

Abstract

Application of Precede-Proceed Model Based education For Prevention of Osteoporosis Risks Among Perimenopausal Women

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Background: Osteoporosis is a major public health problem worldwide especially among perimenopausal women in the world, which can be prevented, or its onset can be delayed through health education and lifestyle changes. **Aim** was to evaluate the effect of application of PRECEDE-PROCEED model (PPM) based education for prevention of osteoporosis risks among perimenopausal women. **Design:** A quasi-experimental design was used to achieve the aim of the study. **Setting:** In Benha University hospital (administrator employee). **Sample:** A purposive sample was carried out in the study according inclusion criteria. The sample consists of 109 perimenopausal women were divided randomly into two groups (control group compromising 54 women and study group compromising 55 women). **Tools:** Two main tools were used; Self-administered questionnaire and Construction of Precede-Proceed model. **Results:** There was a highly statistically significant difference was observed in all construction of Precede-Proceed model of the study group compared with the control group after application of PRECEDE - PROCEED model ($p < .001$). **Conclusion:** application of PPM was effective in improvement of perimenopausal women's predisposing factors of osteoporosis (knowledge and attitude), healthy practices and activities, reinforcing factors, enabling factors. **Recommendations:** It is crucial to conduct an extensive future studies with larger sample probability sizes of perimenopausal women to enhance the accuracy of the findings, Also application of PRECEDE-PROCEED Model Based Education program among perimenopausal women in health system to increase the level of awareness towards osteoporosis and its prevention.

Key words: *Osteoporosis, Perimenopause, PRECEDE - PROCEED model, Prevention*

Introduction

Perimenopause or menopause transition begins several years before menopause. It's the time when the ovaries gradually begin to make less estrogen. It usually starts in women's 40s, but can start in 30s or even earlier. Perimenopause lasts up until menopause, the point when the ovaries stop releasing eggs. In the last 1 to 2 years of perimenopause, this drop in estrogen speeds up. At this stage, many women have menopause symptoms. The average length of perimenopause is 4 years, but for some women this stage may last only a few months or continue for 10 years. Perimenopause ends when women have gone 12 months without having their period (*Huang et al., 2020*).

Regarding to menopausal problem as: Vaginal and bladder problems occur when estrogen levels diminish, vaginal tissues may lose lubrication and elasticity, making intercourse painful. Low estrogen may also leave more vulnerable to urinary or

vaginal infections. Changes in sexual function. During perimenopause, sexual arousal and desire may change. Loss of bone. With declining estrogen levels, start to lose bone more quickly than replace it, increasing risk of osteoporosis, it is a disease that causes fragile bones (*Jalili, 2021*).

Osteoporosis is an irreversible, systemic skeletal disorder that affects bone density and quality, leading to bone fragility and increased risk of fractures. One in two women and one in five men over the age of 50 are expected to have a bone fracture, as a result of poor health of bones. Owing to the fact that people are usually not aware that their bones are fragile until a time of a first fracture and thus it is known as a 'silent disease'. The fractures could result in disability, poor quality of life, and premature mortality, in addition to economic consequences. (*Jakimiuk, 2020*).

Around the time of menopause, the risk of developing osteoporosis can be prevented by following a few lifestyle recommendations, such as: dietary calcium intake every day. Do regular and appropriate weight-bearing physical activity, including resistance training exercise with weights (always do the type of exercise under supervision). Maintain adequate vitamin D levels. Vitamin D helps the body to absorb calcium. It is made in the skin following sun exposure, and is found in very small amounts in some foods. Avoid excessive alcohol intake. Avoid smoking (smoking cigarettes is associated with a higher risk of developing osteoporosis). Avoid excessive caffeine intake. (Khani, 2020).

In this study, precede-proceed model was used to implement health education and health promotion interventions for the prevention of osteoporosis risks. This model was introduced by *Green and Kreuter(2005)*, as an evaluation framework for health education and health promotion planning. This model consists of stages, including social diagnosis, epidemiological diagnosis, behavioral and environmental diagnosis, educational and ecological diagnosis, that with predisposing and reinforcing and enabling factors try to divide items for educational intervention; and administrative assessment which try to assess individual or community interventions. (Bammann et al., 2020).

In the Egypt, menopausal women constitute a considerable sector of the whole population. Percentage of women at menopausal age to all women age group is 20.5%, their percentage to the whole population is 10.7%. Recent statistics in Egypt proved that about 4.7 millions of women at age of 45 years or more have osteoporosis. This number is expected to increase to 7.7 million by year of 2020 and to 13 million by the year 2030 (Abd El Rahman et al., 2019).

Aim of the study:-

This study aimed to evaluate the effect of application of PRECEDE-PROCEED model based education for prevention of osteoporosis risks among perimenopausal women.

