related to variations in bone density. Despite being preventable and treatable, osteoporosis is irreversible and can leave the patient disabled (**Panahi et al., 2021**).

The best way to prevent osteoporosis is to start early in life by achieving high peak bone mass and leading a naturally healthy lifestyle. This aids in reducing bone loss in middle and old life as well as, in avoiding or reducing other risk factors for fractures. The most important measures to prevent osteoporosis are to increase effective exercise, stop smoking, consume enough calcium and vitamin D in the diet, a healthy lifestyle, and early screening. Effective preventative education programs can greatly reduce the likelihood of developing osteoporosis in later life by increasing awareness of risk factors and ways to avoid it (**Naji & Niama, 2022**).

A crucial step in educational program is choosing a model or theory depending on the nature of the problem; also, the efficacy and goals of the model or theory should be in line with the program's objectives. Without a plan, efforts to promote health are useless. Changes in health behavior that are started and maintained have a significant impact on

program's effects on health outcomes. Therefore, selecting a suitable theory or educational model aids in starting and continuation of the program about osteoporosis prevention, moreover program components that need more attention can be identified (**Pakyyar et al., 2021**).

The Theory of Planned Behavior (TPB) has been implemented to promote a variety of behaviors, discover and understand the individual and environmental elements that influence behavior. According to TPB, the likelihood level of behavioral achievement or perceived behavioral control, as well as attitudes, individual thoughts about the behavior, subjective norms, as well as the resources and opportunities available to people, are predicting the individual behavioral intention, and the suggested behavior (**Sharbatiyan et al., 2021; Shahmohamadi et al., 2022**).

Community health nurses play a significant role as major participants in health education by teaching female teachers how to prevent osteoporosis, promoting healthy habits aimed at disease prevention, and lowering the costs of treatment. In addition, increase awareness regarding osteoporosis symptoms to aid in early detection of the disease, promote help-seeking behaviors, and reduce complications. Also, educate female teachers about preventing risk factors and preserving healthy lifestyles, adhering to good nutrition, exercising, and avoiding falls (**Mahmoud & Sabry, 2017**).

Significance of the study:

In Egypt, osteoporosis is regarded as a serious health issue. Osteoporosis is more responsible for days spent in the hospital among females over 45 than many other disorders. According to earlier studies, the incidence of osteoporosis in females in Egypt

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was 28.4%; furthermore, postmenopausal women living in rural Upper Egypt had a greater prevalence of osteoporosis, at 47.8%. Egyptian women typically have lower bone mineral density when compared to women in western countries (**Hussein & Wahdan, 2021**).

The majority of females are unaware that osteoporosis can cause severe height loss, a painful stooping posture, and broken hips, which makes this study crucial. Females mistakenly believe that brittle bones and a frail body are unavoidable aspects of aging. Osteoporosis can make a woman incapable of caring for herself, so prevention is crucial. Simple tasks like carrying groceries upstairs or downstairs become challenging. Also, women with the disease may gradually lose the independence, due to painful fractures or incapacity brought on by a broken hip (**Elesawy et al., 2021**). So, this study was performed based on TPB for female teachers regarding osteoporosis prevention.

Aim of the study:

This study aimed to evaluate the effect of educational program based on theory of planned behavior for female teachers regarding osteoporosis prevention.

Research objectives

- Assess female teachers' knowledge regarding osteoporosis.
- Assess female teachers' reported practices regarding osteoporosis prevention.
- Assess female teachers' attitude, perceived behavioral control, subjective norms, and behavioral intention regarding osteoporosis prevention.
- Develop, implement, and evaluate the effect of the educational program based on theory of planned behavior for female teachers regarding osteoporosis prevention.

Study hypothesis:

Female teachers who will receive the educational program based on theory of planned behavior will have improved knowledge, reported practices, attitudes, perceived behavioral control, subjective norms and behavioral intention regarding osteoporosis prevention than those who will not receive the educational program.

Operational definitions:

Theory of planned behavior: This theory discusses how attitudes and behavior are related. It was proposed by Icek Ajzen as a development of the theory of reasoned action. It is among the persuasion theories that is the most accurate. It has been used in research on the relationships between attitudes, intentions, and behaviors in a variety of fields, including healthcare.

Subjects and methods:

Research design:

A quasi-experimental research design was used to accomplish the aim of this study.

Research setting:

The study was carried out at the Governmental Preparatory Schools affiliated to Educational Benha Administration in Egypt which included 25 preparatory schools. 25% of these Preparatory schools were selected randomly including 7 schools named EI-Emam Mohamed Abdo School, Huda Shaarawy School, Naser Preparatory School, Omar Ibin El-Khattab School, El-Sayyida Aisha School, Anas Ibin Malik School and Zaid Ibin Haritha School.

Sampling:

A simple random sample was utilized in this study. The total number of female teachers during the year 2022-2023 in the previously mentioned 7 schools were 550 female teachers.

The following equation of Stephen Thampsons (**Fearon et al., 2017**) was used to calculate the sample size.

$$n = \frac{N \times p (1-p)}{((N-1) \times (d^2 + z^2)) + p (1-p)} = 126$$

N = Population size is 550, **p** = Ratio provides a neutral property is equal to 0.12, **d** = the error rate is equal to 0.05, **z** = Class standard responding to the level of significance equal to 1.96.

Based on the above equation, the sample size was 126 female teachers taken randomly. The number of female teachers taken from each school as follows:

School name	Number
El-Emam Mohamed Abdo	18
Huda Shaarawy	18
Naser Preparatory School	17
Omar Ibin El-Khattab	18
El-Sayyida Aisha	17
Anas Ibin Malik	16
Zaid Ibin Haritha	22
Total	126

The female teachers were randomly divided into two equal groups (study group and control group) each included 63 female teachers. The study group received the educational program, but the control group didn't receive it.

Tools for data collection: Two tools were used.

First tool: A structured questionnaire: It was established by the researchers, based on the pertinent literature and it contains the following:

Part I: Female teachers' demographic characteristics which included five questions about age, marital status, educational level, residence and monthly income.

Part II: Female teachers' history including:

a- **Obstetric history** consisted of 8 questions as age of menarche, regular menstruation, ovariectomy surgery, hysterectomy, number of gravida, number of parity, number of breast-fed children, and contraceptive methods.

b- **Family and medical history** composed of 5 questions as family history of osteoporosis, kinship degree, history of passive smoking, presence of comorbid diseases and medications previously used.

Part III: Female teachers' knowledge regarding osteoporosis included 8 closed ended questions covered meaning, causes, manifestations, risk factors, diagnostic methods, treatment modalities, complications and preventive measures of osteoporosis. This part used pre and post program.

Scoring system:

A complete correct answer was scored 2 points, incomplete correct answer was scored 1, and don't know was scored zero. Total scores were 16 points, it was categorized into good knowledge $\geq 75\%$ (≥ 12 points), fair knowledge $50\% - < 75\%$ ($8 - < 12$ points) and poor knowledge $< 50\%$ (< 8 points).