Research hypothesis

Application of precede-proceed model based education would help to prevent osteoporosis risks among perimenopausal women.

Subject and methods

Study design:

A quasi-experimental design was utilized to fulfill the aim of this study.

Study setting:

The study was conducted in Benha University hospital (administrator employee).

Sampling:

Sample type:

A purposive sample

Sample size: Total number of perimenopausal women at Benha University hospital was 363 women 30% of total number (109 perimenopausal women) were being divided randomly into two groups (study group was comprised of 54 women and control group was comprised of 55 women).

Sample technique:

A Perimenopausal woman was chosen by simple random sample. The researcher visited the study settings and explained the purpose of the study to perimenopausal women and the visit was repeated 3 times/weekly until predetermined number completed.

Inclusion criteria:

Natural perimenopausal women, agreed to respond to the questionnaire, read and write, had telephone number

Exclusion criteria:

- Premature menopause
- Diagnosis of osteoporosis
- No predisposing factor as menopause
- Refuse or withdraw from the study

Tools of data collection:

Two main tools were used for data collection:-

Tool I:- Self-administered questionnaire. It was designed by the researcher after reviewing related literature and under guidance of supervisors; it was written in an Arabic language in the form of close ended questions and consisted of two parts:

Part 1:- Socio-demographic characteristics such as (age, residence, body mass index).

Body mass index's scoring system:-

Body mass index calculated as following:

BMI = weight (kg)/height² (m)

BMI Categories:

- Underweight = <18.5
- Normal weight = 18.5–24.9
- Overweight = 25–29.9
- Obesity = BMI of 30 or greater
- Obstetrical and gynecological history such as (gravidity, parity).
- Menstrual history such as (age of menarche, regularity of menstrual cycle).

Part 2: Healthy practices and activities questionnaire:

It was adopted from *Kuan et al., (2019)*. This questionnaire comprised of 33 items to measure healthy practices and activities of women physical activity in past month and was divided into seven dimensions; dietary habits (16 items), practicing exercise (3 items), exposure to the sun (1 item), smoking (1 item), Periodic check-up (2 items), taking medication (5 items) and reducing the risk of falling (5 items).

Scoring:

Each item had -point Likert's scale ranging from (0) to (2), each item scored as following: (2) if always done, (1) if sometimes done and (0) if never done. The total healthy practices and activities' score was classified into two levels as the following:

- Satisfactory level: $\geq 75\%$
- Unsatisfactory level: $< 75\%$

Tool II: Precede-Proceed model constructs:

A-Predisposing factor included two parts

Part One: knowledge regarding osteoporosis and its prevention. It consisted of 7 section of knowledge ;include (menopause, osteoporosis, hormonal replacement therapy, dietary habits, practicing sports, sun exposure, Periodic examination).

Scoring system:

Each item was assigned a score of (2) given when the answer was completely correct, a score (1) was given when the answer was incompletely correct and a score (0) was given when the answer was don't know or wrong. The total score of each part was calculated by summation of the scores of its items. The total score for the knowledge of a woman was calculated by the addition of the total score of all parts. As well as women' total knowledge score was classified as the following:

- Poor ($<50\%$ correct answers)
- Average (50% to $<75\%$ correct answers)
- Good ($\geq 75\%$ to 100% correct answers).

a score of (0). The total score of reinforcing factors was classified into two levels:

- Strong factors: $\geq 60\%$
- Weak factors: $< 60\%$

Part Two: Women's attitude regarding prevention of osteoporosis. Modified likert scale .This scale was adopted from *Ghaderi et al., (2010)*. It was translated into Arabic language to suit women's level of understanding and modified by the researcher to have broader study about perimenopausal women's attitude regarding prevention of osteoporosis. The questionnaire consisted of 12 items such as (osteoporosis is dangerous, and can lead to serious fractures and death, osteoporosis affects daily activities, there is a relationship between menopause and osteoporosis). care with information from health care.

Scoring system:

To obtain the outcome of attitude scale, the items were judged according to three point likert scale continuum from disagree (0), to some extent (1), and agree (2). Women' total attitude score was expressed as a percentage and classified as the following:

- Negative attitude: $< 75\%$
- Positive attitude: $\geq 75\%$

B: Enabling factor: was adapted from (Meselhy,2016)The questionnaire was translated into Arabic language to suit women's level of understanding and consisted of 8 items such as (logging onto websites to find useful information about a healthy lifestyle during perimenopause, attending workshops or seminars,etc.)

Scoring system:

The answer choices to these statements were "always", "to some extent" and "never". The "always" answer was allocated a score of (2), "to some extent" was allocated a score of (1) and "never" was allocated a score of (0). The total score of enabling factors was classified into two levels:

- Strong factors: $\geq 60\%$
- Weak factors: $< 60\%$

C: Reinforcing factor: was adapted from (*Orabi, 2017*) The questionnaire was translated into Arabic language to suit women's level of understanding and consisted of 7 items such as (Praising of other people easily for achievements, maintaining meaningful and fulfilling relationships with others).

Scoring system:

The answer choices to these statements were "always", "to some extent" and "never". The "always" answer was allocated a score of (2), "to some extent" was allocated a score of (1) and "never" was allocated

Tools Validity:-

The validity of questionnaire was reviewed by 5 jury experts in the field of obstetrics & woman health nursing and of obstetrics and gynecology at faculty of medicine, at Benha University to ascertain clarity, relevance, comprehensiveness and applicability of tools. Modifications were done such as adding, rephrasing and omitting some questions.

Tool reliability:

The reliability was done by Cronbach's Alpha coefficient test which revealed that: the internal consistency of knowledge assessment questionnaire was 0.81, the internal consistency of attitude assessment scale was 0.79 and the internal consistency of enabling and reinforcing factor was 0.76.

Ethical considerations:

An official permission from the selected study setting was obtained for the fulfillment of the study. Each woman was informed about the purpose and benefits of the study at the beginning of interview and time throughout the study. An informal consent was

obtained from each woman before starting data collection. Confidentiality was ensured throughout the study process, where personal data were not disclosed, and the women were assured that all data was used only for research purpose. Each woman was informed that, participation is voluntary and her withdrawal will not affect her care. The study didn't have any physical, social or psychological risk on the participants.

Pilot Study:-

A pilot study was conducted on (10%) from the total sample (10 women) to test the clarity and applicability of the study tools as well as estimation of the time needed to fill the questionnaire. Required modifications were done in the form of adding or omission of some questions. Women involved in the pilot were included from the study.

Field work:

The study was conducted through PPM phases. It was carried out from the beginning of June 2019, and completed at the end of May 2020 covering 12 months. This study was conducted under the approval of the Faculty of Nursing Ethical Committee, Benha University. A written official approval to conduct this study was obtained from the Dean of faculty nursing to director of Benha university hospital. Other written official letter was taken and delivered to the director of Benha university hospital, in order to obtain their agreement to conduct the study after explaining its purpose. An informal consent was also taken from each woman for participation. The researcher conducted the study 3 times/weekly (Saturdays, Mondays and Thursday); from 9.00 a.m. to 2.00 p.m.

To fulfill the aim of this study, the following phases were adopted; preparatory phase, interviewing and assessment phase, planning phase, PRECEDE-PROCEED model implementation phase and evaluation phase.

Preparatory phase:

The preparatory phase was the first phase of the study, the researcher carried out through review of local and international related literature about the various aspects of the study problem. This helped the researcher to be acquainted with magnitude and seriousness of the problem, and guided the researcher to prepare the required data collection tools. The tool was distributed to experts in the field; the aim was to test its appropriateness, comprehensiveness, clarity, importance and applicability. The jury recommended omissions of some items or addition which were done.

Interviewing and assessment phase:

This phase encompassed interviewing both control group and study group to collect socio-demographic characteristics, baseline data about women's health practices and activities, knowledge and attitude regarding prevention of osteoporosis as well as enabling and reinforcing factor through asking

questions. Interviewing begin first with control group to avoid bias then with study group. At the beginning of interview the researcher greeted the woman, introduced herself to each woman included in the study, explained the purpose of the study and provided the woman with all information about the study (purpose, duration, and activities) and take informal consent. Data were collected by the researcher through administration of the tools to each woman at their work places. Average time for the completion of each woman interview was around (30-40 minutes). Average number collected was 3-4 women per day.

Planning phase:

Based on results obtained during assessment phase, the intervention program based on PRECEDE-PROCEED model was developed by the researcher after reviewing related literature in a form of printed booklet. The booklet was designed specifically for women, in simple Arabic language to suit their level of understanding and to satisfy the studied pregnant women's deficit knowledge and attitude regarding prevention of osteoporosis. It was illustrated by colored pictures. Sessions number and its contents, different methods of teaching, and instructional media were determined. Objectives were constructed to be attained after completion the intervention program.

Implementation of the program phase:

PRECEDE-PROCEED model intervention program was conducted to study group through five sessions. Total time for all sessions to each woman took about three hours and half, each session took about 45-60 minutes. At the beginning of the first session women were oriented with the program contents. Each woman was informed about the time of the next sessions at the end of session. The subsequent session started by a feedback about the previous session and the objectives of the new session, using simple Arabic language to suit women' level of understanding. At the end of each session, women' questions were discussed to correct any misunderstanding.