Part IV: Female teachers reported practices regarding osteoporosis prevention which included; nutritional practices (10 items), exercise practices (3 items), sun exposure (2 items), avoiding smoking (2 items), medical supplements (2 items), regular examinations (2 items), and reducing risk of falling (4 items) used pre and post program.

Scoring system:

Done practice was scored one, while not done was scored zero. The total practice included 25 points which classified as the following: Adequate if the score equals 60% or more (≥ 15 points) and inadequate if the score less than 60% (< 15 points).

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Second tool: Theory of planned behavior questionnaire: It was adopted from (Fishbein & Ajzen, 2010) and modified by researchers to assess attitude, perceived behavioral control, subjective norms and behavioral intention of female teachers. This tool was used pre and post program and comprised a total of 36 items divided into 4 sections.

- 1- Attitude:** Reflects the positive and negative evaluation of a behavior of the female teachers about osteoporosis prevention. It comprised 11 items as; I think osteoporosis is serious disease, I think osteoporosis can cause death, I think osteoporosis interferes with daily activities, I think a balanced diet helps to prevent osteoporosis and fractures.... etc.
- 2- Perceived behavioral control:** Which refers to the degree of female teachers' ability of doing or not doing a behavior under their control and included 8 items as; I can expose to sunlight 15 min/day in the morning, I can consume food-containing calcium and vitamin D, I can't prevent exposure to passive smoking, I can control intake of caffeine beverages etc.
- 3- Subjective norms:** It refers to the societal pressure experienced by female teachers to participate in or avoid the intended behavior. It was consisted of 9 items as; my family help me to eat a healthy diet, I follow medical orders that will benefit my health status, my friends frequently encourage me to make things that improve health and prevent osteoporosis, I search with my friends for new information related to osteoporosis... etc.
- 4- Behavioral intention:** Expresses the female teachers' intention to undertake the intended behavior to prevent osteoporosis. It involved 8 items as; I intend to maintain regular physical activity, I intend to take

dairy products daily, I intend to reduce intake of fatty and canned foods, I will take fresh fruits and vegetables containing calcium as banana and cabbage.... etc.

Scoring system:

Each response was given a score of "two" for agree, "one" for neutral and "zero" for disagree. The total planned behavior scores were ranged from 0-72 points and categorized as:

- Positive behavior equals $\geq 60\%$ (43-72 points).
- Negative behavior $< 60\%$ (< 43 points).

Administrative design:

The Directors of the seven Preparatory Schools received a formal letter from the Dean of Faculty of Nursing, Benha University asking for their cooperation and acceptance to conduct the study after being informed of its objectives.

Ethical considerations:

Benha Faculty of Nursing Research Ethical Committee provided acceptance for the study conduction then the female teachers' consent to participate in the study was taken after being informed that any information gathered about them would be kept private, used just for research purpose. The safety, protection, privacy, and anonymity of female teachers were ensured. The female teachers have the right to leave the study at any time.

Tools validity:

Three specialists from Community Health Nursing field assessed the study tools to ensure that they were valid. The proposed modifications were made in accordance with the findings to ensure completeness and relevance.

Reliability:

The Cronbach's alpha coefficient, which was **0.694** for knowledge, **0.930** for

reported practices, and **0.788** for planned behavior, was used to assess the reliability of the instruments. These are the only indications that this tool is a reliable instrument.

A pilot study:

It was performed on 10% (12) of the female teachers in order to assess the tools' applicability, clarity, and estimated fill-out time. After an analysis of the pilot's data, no modifications were made, so the female teachers who took part in the pilot study were also encompassed in the whole study sample.

Field work:

Following formal approval, the researchers were available two days a week (Monday and Thursday) at the study settings. Before the female teachers participated in the study and their consents were obtained, the researchers gave an introduction about themselves and the purpose of the research. A total of six months were allocated to complete the fieldwork starting in June 2023 and ending in November 2023. Using the study instruments, an average of five to six female teachers were interviewed individually each week. Interviews with the female teachers took place in the teachers' office. The female teachers were given the study tools, and their responses were measured. To complete the questionnaire, it took roughly 15 to 20 minutes.

Educational program: Was created by researchers to satisfy the actual needs of the female teachers to improve their knowledge, reported practices; and all components of theory of planned behavior for female teachers regarding osteoporosis prevention. There were four phases for the completion of the program:

1. Assessment phase:

The initial stage of the educational program in which the researchers met the female teachers, outlined the study's objectives, and asked the

female teachers about their interest in participating in the study and took their informed consent. Each female teacher was told to answer and response to study tools completely and honestly. The pretest results were utilized to determine the needs of the studied teachers and how long the study tools took to complete. Also; the program design is further influenced by the analysis of the collected pretest data.

2. Planning phase:

The educational program about osteoporosis prevention was designed based on the findings attained from the assessment phase. The general objectives were established to enhance female teachers' knowledge, reported practices and behavior regarding osteoporosis prevention. Consequently, after examining the relevant material, educational sessions were planned and scheduled and the identified needs and deficiencies were transformed into the goals and objectives of the sessions.

3. Implementation phase:

Female teachers of the study group who received the educational program were 63, they were separated into 10 groups and each group comprised 6-7 teachers. The program was implemented in 5 sessions: 2 for theoretical part and 3 for practical part. The length of every session was 30-45 minutes. The researchers began each session by summarizing what was learned from the previous one and outlining the goals for the current session, paying close attention to the use of simple Arabic language. A combination of teaching methods as; handouts, brainstorming, small group discussions, lectures, demonstration and redemonstration as well teaching aids includes brochures, colored posters and PowerPoint presentations were used. The educational booklet was given

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to female teachers in the **first session** in which the researchers described meaning of osteoporosis, causes, symptoms, risk factors and diagnosis. In the **second session** the researchers explained treatment, complications and preventive measures. While the content of the **third session** involved healthy nutritional practices, demonstrating exercise and exposure to sunlight. Additionally, the **fourth session** focused on avoiding smoking and taking medical supplements. The researchers covered how to make regular examinations, and how to reduce risk of falling in the **fifth session**. Each session ended with informing the studied teachers about the content and timing of the next one. Also, the researchers give them the chance to ask questions to identify their needs.

4. Evaluation phase:

The posttest was done post one month of the educational program. Firstly, post test was conducted for control group then the study group through visits to the prementioned schools using the same tools of pretest. The booklet was given to control group after the completion of the program.