Different methods of teaching were used such as discussion, demonstration and redemonstration. Instructional media included video contain all content of program and educational booklet about osteoporosis which constructed by the researcher in a simple Arabic language after reviewing the related literatures and based on women' deficit knowledge healthy practices and attitude regarding prevention of osteoporosis.

The first session included the researcher gave the women the educational booklet and introduced an orientation to the program, introduction about perimenopause, causes, risk factors, perimenopause symptoms, complication, methods of perimenopause management. The second session included general

knowledge about osteoporosis , causes ,risks, prevention The third session included general knowledge about healthy behavior (periodic checks and investigations), importance of exercise, rate and types of exercises The fourth session included nutrition, and interpersonal relations. Women were taught about balanced diet, modifying unhealthy nutritional behaviors, strict intake of processed and sugar rich foods and carbohydrates, increasing intake of fresh vegetables and fruits, increasing dairy intake. As well as, maintaining weight control and reducing obesity. Social support and maintaining communications with others, overcoming the embarrassment and strengthening talking with the husband about perimenopause The fifth session included PPM, its phases and predisposing factors, reinforcing factors and enabling factors for prevention osteoporosis risks during perimenopause.

Evaluation phase:

The effectiveness of the PRECEDE-PROCEED model intervention program was evaluated 6 months after implementation, using the same format of tools which used during the assessment phase (pre-post test format) which were (tool I- Part 2 to measure healthy practices and activities of women physical activity and tool II to evaluate women's knowledge and attitude regarding prevention of osteoporosis and to evaluate the enabling and reinforcing factor).

Evaluation started first with control group then with study group to avoid bias. At almost time the researcher followed the women via telephone.

Administrative design:

The necessary official permissions for data collection were obtained by submission an official letters issued from the dean of faculty of nursing to administrators of the study setting. The title and objectives of study were illustrated as well as the main data item to be covered.

Statistical design:

Data was verified prior to computerized entry. The Statistical Package for Social Sciences (SPSS version 22.0) was used for that purpose, followed by data tabulation and analysis. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). Test of significance (t test, chi-square), Pearson correlation coefficients were used. A significant level value was considered when $p \leq 0.05$. And A highly significant level value was considered when $p < 0.01$.

RESULTS

Table (1) clarifies that there was no statistically significant difference between control and study groups regarding socio-demographic characteristics (Age, residence, education, marital status, nature of work, monthly income ($p > 0.05$) reflected group homogeneity.

Table (2) represents the anthropometric measurements of both study and control group, it showed that, the mean weight of both study and control groups were 80.95 ± 11.24 kg and 77.54 ± 12.24 kg respectively, the mean height of both study and control groups were 160.33 ± 4.63 cm and 161.70 ± 3.76 cm respectively. In addition, the mean body mass index in both study and control groups were 31.12 ± 4.30 kg / m² and 29.71 ± 4.93 kg / m² respectively, this mean no significance difference in anthropometric data of both group ($p > 0.05$) reflect homogenous.

Table (3) illustrates that there was no statistically significant difference between control and study groups regarding all items of knowledge about osteoporosis before intervention ($P > 0.05$). However, there was a highly statistical significant improvement were observed in the study group compared with the control group after intervention ($p < 0.001$).

Figure (1): Distribution of the studied women (control and study groups) according to their total attitude score regarding prevention of osteoporosis at pre and post intervention phases (n=109).

Table (4): represents that there was no statistically significant difference between control and study groups regarding all items of healthy practices and activities regarding dietary habits before intervention ($P > 0.05$). However, there was a highly statistical significant improvement was observed in the study group compared with the control group after intervention ($p < 0.001$).

Table (5): clarifies that there was a highly statistically significant positive correlation between total knowledge score

and total attitude of both study and control groups before and after intervention ($P < 0.001$). Moreover, there was a highly statistically significant positive correlation between total knowledge score and total healthy practices and activities of both study and control groups before and after intervention ($P < 0.001$).

Table (1): Distribution of the studied women (control and study groups) according to their socio-demographic characteristics (n= 109).