Statistical Analysis

The SPSS program (version 25) was used for data analysis. The terms mean, standard deviation (SD), and range were used to represent numerical data. Frequency and percentage were used to represent qualitative data. Two groups' nominal variables were compared using chi-square testing. As an alternative to the chi-square test, Fisher's exact test was used on fewer sample sizes when the frequency count was less than five for more than 20% of the cells. To compare the mean scores between the two groups, independent t-tests were employed. The Pearson method was applied to check for correlation between numerical variables. For multivariate analyses

with the planned behavior score as the dependent variable, linear regression was employed. P-values < 0.05 were regarded as significant, and less than 0.001 as highly significant.

Results:

Table (1) shows that 39.7% of the study group and 33.3% of the control group aged from 40 -<50 with mean age 41.09 ± 8.51 and 41.11 ± 8.34 respectively, 65.1% and 73.1% of both groups were married respectively. Additionally, 68.3% of the study group and 60.3% of the control group had university education and 50.8% and 57.1% of both groups were from rural areas respectively.

Table (2) clarifies that 73% of the study group and 60.3% of the control group their age of menarche was 11-< 13 years with mean age 12.19 ± 0.39 and 12.33 ± 0.47 years respectively. While 74.6% and 65.1% of the two groups had regular menstruation respectively, 93.7% and 88.9% of both groups didn't make hysterectomy and 46% and 49.2% of study and control groups had ≤ 3 gravida. Moreover, 49.2% and 60.4% of the two groups had ≥ 3 breastfed children respectively.

Table (3) declares that 82.5% of the study group and 69.8% of control group didn't have family history of osteoporosis respectively. While 58.7% and 50.8% of both groups didn't have history of passive smoking respectively. In addition, 55.5% and 63.5% of the study and control groups used anti-inflammatory medications previously.

Table (4) indicates that there was a highly statistically significant difference was noticed between the study and control groups regarding all knowledge items about osteoporosis post educational program ($p \leq 0.001$). However, there was no statistically significant difference between the study and

control groups regarding all knowledge items about osteoporosis pre-educational program ($p > 0.05$).

Figure (1) shows that 14.3% of the study group had good total knowledge level regarding osteoporosis pre-educational program implementation and improved to 79.4% post educational program implementation. However, 7.9% of the control group had good total knowledge level pre-educational program implementation and increased to 17.5% post educational program implementation.

Table (5) reveals that there was no statistically significant difference between the study and control groups regarding all practices' items about osteoporosis prevention pre-educational program implementation ($p > 0.05$). However, a highly statistically significant difference was observed between the study and control groups regarding all practices' items post educational program implementation ($p \leq 0.001$).

Figure (2) shows that 20.6% of the study group had adequate total reported practices level regarding osteoporosis prevention pre-educational program and improved to 69.8% post educational program implementation. However, 14.3% of the control group had adequate total reported practices level regarding osteoporosis prevention pre-educational program and improved to 25.4% post educational program implementation.

Table (6) reveals that there were highly statistically significant differences between both groups (study and control) regarding total attitude, perceived behavioral control, subjective norms and behavioral intention post educational program ($p < 0.001$). Also, there was a highly statistically significant difference between both groups regarding total planned

behavior post educational program implementation ($p < 0.001$).

Figure (3) portrays that 11.1% of the study group had total positive planned behavior regarding osteoporosis prevention pre-educational program implementation and increased to 95.2% post educational program implementation. However, 17.5% of the control group had total positive planned behavior regarding osteoporosis prevention pre-educational program implementation and enhanced to 23.8% post educational program implementation.

Table (7) illustrates that there was highly statistically significant positive correlation between total knowledge and total reported practices for osteoporosis prevention of the study and control group pre and post educational program implementation ($p \leq 0.001$).

Table (8): Multivariate linear regression model in this table reveals that planned behavior score post educational program implementation among female teachers regarding osteoporosis prevention was best predicted among study group by marital status, residence, monthly income, family history, total knowledge and practices ($p = <0.001^{**}$, $<0.001^{**}$, 0.011^* , $<0.001^{**}$, $<0.001^{**}$, and $<0.001^{**}$, respectively), accounting for 99.2 % of the variance of planned behavior score. As regards control group, it was best predicted by marital status, comorbid diseases, and practices for prevention ($p = <0.001^{**}$, $<0.001^{**}$, and $0 < 0.001^{**}$, respectively), accounting for 96.9 % of the variance of planned behavior score.

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Table 1. Distribution of both groups according to their demographic characteristics, study group (n=63), and control group (n= 63).

Demographic data	Variables	Study group n=63		Control group n=63		X ²	P value
		No.	%	No.	%		
Age (year)	<30	13	20.6	12	19.1	1.877	0.598 ^{n.s}
	30-<40	19	30.2	26	41.3		
	40 -<50	25	39.7	21	33.3		
	≥ 50	6	9.5	4	6.3		
	Mean ± SD	41.09± 8.51		41.11± 8.34		t= -0.011	0.992 ^{n.s}
Marital status	Single	7	11.1	6	9.5	1.946	0.584 ^{n.s}
	Married	41	65.1	46	73.1		
	Widowed	11	17.5	6	9.5		
	Divorced	4	6.3	5	7.9		
Educational level	Diploma of teaching	12	19.0	19	30.2	2.175	0.337 ^{n.s}
	University education	43	68.3	38	60.3		
	Post graduate studies	8	12.7	6	9.5		
Residence	Urban	31	49.2	27	42.9	0.511	FEp 0.592 ^{n.s}
	Rural	32	50.8	36	57.1		
Monthly income	Inadequate	34	54.0	38	60.3	0.519	FEp 0.589 ^{n.s}
	Adequate	29	46.0	25	39.7		

(n.s) Not Significant (P>0.05)

FEp: p value for Fisher exact for chi square

Table 2. Distribution of both groups according to their obstetric history, study group (n=63), and control group (n= 63).

Obstetric history	Variables	Study group n=63		Control group n=63		X ²	P value
		No.	%	No.	%		
Age of menarche	11-< 13 years	46	73.0	38	60.3	2.286	FE 0.186 ^{n.s}
	13 years-< 15 years	17	27.0	25	39.7		
	Mean ± SD	12.19± 0.39		12.33± 0.47		t= -1.833	0.069 ^{n.s}
Regular menstruation	Yes	47	74.6	41	65.1	1.356	FE 0.332 ^{n.s}
	No	16	25.4	22	34.9		
Ovariectomy surgery	Yes	6	9.5	12	19.0	2.333	FE 0.202 ^{n.s}
	No	57	90.5	51	81.0		
Hysterectomy	Yes	4	6.3	7	11.1	0.896	FE 0.530 ^{n.s}
	No	59	93.7	56	88.9		
Number of gravida	Not present	17	27.0	13	20.6	0.711	0.701 ^{n.s}
	≤ 3	29	46.0	31	49.2		
	>3	17	27.0	19	30.2		
Number of parities	Not present	24	38.1	19	30.2	0.922	0.631 ^{n.s}
	≤ 3	23	36.5	25	39.6		
	>3	16	25.4	19	30.2		
Number of breast-fed children	Not present	13	20.6	6	9.5	4.599	0.204 ^{n.s}
	1	3	4.8	6	9.5		
	2	16	25.4	13	20.6		
	≥ 3	31	49.2	38	60.4		
Contraceptive methods	Not present	19	30.2	18	28.6	1.591	0.451 ^{n.s}
	Tablets	13	20.6	19	30.2		
	Intra uterine device	31	49.2	26	41.2		

(n.s) Not Significant (P>0.05)

FEp: p value for Fisher exact for chi square

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Table 3. Distribution of both groups according to their family and medical history, study group (n=63), and control group (n= 63).