Socio-demographic characteristics	Control group n= 54		Study group n=55		X2 p-value
	No	%	No	%	
Age (years)					
42-45	13	24.1	18	32.7	1.80 >0.05
46-50	23	42.6	17	30.9	
≥ 51	18	33.3	20	36.4	
Mean ± SD	47.67 ± 3.54		48.41 ± 2.34		
Residence					
Rural	34	63.0	40	72.7	1.19 >0.05
Urban	20	37.0	15	27.3	
Education					
Basic education	5	9.3	4	7.3	.552 >0.05
Secondary education	30	55.6	28	50.9	
University education	19	35.1	23	41.8	
Marital status					
Married	46	75.9	46	69.1	.524 >0.05
Divorced	3	5.6	2	36.6	
Widowed	5	18.5	7	27.3	
Nature of work					
Office and writing work	52	96.3	49	89.1	2.08 >0.05
Require physical effort and movement	2	3.7	6	10.9	
Monthly income					
Enough	12	22.2	19	34.5	2.03 >0.05
Not enough	42	77.8	36	65.5	

Parameters	Control group n=54		Study group n=55		Independent t test	P value
	Mean ±SD		Mean ±SD			
Weight in kg	77.54±12.24		80.95±11.24		-1.15	>0.05
Height in cm	161.70±3.76		160.33±4.63		.465	>0.05
BMI	29.71±4.93		31.12±4.30		-1.58	>0.05

Table (2): Mean score of anthropometric measurements of control and study groups (n=109)

Table (3): Distribution of the studied women (control and study groups) according to their knowledge regarding osteoporosis at pre and post intervention phases (n=109).

A Statistical significant $p \leq 0.05$

A Highly Statistical significant $p \leq 0.001$

Knowledge items	Before intervention					After intervention				
	Control group n=54		Study group n=55		X2 p-value	Control group n=54		Study group n=55		X2 p-value
	No	%	No	%		No	%	No	%	
Definition of osteoporosis										
Complete correct answer	7	13	10	18.2	0.981 0.612	8	14.8	39	70.9	35.522€ 0.000**
Incomplete correct answer	24	44.4	26	47.3		26	48.1	11	20	
I don't know or wrong	23	42.6	19	34.5		20	37	5	9.1	
Factors that contribute to the occurrence of osteoporosis										
Complete correct answer	3	5.6	5	9.1	0.99€ 0.609	5	9.3	30	54.5	36.55€ 0.000**
Incomplete correct answer	16	29.6	19	34.5		25	46.3	23	41.9	
I don't know	35	64.8	31	56.4		24	44.4	2	3.6	
Symptoms of osteoporosis										
Complete correct answer	4	7.4	3	5.5	1.14€ 0.564	8	14.8	37	37	41.37 0.000**
Incomplete correct answer	23	42.6	29	52.7		31	54.4	13	13	
I don't know	27	50	23	41.8		15	27.8	5	5	
Diagnosis of osteoporosis										
Complete correct answer	3	5.6	4	7.3	0.30€ 0.860	5	9.3	31	56.4	51.51 0.000**
Incomplete correct answer	18	33.3	20	36.4		24	44.4	19	34.5	
I don't know	33	61.1	31	56.3		25	46.3	5	9.1	
Time need to measure bone density										
Complete correct answer	0	0	2	3.6	2.82€ 0.244	2	3.7	29	52.7	32.20€ 0.000**
Incomplete correct answer	24	44.4	19	34.5		33	61.1	17	30.9	
I don't know	30	55.6	34	61.8		19	35.2	9	16.4	
Prevention of osteoporosis										
Complete correct answer	4	7.4	7	12.7	1.46€ 0.481	3	5.6	49	89.1	79.02€ 0.000**
Incomplete correct answer	18	33.3	21	38.2		21	38.9	6	10.9	
I don't know	32	59.3	27	49.1		30	55.6	0	0	
Methods of protection to reduce the risk of falling										
Complete correct answer	6	11.1	7	12.7	1.110 0.574	5	9.3	31	56.3	38.93€ 0.000**
Incomplete correct answer	22	40.7	27	49.1		21	38.9	21	38.2	
I don't know	26	48.2	21	38.2		28	51.8	3	5.5	
Treatment of osteoporosis										
Complete correct answer	2	3.7	1	1.8	1.53€ 0.460	0	0	18	32.7	34.64€ 0.000**
Incomplete correct answer	15	27.8	21	38.2		28	48.1	32	58.2	
I don't know	37	68.5	33	60		26	51.9	5	9.1	

*A statistical significant difference ($P \leq 0.005$) **A high statistical significant difference ($P \leq 0.001$)

€ Fisher Exact Test

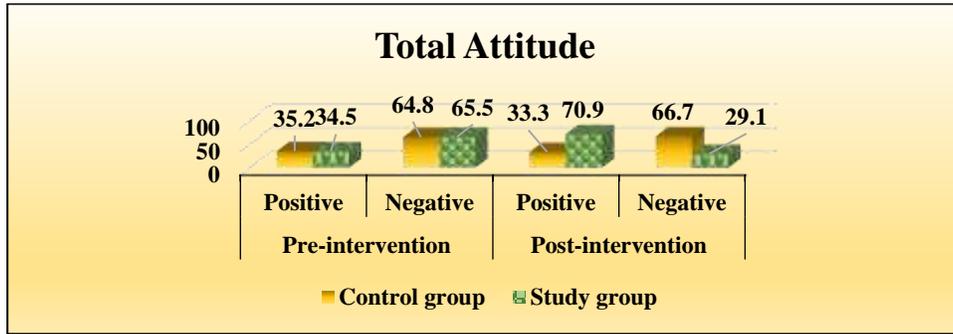


Table (4): Distribution of the studied women (control and study groups) according to their healthy practices and activities regarding dietary habits at pre and post intervention phases (n=109).

Dietary habits	Before intervention					After intervention				
	Control group n=54		Study group n=55		X2 p-value	Control group n=54		Study group n=55		X2 p-value
	No	%	No	%		No	%	No	%	
Eating three regular meals a day that contain all the nutrients that are beneficial for the bones										
Always	7	13	8	14.5	0.452 0.796	8	14.8	22	40	13.45 0.000**
Sometimes	29	53.7	26	47.3		25	46.3	26	47.3	
Never	18	33.3	21	38.2		21	38.9	7	12.7	
Eating eggs and dairy products										
Always	5	9.3	6	10.9	0.748€ 0.688	3	5.6	21	36.4	11.42€ 0.000**
Sometimes	19	35.2	23	41.8		27	50	23	43.6	
Never	30	55.6	29	47.3		24	44.4	11	20	
Eating fresh fruits and vegetables that contain calcium and vitamins										
Always	5	9.3	3	5.5	0.855€ 0.754	10	18.5	18	32.7	10.67€ 0.000**
Sometimes	24	44.4	25	45.4		29	53.7	34	61.8	
Never	25	46.3	27	49.1		15	27.8	3	5.5	
Eating fish regularly										
Always	5	9.3	3	5.5	2.73€ 0.255	3	5.6	26	47.3	25.04€ 0.000**
Sometimes	24	44.4	33	60		30	55.6	20	36.3	
Never	25	46.3	19	34.5		21	38.9	9	16.4	
Eating legumes										
Always	4	7.4	6	10.9	5.53€ 0.057	5	9.3	36	65.5	40.86 0.000**
Sometimes	18	33.3	29	52.7		21	38.9	14	25.4	
Never	32	59.3	20	36.4		28	51.8	5	9.1	
Using vegetable ghee / or oils instead of animal ghee in cooking food										
Always	3	5.6	2	3.6	4.84€ 0.089	4	7.4	31	56.4	36.32€ 0.000**
Sometimes	22	40.7	34	61.9		23	42.6	19	34.5	
Never	29	53.7	19	34.5		27	50	5	9.1	
Reducing the intake of animal protein										
Always	2	3.7	5	9.1	2.30€ 0.316	7	13	40	72.7	50.28€ 0.000**
Sometimes	24	44.4	28	50.9		21	38.9	11	20	
Never	28	51.9	22	40		26	48.1	4	7.3	
Avoid eating foods rich in fat										
Always	1	1.9	2	3.6	0.928€ 0.629	2	3.7	24	43.6	25.37€ 0.000**
Sometimes	24	44.4	28	50.9		28	51.9	21	38.2	
Never	29	53.7	25	45.5		24	44.4	10	18.2	
Avoid eating pickles and salty foods										
Always	5	9.3	2	3.6	3.80€ 0.150	9	16.7	47	85.5	54.53€ 0.000**
Sometimes	25	46.3	35	63.7		25	46.3	8	14.5	
Never	24	44.4	18	32.7		20	37	0	0	
Avoid eating preserved foods										
Always	6	11.1	7	12.7	3.571 0.168	8	14.8	36	65.4	29.04€ 0.000**
Sometimes	36	66.7	43	78.2		38	70.4	16	29.1	
Never	12	22.2	5	9.1		8	14.8	3	5.5	
Avoid taking fast food out of home										
Always	7	13	10	18.2	0.981 0.612	8	14.8	39	70.9	35.52€ 0.000**
Sometimes	24	44.4	26	47.3		26	48.1	11	20	
Never	23	42.6	19	34.5		20	37	5	9.1	
Avoid adding too much salt to food.										
Always	6	11.1	9	16.4	0.994 0.608	5	9.3	49	89.1	69.727€ 0.000**
Sometimes	20	37	22	40		24	44.4	4	7.3	
Never	28	51.9	24	43.6		25	46.3	2	3.6	
Avoid drinking soft drinks										
Always	0	0	0	0	.238€ 0.626	0	0	22	40	46.87€ 0.000**
Sometimes	16	29.6	13	23.6		18	33.3	23	41.8	
Never	38	70.4	42	76.4		36	66.7	10	18.2	
Avoid drinking more than 2 cups of tea per day										
Always	5	9.3	3	5.5	2.73€ 0.255	3	5.6	31	56.4	32.79€ 0.000**
Sometimes	24	44.4	33	60		37	68.5	17	30.9	
Never	25	46.3	19	34.5		14	25.9	7	12.7	
Avoid drinking more than 2 cups of coffee per day.										
Always	0	0	2	3.6	4.84€ 0.089	0	0	30	54.6	58.19€ 0.000**
Sometimes	15	27.8	23	41.9		16	29.6	19	34.5	
Never	39	72.2	30	54.5		38	70.4	6	10.9	
Following a diet to maintain weight.										
Always	0	0	2	3.6	3.135 0.209	0	0	32	58.2	52.45€ 0.000**
Sometimes	19	35.2	24	43.7		24	44.4	19	34.5	
Never	35	64.8	29	52.7		30	55.6	4	7.3	