Family and Medical history	Variables	Study group n=63		Control group n=63		X ² test	P value
		No.	%	No.	%		
Family history of osteoporosis	Yes	11	17.5	19	30.2	2.800	FE 0.142 ^{n.s}
	No	52	82.5	44	69.8		
Kinship degree	1 st degree	6	54.5	13	68.4	0.578	FE 0.696 ^{n.s}
	2 nd degree	5	45.5	6	31.6		
History of passive smoking	Yes	26	41.3	31	49.2	0.801	FE 0.474 ^{n.s}
	No	37	58.7	32	50.8		
# Presence of comorbid diseases	No	13	20.6	11	17.5	5.175	0.639 ^{n.s}
	Gastritis	25	39.7	27	42.9		
	Colitis	13	20.6	18	28.6		
	Diabetes mellites	18	28.6	19	39.2		
	Cardiac diseases	6	9.5	6	9.5		
	Bone diseases	6	9.5	7	11.1		
# Medications previously used	No	13	20.6	11	17.5	3.564	0.614 ^{n.s}
	Steroids	6	9.5	6	9.5		
	Antidiuretics	15	23.8	12	19.0		
	Anti-inflammatory	35	55.5	40	63.5		
	Anticoagulants	12	19.0	11	17.5		
	Chemotherapy	6	9.5	7	11.1		

(n.s) Not significant (p > 0.05)

not mutually conclusive

Table 4. Comparison of knowledge among female teachers about osteoporosis pre and post educational program implementation, study group (n=63), and control group (n= 63).

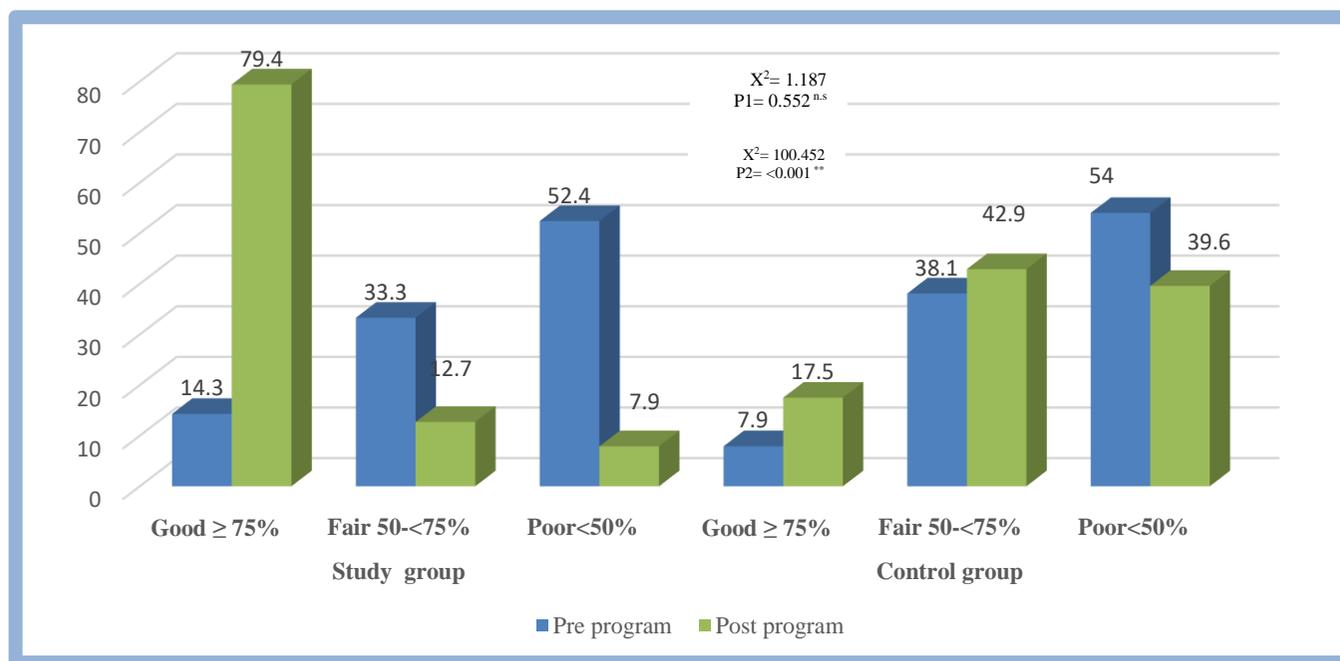
Knowledge items	Response	Study group (n=63)				Control group (n=63)				X ² test P value (1)	X ² test P value (2)
		Pre Educational program		Post educational program		Pre Educational program		Post educational program			
		No.	%	No.	%	No.	%	No.	%		
Meaning of osteoporosis	Completely correct	11	17.5	46	73.0	7	11.1	13	20.6	2.724 0.256 ^{n.s}	38.846 <0.001 ^{**}
	Incompletely correct	36	57.1	14	22.2	32	50.8	25	39.7		
	Don't know	16	25.4	3	4.8	24	38.1	25	39.7		
Causes of osteoporosis	Completely correct	7	11.1	36	57.1	11	17.5	19	30.2	1.253 0.449 ^{n.s}	24.425 <0.001 ^{**}
	Incompletely correct	32	50.8	25	39.7	32	50.8	20	31.7		
	Don't know	24	38.1	2	3.2	20	31.7	24	38.1		
Manifestations of osteoporosis	Completely correct	10	15.9	49	77.8	6	9.5	13	20.6	1.224 0.542 ^{n.s}	43.089 <0.001 ^{**}
	Incompletely correct	33	52.4	10	15.9	34	54.0	23	36.5		
	Don't know	20	31.7	4	6.3	23	36.5	27	42.9		
Risk factors of osteoporosis	Completely correct	9	14.3	48	76.2	8	12.7	0	0.0	0.524 0.769 ^{n.s}	78.821 <0.001 ^{**}
	Incompletely correct	30	47.6	10	15.9	27	42.9	29	46.0		
	Don't know	24	38.1	5	7.9	28	44.4	34	54.0		
Diagnostic methods of osteoporosis	Completely correct	10	15.9	46	73.0	10	15.9	9	1.3	0.161 0.923 ^{n.s}	47.042 <0.001 ^{**}
	Incompletely correct	32	50.8	14	22.2	34	54.0	30	47.6		
	Don't know	21	33.3	3	4.8	19	30.1	24	38.1		
Treatment modalities of osteoporosis	Completely correct	9	14.3	52	82.6	11	17.5	21	33.3	0.865 0.649 ^{n.s}	48.404 <0.001 ^{**}
	Incompletely correct	39	61.9	7	11.1	41	65.1	29	46.0		
	Don't know	15	23.8	4	6.3	11	17.5	13	20.6		
Complications of osteoporosis	Completely correct	8	12.7	46	73.1	7	11.2	6	9.5	0.085 0.958 ^{n.s}	57.231 <0.001 ^{**}
	Incompletely correct	27	42.9	13	20.6	28	44.4	23	36.5		
	Don't know	28	44.4	4	6.3	28	44.4	34	54.0		
Preventive measures for osteoporosis	Completely correct	10	15.9	55	87.4	10	15.9	0	0.0	0.042 0.979 ^{n.s}	98.028 <0.001 ^{**}
	Incompletely correct	34	54.0	4	6.3	35	55.5	43	68.3		
	Don't know	19	30.1	4	6.3	18	28.6	20	31.7		