*A statistical significant difference (P ≤ 0.005) **A high statistical significant difference (P ≤ 0.001) € Fisher Exact Test

Table (5): Correlation coefficient between total knowledge score, total attitude score and total healthy practices and activities of the studied women at pre and post-intervention phases (n=109).

Variables	Total Knowledge							
	Control group				Study group			
	Before intervention		After intervention		Before intervention		After intervention	
	r	p-value	r	p-value	r	p-value	r	p-value
Total attitude	0.838	≤ 0.001**	0.674	≤ 0.001**	0.733	≤ 0.001**	0.759	≤ 0.001**
Total healthy practices and activities	0.739	≤ 0.001**	0.745	≤ 0.001**	0.515	≤ 0.001**	0.549	≤ 0.001**

A statistical significant difference (P ≤ 0.005) **A high statistical significant difference (P ≤ 0.001) € Fisher Exact Test

Discussion:

Peri-menopause represents a delicate transition period of a woman's life during which physiological, affective, psychological, and social changes mark progression from a woman's fertile life to climacterium, with wide sexual hormones fluctuations until the onset of hypergonadotropic amenorrhea. During this stage, because of the decreases or fluctuations of sex hormones caused by recession of ovarian function, women undergo a series of psychological and physical symptoms, clinically called perimenopausal syndrome *Huang et al, (2020)*.

Socio-demographic characteristics of studied women such as age, residence, educational level, occupation and income mainly affect women's knowledge, attitude, practices, enabling factors and reinforcing factors regarding prevention of osteoporosis risks. So, these factors should be determined for the studied women. The finding of the current study revealed that more than two-fifths and more than one-third of both study and control groups respectively in age group (46-50 years) with a mean age of 48.41 ± 2.34 years and 47.67 ± 3.54 years respectively.

Conducted "Knowledge, Attitude and Practice (KAP) Survey of Osteoporosis among Students of a Tertiary Institution in Malaysia", found that a minority of participants reported that health care professionals were their primary source of information. This may be due to lack of time on the part of health care professional, ignorance of the seriousness of osteoporosis as a disease or even low level of knowledge among healthcare professionals. Studies that evaluated knowledge of osteoporosis among healthcare professionals surprisingly reported a low level of knowledge especially among nurses who are more often in contact with patients and their families *Chen et al, (2005)*.

Additionally, *ElTohami, et al, (2015)* in a study entitled "Study of Knowledge, Attitude and Practice of Osteoporosis among Adult Women in Majmaah City, Saudi Arabia", revealed that Media was the main source of information about osteoporosis.

Concerning the body mass index, the results of current study represented the anthropometric measurements of both study and control group, it showed that, the mean weight of both study and control groups were 80.95 ± 11.24 kg and 77.54 ± 12.24 kg respectively, the

mean height of both study and control groups were 160.33 ± 4.63 cm and 161.70 ± 3.76 cm respectively. In addition, the mean body mass index in both study and control groups were 31.12 ± 4.30 kg / m² and 29.71 ± 4.93 kg / m² respectively, this mean no significance difference in anthropometric data of both group (p>0.05) reflect homogenous.

These results were a serious indicator and needed to study the relationship between the body mass index, incidence, and severity of symptoms and complication during menopause. Also, these results serve as a warning bell and indicate the extent of false dietary habits and practices among women, which may worsen their complaints from menopause or causing some complications demonstrating the importance of dietary health education programs for women at all ages. This finding may be explained by the fact that women, due to cultural or personal reasons, generally do not practice physical activity and may overeat. Besides, limited physical activity leads to obesity, which is a predisposing factor for increased health problems as osteoporosis.