(FE) p value for Fisher exact for chi square Not significant (p > 0.05) ** Highly significant (p ≤ 0.001)

(1) control group (pre educational program) vs study group (pre educational program)

(2) control groups (post educational program) vs study groups (post educational program)

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Not significant ($p > 0.05$)

** Highly significant ($p \leq 0.001$)

(1) control group (pre educational program) vs study group (pre educational program)

(2) control groups (post educational program) vs study groups (post educational program)

Figure (1): Comparison of studied female teachers' total knowledge level about osteoporosis pre, and post educational program implementation, study group (n=63), and control group (n= 63).

Table (5): Comparison of reported practices regarding osteoporosis prevention among female teachers pre, and post educational program implementation, study group (n=63), and control group (n= 63).

Practices regarding osteoporosis prevention	Response	Study group (n=63)				Control group (n=63)				X ² test P value (1)	X ² test P value (2)
		Pre Educational program		Post Educational program		Pre Educational program		post Educational program			
		No.	%	No.	%	No.	%	No.	%		
Nutritional practices	Done	19	30.2	50	79.4	16	25.4	19	30.2	0.356 FE 0.691 n.s	30.787 <0.001**
	Not done	44	69.8	13	20.6	47	74.6	44	69.8		
Exercise practices	Done	13	20.6	51	81.0	18	28.6	24	38.1	1.070 FE 0.408 n.s	24.014 <0.001**
	Not done	50	79.4	12	19.0	45	71.4	39	61.9		
Sun exposure practices	Done	32	50.8	63	100.0	25	39.7	35	55.6	1.570 FE 0.283 n.s	36.000 <0.001**
	Not done	31	49.2	0	0.0	38	60.3	28	44.4		
Avoiding smoking practices	Done	31	49.2	57	90.5	22	34.9	22	34.9	2.638 FE 0.149 n.s	41.570 <0.001**
	Not done	32	50.8	6	9.5	41	65.1	41	65.1		
Medical supplements practices	Done	20	31.7	50	79.4	19	30.2	25	39.7	0.037 FE 1.000 n.s	20.588 <0.001**
	Not done	43	68.3	13	20.6	44	69.8	38	60.3		
Regular examinations practices	Done	19	30.2	63	100.0	25	39.7	29	46.0	1.257 FE 0.350 n.s	46.565 <0.001**
	Not done	44	69.8	0	0.0	38	60.3	34	54.0		
Reducing risk of falling practices	Done	17	27.0	57	90.5	19	30.2	29	46.0	0.156 FE 0.844 n.s	28.716 <0.001**
	Not done	46	73.0	6	9.5	44	69.8	34	54.0		

(FE) p value for Fisher exact for chi square

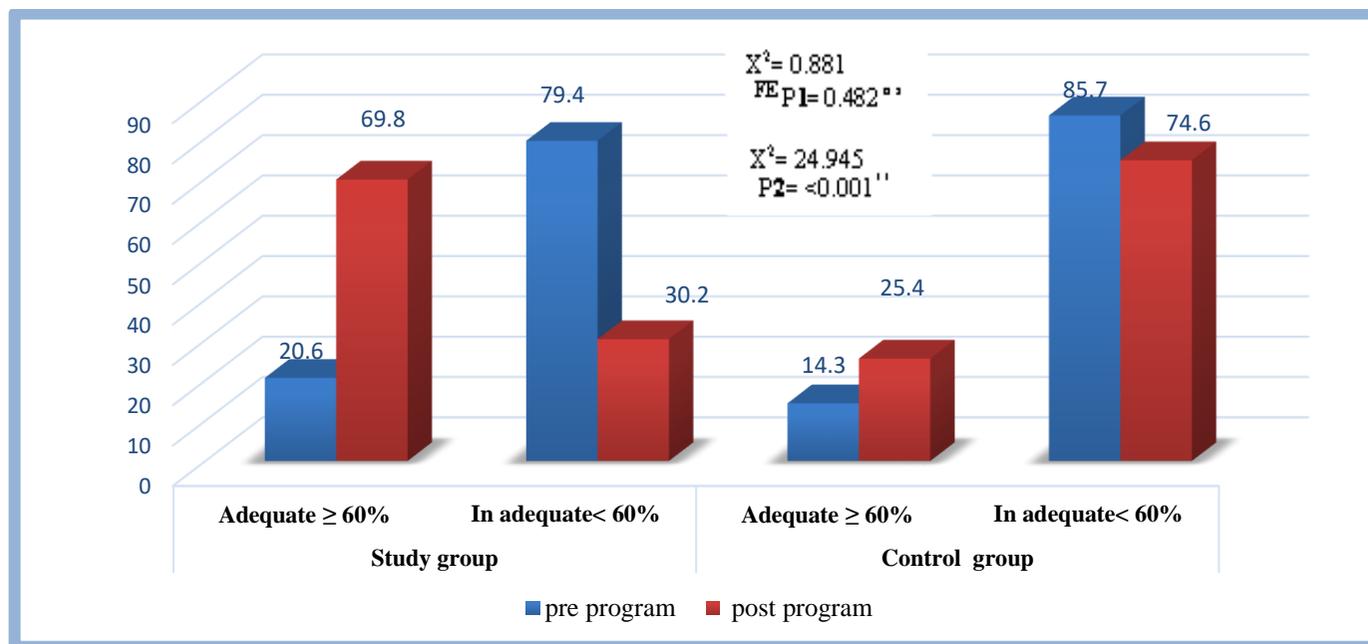
Not significant (p > 0.05)

** Highly significant (p ≤ 0.001)

(1) control group (pre-educational program) vs study group (pre educational program)

(2) control groups (post educ ational program) vs study groups (post educational program)

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(FE) p value for Fisher exact for chi square

Not significant ($p > 0.05$)

** Highly significant ($p \leq 0.001$)

- (1) control group (pre educational program) vs study group (pre educational program)
- (2) control groups (post educational program) vs study groups (post educational program)

Figure (2): Comparison of total levels of reported practices regarding osteoporosis prevention among female teachers pre, and post educational program implementation, study group (n=63), and control group (n= 63).

Table (6): Comparison of planned behavior among female teachers regarding osteoporosis prevention pre and post educational program implementation, control group (n=63), and study group (n= 63).

Planned behavior	Total score	Study group (n=63)			% of mean post educational program	Control group (n=63)		% of mean post educational program	t- test P value (1)	t- test P value (2)
		Pre Educational program	Post educational program			Pre Educational program	Post educational program			
		X ⁻ ± SD	X ⁻ ± SD			X ⁻ ± SD	X ⁻ ± SD			
Attitude	22	8.19± 4.02	19.38± 2.02	88.0 %	8.14± 4.07	8.30± 3.96	37.7 %	0.066 0.948 ^{n.s}	19.367 <0.001**	
Perceived behavioral control	16	3.19± 2.10	13.82± 1.30	86.3%	3.25± 2.13	3.34± 2.07	20.8%	-0.168 0.867 ^{n.s}	33.974 <0.001**	
Subjective norms	18	3.23± 2.33	16.33± 2.44	90.7%	3.26± 2.35	3.65± 2.37	20.2%	-0.076 0.939 ^{n.s}	29.533 <0.001**	
Behavioral intention	16	3.20± 1.85	13.92± 1.31	87.0%	3.23± 1.76	3.28± 1.77	20.5%	-0.098 0.922 ^{n.s}	38.281 <0.001**	
Total	72	17.82±6.72	63.41± 10.77		17.90± 6.67	18.58± 6.55		0.066 0.947 ^{n.s}	39.037 <0.001**	

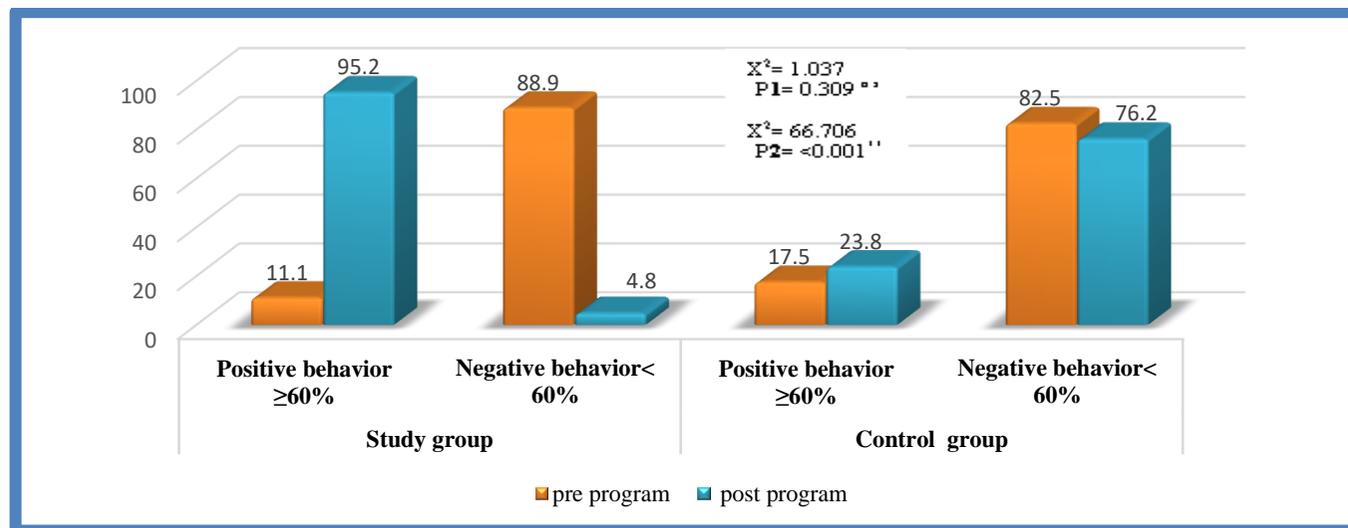
Not significant (p > 0.05)

** Highly significant (p ≤ 0.001)

(1) control group (pre educational program) vs study group (pre educational program)

(2) control groups (post educational program) vs study groups (post educational program)

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Not significant ($p > 0.05$)

** Highly significant ($p \leq 0.001$)

(1) control group (pre educational program) vs study group (pre educational program)

(2) control groups (post educational program) vs study groups (post educational program)

Figure (3). Comparison of total planned behavior among female teachers regarding osteoporosis prevention pre and post educational program implementation, control group (n=63), and study group (n= 63).

Table (7): Correlation coefficient between total knowledge and total reported practices of osteoporosis prevention among female teachers (study and control groups) pre and post educational program implementation.

Total knowledge	Total reported practices			
	Pre educational program		Post educational program	
	r	P value	R	P value
Study group	0.559	<0.001**	0.543	<0.001**
Control group	0.615	<0.001**	0.610	<0.001**

** Highly Statistically significant $p \leq 0.001$

Table (8): Multiple linear regression analysis for predictor variables of planned behavior among female teachers regarding osteoporosis prevention post educational program implementation, study (n=63), and control group (n= 63).

Planned behavior	Study group (n=63)					Control group (n=63)				
	Standardized Coefficients	Unstandardized Coefficients		t	Sig.	Standardized Coefficients	Unstandardized Coefficients		t	Sig.
	Beta	B	Std. Error			Beta	B	Std. Error		
(Constant)	37.929	1.927		19.685	.000	27.881	2.864		9.737	.000
Age	-	-	-	-	-	-	-	-	-	-
Marital status	-1.786	.141	-.272	-12.621	<0.001**	-5.650	1.124	-.933	-5.029	<0.001**
Education level	-	-	-	-	-	-	-	-	-	-
Residence	-2.143	.318	-.176	-6.732	<0.001**	-	-	-	-	-
Monthly income	-.929	.343	-.076	-2.707	.011*	3.371	2.144	.370	1.572	.126
Number of gravida	5.919E-14	.206	.000	.000	1.000	.220	.400	.044	.550	.586
Presence of comorbid diseases	-	-	-	-	-	-8.087	1.411	-.887	-5.730	<0.001**
Family history	-5.929	.403	-.258	-14.713	<0.001**	-.045	.159	-.024	-.285	.778
Total knowledge	2.857	.181	.400	15.799	<0.001**	.196	.248	.115	.791	.435
Total practices of prevention	2.000	.092	1.092	21.777	<0.001**	.600	.117	.841	5.145	<0.001**
Adjusted R²= 0.992 P = <0.001**					Adjusted R²= 0.969 P = <0.001**					

(B) Beta Co-Efficient

(SEB) Standard Error

*** Statistically significant $p \leq 0.05$**

**** Highly Statistically significant $p \leq 0.001$**

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Discussion

Osteoporosis is a skeletal disorder that worsens bone fragility, alters bone mineral density, and raises the risk of bone fractures. Although it is a silent illness, it is also a disease that may be treated and prevented. The Egyptian population has a remarkably high frequency of osteoporosis, which is linked to numerous risk factors and conditions (**El Miedany et al., 2021**). Maintaining and improving females' health can be achieved through the application of new approaches to enhance behavior. Applying an appropriate theory for behavior modification is essential to implementing a successful education program. The theory of planned behavior was selected for this study in order to offer a methodical foundation for health education. According to the following, this theory is classified into attitude, behavioral control, subjective norms and behavioral intention (**Zandi et al., 2023**).

Regarding to demographic characteristics of studied sample, the results showed that more than one third of the study group and one third of control group aged 40-<50 with mean age were 41.11 ± 8.34 for the control group and 41.09 ± 8.51 for study group. Also, less than three quarters of both groups were married, more than three fifths of both groups had university education, and lived in rural areas and had inadequate monthly income respectively. Such findings agreed with **Hussein & Wahdan (2021)**, who found that more than one third of the studied Egyptian women living in Cairo, Egypt were in the age group of 40 to 49 with a mean age of 35.6 ± 10.6 years old and 67.1% of them were married and 51% of them had university education. However, these findings contradicted with **Dastmanesh et al. (2023)**, who stated in their study on women, in rural areas of Fasa, Iran, that the mean age of the

participants in the control and intervention groups was 65.70 ± 7.87 and 67.05 ± 5.33 years, respectively and 5.8% the of them were highly educated for control group and 5.1% for intervention group.

In relation to obstetric history of studied female teachers, the mean age of menarche was 12.19 ± 0.39 and 12.33 ± 0.47 years old for study and control groups respectively, less than three quarters of both groups had regular menstruation, most of study group didn't have ovariectomy and hysterectomy while majority of control group didn't have ovariectomy and hysterectomy, less than half of both groups had less than or equal three gravida, nearly half of the study group and less than two thirds of control group had three breast-fed children and more. These findings were consistent with **Chan et al. (2019)**, who handled a study on populations > 40 years old in Malaysia and found that 44.3% of their participant women labored from one to three times, the mean age of menarche was 13.17 ± 1.73 years old for their subjects. Also, these findings were in the same line with **Mohamed, (2018)**, who conducted a study on working women at Toshiba factory in Egypt and reported that minority of working women had hysterectomy and ovaries removal.

Also, these results were in harmony with **Mahmoud & Sabry (2017)**, who carried out a study on working women at Benha and Quesna Toshiba Elaraby factories, Qaluobia and Elminofyia Governorates, and revealed that, the mean age of menarche of their study group was 12.86 ± 0.8 -year-old. 56.4%, of women had children and 73.2% breastfed their babies.

Regarding family and medical history of both groups, the current study showed that less than one fifth and less than one third of the

study and control group had family history of osteoporosis from the first degree. These findings weren't matched with **Mortada et al. (2020)**, who made a study among women of reproductive age in Egypt and found that 32.9% of participants reported a positive family history from the first degree relative and also agreed with **Elgzar et al. (2023)**, who done a study among perimenopausal women in Najran City, Saudi Arabia, and stated that 25.8% of their respondents had a family history of osteoporosis.

Moreover, the existing study illustrated that more than half of the study group and more than three fifths of control group used anti-inflammatory medications. These findings were not in the line with **AbdAllah et al. (2020)**, who accomplished a study on staff nurses in critical care units at Benha University Hospital, Benha City, Egypt and reported that 15% were taking corticosteroids.

Regarding female teachers' knowledge about osteoporosis, the current study showed a great improvement in the knowledge of female teachers about osteoporosis with a highly statistically significant difference between study and control groups post educational program. These findings agreed with **Belgacem et al. (2022)**, who achieved a study on Tunisian premenopausal women working in sedentary occupations and showed highly statistically significant difference ($p < 0.001$) between study and control groups in relation to their knowledge about osteoporosis after the implementation of the educational program than pre-educational program.

Additionally; these results were reinforced by **Sobeih & Abd Elwahed (2018)**, who achieved a study on women in Ain Shams, Egypt and stated that concerning

the level of women's knowledge about osteoporosis, there were significant differences before, after and after two months of educational intervention. This might be due to the effect of the educational program and application of suitable theory that focused on improving female teachers' knowledge and readiness to learn about osteoporosis, to live healthy and independent.

Regarding total knowledge level of the study and control groups, the existing study denoted that, less than one fifth of study group had good total knowledge level about osteoporosis pre-educational program and increased to more than three quarters post program. These findings weren't in the same line with the study done by **Ranbhise et al. (2020)**, among working women of Kolhapur, Maharashtra and reported that in pre-test, 95% of the subjects had average knowledge, while in post-test it varied between good to average (40% to 60%, respectively).

Moreover; these results were incongruent with the study of **Faris et al. (2023)**, who conducted study among employee females at the University of Sulaimani /Old Campus, Iraq and reported that the 56 % of employees had a fair understanding of osteoporosis, 38% had strong knowledge, and just 6% had poor knowledge according to their survey. This might be due to the educational program had great effect in enhancing female teachers' total knowledge and also related to using a combination of learning methods such as lectures, brochures and power point presentation.

Concerning female teachers' reported practices toward osteoporosis prevention, this study revealed that a significant improvement in the female teachers' reported practices toward osteoporosis prevention between

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study and control groups post educational program ($p \leq 0.001$). These results disagreed with **Dastmanesh et al. (2023)**, who stated that there were no significant differences in the total mean score of osteoporosis prevention behaviors and practices between control and intervention group, both before and after the intervention ($p > 0.05$) and also differed with **Parandeh et al. (2019)**, who accomplished a study on women in Iran and found that no significant differences were observed at baseline of practices between the two groups. This might be due to the improvement of female teachers' knowledge and increased their ability to control their behaviors which finally translated into improved practices regarding prevention of osteoporosis.

Regarding total reported practices level of the control and study group, the current study revealed that the total level of reported practices among the study group before the program implementation was adequate for nearly one fifth and improved after the program implementation to more than two thirds and for the control group, less than one fifth of them had adequate total reported practices level preprogram and increased to one quarter post program. These findings agreed with **Mohamed, (2018)**, who found that there was a statistically significant difference between total practices score regarding osteoporosis pre and post implementing of the systematic health education. This reflected positive effect of the educational program, and this might be attributed to high percentage of studied teachers had university education which make them acquire knowledge easily and resulted in improving their practices regarding osteoporosis prevention.

As regards planned behavior among female teachers regarding osteoporosis prevention, the present study showed that there was highly statistically significant difference between control and study group in all items of planned behavior (attitude, perceived behavioral control, subjective norms and behavioral intention) post educational program. These findings were in accordance with **Shahmohamadi et al. (2022)**, who established a study in Tehran, Iran on mothers of lower secondary school students and stated that the difference in the mean scores of attitudes, subjective norms, perceived behavioral control, mothers' behavioral intention in the two groups (experimental and control) immediately after and 1 month post the intervention was ($P < 0.05$). Also, these findings agreed with **Pakyyar et al. (2021)**, who conducted study on middle-aged individuals presenting to primary care centers, in Iran and stated that, a significant difference was found between the intervention and control groups ($P < 0.05$) in the mean score of osteoporosis preventive behavior, attitude, subjective norms, perceived behavioral control and behavioral intention after the intervention.

Regarding to total planned behavior among studied female teachers, the results of the current study indicated that the minority of the study group had total positive planned behavior regarding osteoporosis prevention preprogram and increased to the majority post program, while less than one fifth of the control group had total positive planned behavior preprogram and elevated to less than one quarter post program. These findings agreed with **Jeihooni et al. (2022)**, who performed a study on premenopausal women in Fasa City, Iran and reported that prior to the implementation of the educational intervention, attitudes, subjective norms,

perceived behavioral control, and behavioral intention did not significantly differ between the experimental and control groups. But two weeks and two months following the educational intervention, the experimental group showed a notable improvement. This might be due to positive effect of educational program based on TPB that reflected on positive change of attitude, behavioral control, subjective norms and behavioral intention of study group.

Concerning correlation between female teachers' total knowledge and total reported practices toward osteoporosis prevention, the present study showed that there were highly statistically significant positive correlation between total knowledge and total reported practices toward osteoporosis prevention among the study and control groups pre and post educational program implementation ($p \leq 0.001$). These findings were in agreement with **Mohamed, (2018)** who reported that the total knowledge and total practices of the studied women after the program showed a statistically significant positive correlation ($p=0.000$). Also; these findings finding agreed with **Sayed et al. (2019)**, who conducted study on women at Benha University Administration, Egypt and stated that there was highly statistically significant correlation between total knowledge and total practice score regarding osteoporosis. This might be due to good knowledge led to adequate practices.

Concerning linear regression analysis in this study revealed that planned behavior score post educational program implementation among female teachers regarding osteoporosis prevention was best predicted among study group by marital status, residence, monthly income, family history, total knowledge and practices ($p=$

$<0.001^{**}$, $<0.001^{**}$, 0.011^{*} , $<0.001^{**}$, $<0.001^{**}$, and $<0.001^{**}$, respectively). As regards control group, it was best predicted by marital status, comorbid diseases, and practices for prevention ($p= <0.001^{**}$, $<0.001^{**}$, and $0<0.001^{**}$, respectively). These results disagreed with **Pakyar et al. (2019)**, who accomplished a study on middle-aged patients, Tehran, Iran and found that there was statistically significant relation between osteoporosis knowledge of participants and subjective norms ($P = 0.02$), perceived behavioral control ($P > 0.001$), behavioral intention ($P = 0.006$)

Moreover, these results were supported by **Shakerinejad et al. (2017)**, who carried out a study on high school female students, Ahvaz, Iran and stated that there was statistically significant relation between experimental and control groups between attitude, intention, subjective norms, perceived behavioral control and their practices ($p<0.05$). Also, these findings agreed with **Atabay et al. (2017)**, who handled a study on rural women of Chabahar, Zahedan, Iran and reported that a significant direct association between attitude ($\text{sig.}<0.001$), subjective norms ($\text{sig.}<0.01$), perceived behavioral control ($\text{sig.}<0.01$), the intention and practices. This might be relevant to applying theories to osteoporosis prevention education that help in identify areas in programs that need more attention. The TPB framework is a useful tool for predicting and explaining health behaviors, which can be applied to the modification of unhealthy habits.

Conclusion:

The educational program based on theory of planned behavior resulted in significant improvement in total levels of knowledge, reported practices and planned

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behavior of the study group female teachers regarding osteoporosis prevention. Consequently, the research's aim and hypothesis were achieved.

Recommendations:

- Design and implement continuous workshops for female teachers to enhance their knowledge, behaviors and practices regarding osteoporosis prevention.
- Disseminate educational booklet to Benha preparatory schools to be available for female teachers.
- Further studies: Implementing awareness programs based on different theories regarding osteoporosis prevention among female teachers in different setting.
- Further researches: Replication of the research on a large probability sample is recommended to achieve more generalization.

Acknowledgments:

The researchers expressed their deepest thanks to all female teachers who shared in achievement of this research.

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برنامج تثقيفي مبني على نظرية السلوك المخطط للمعلمات فيما يتعلق بالوقاية من هشاشة العظام

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تعتبر هشاشة العظام هي أكثر أمراض العظام الأيضية شيوعاً. وان السلوكيات الوقائية هي طرق بسيطة وفعالة يمكن أن تساعد في الوقاية من هشاشة العظام وتعزيز الصحة. لذا هدفت هذه الدراسة إلى تقييم تأثير برنامج تثقيفي مبني على نظرية السلوك المخطط للمعلمات فيما يتعلق بالوقاية من هشاشة العظام. و تم استخدام تصميم البحث شبه التجريبي في هذه الدراسة. حيث أجريت الدراسة في سبعة مدارس إعدادية تابعة لإدارة بنها التعليمية. على عينة عشوائية بسيطة مكونة من ١٢٦ معلمة مقسمة إلى مجموعتين الدراسة والضابطة، ضمت كل مجموعة ٦٣ معلمة. وقد أظهرت النتائج بوجود فرق ذو دلالة إحصائية عالية في المستويات الكلية للمعلومات والممارسات والسلوكيات المخططة لمجموعة الدراسة بعد البرنامج. أيضاً، كانت نتيجة السلوك المخطط بعد تنفيذ البرنامج التثقيفي فيما يتعلق بالوقاية من هشاشة العظام بين مجموعة الدراسة من أفضل التنبؤات حسب الحالة الاجتماعية ومحل الإقامة والدخل الشهري والتاريخ العائلي والمعلومات الكلية والممارسات المذكورة. كما أدى البرنامج التثقيفي المبني على نظرية السلوك المخطط إلى رفع المستوى الكلي للمعلومات، والممارسات المذكورة، والاتجاهات، والسيطرة السلوكية المدركة، والمعايير الذاتية والنية السلوكية للمعلمات فيما يتعلق بالوقاية من هشاشة العظام. واوصت الدراسة بتصميم وتنفيذ ورش عمل مستمرة للمعلمات لتعزيز معلوماتهن وسلوكياتهن وممارساتهن فيما يتعلق بالوقاية من هشاشة العظام.