In the same context, *Hajizadeh et al, (2019)* who studied "Development and validation of a theory of planned behavior-based weight control behavior questionnaire among postmenopausal women with osteoporosis", concluded that postmenopausal women, deprived of the protective effects of endogenous estrogen are predisposed to increases in weight. For instance, women have exhibited a sharp increase in obesity between the ages of 45 and 54 years, as a result of declines in endogenous estrogen, together with physical. Overweight or high body mass index (BMI) are also reported as risk factors for vertebral fracture among postmenopausal osteoporotic women.

Owing to knowledge of the studied women regarding prevention of osteoporosis risks at menopause, the current study findings clarified that there was no statistically significant difference between control and study groups regarding all items of knowledge about menopause, osteoporosis, hormonal replacement therapy, dietary habits, practicing sports, importance of sun exposure and periodic examination at menopause before intervention (P > 0.05). However, there was a highly statistical significant improvement were observed in the study group compared with the control group after

intervention ($p < 0.001$). Where, it was displayed that, one-fifth of study group and less than one-quarter of control group had good knowledge before intervention. Meanwhile, after intervention, more than three-quarters of study group had good knowledge compared with more than one-quarter (27.7%) of the control group.

This result was consistent with *Tabasi et al, (2018)* who conducted "Application of the Precede-Proceed Model in Promoting Physical Activity for Prevention of Osteoporosis among Women" found that after educational interventions, the mean scores of predisposing factors including knowledge are significantly increased only in the intervention group ($p < 0.001$). In this regard, the present study was consistent with studies conducted by *Estebarsari et al, (2010)*, *Jimba & Murakami, (2001)*, and *Polcyn et al, (1991)* who studied "Planning and evaluation of an educational program based on Precede model to improve physical activity in female students", "Eliminating iodine deficiency disorders in Nepal through Precede-Proceed" and "Utility of the Precede model in differentiating users and nonusers of smokeless tobacco" respectively. These findings reflect the impact of the implementation of PPM model-based interventions on raising the level of knowledge among people, especially regarding the fact that knowledge is of utmost importance in making the right attitude and behavior.

Moreover, *Jeihooni et al, (2019)* in a study entitled "The effect of education based on based health belief model on osteoporosis and bone mineral density among women", reported that the experimental group showed a significant increase in knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, internal cues to action, nutrition, and walking performance immediately and one year after the intervention. The result obtained from these studies can be concluded that providing educational programs in this regard for family members, physicians and other health personnel and offering training programs in radio and television broadcasting is essential.

Additionally this result went in the same line with *Pourhaji et al, (2020)* in the study entitled "Effects of educational program based on Precede-Proceed model in promoting low back pain behaviors (EPPLBP) in health care workers Shahid Beheshti University of medical sciences: randomized trial", reported that there was a significant interaction between the factors "group" and "test time" ($p < 0.05$, $p < 0.001$) of knowledge of the intervention group., although, no significant alternate became located in the mean score of above structures of the control group.

Also, the result of the current study was supported by *El-Said et al, (2021)* who carried out study on "Application of an Educational Program on Lifestyle of Perimenopausal Women Utilizing PRECEDE – PROCEED Model", revealed that there was no statistically significant difference between control and study groups

regarding knowledge before PPM application. However, there was a highly statistically significant difference was observed in knowledge of the study group compared with the control group after three and six months of PPM application.

The findings confirmed the effectiveness of the PRECEDE-PROCEED model-based educational program on preventing osteoporosis by enhancing scores of model constructs. However, these results should be repeated in further studies to be able to apply this program in health system.

Increasingly, the result of the current study was supported by *Sullivan, et al, (2007)* in a study entitled "Psycho-educational intervention for achieving and maintaining adequate dietary calcium intake in premenopausal Chinese women", demonstrated that on controlling for the effect of age, no significant difference between the experimental and control group was found at the pre-test for knowledge. After the intervention, the experimental group scored significantly higher than the controls for knowledge on the immediate, 3-month and 6-month post-tests.

It was reported by *John Cecily, (2020)* that majority of the women 94.5% had inadequate knowledge on preventive measures of osteoporosis. This indicates the ultimate importance of educational intervention to improve knowledge and thus prevent development of osteoporosis in later life. This result was in agreement with *Barzanji et al, (2013)*, who illustrated that there was lack of knowledge of the studied sample regarding prevention of osteoporosis risks.

Concerning attitude of the studied women regarding prevention of osteoporosis risks at menopause, there was no statistically significant difference between control and study groups regarding all items of attitude towards prevention of osteoporosis before intervention ($P > 0.05$). However, there was a highly statistically significant improvement was observed in the study group compared with the control group after intervention ($p < 0.001$). Where, it was illustrated that, less than one-third of both study and control groups respectively had positive attitude before intervention. Meanwhile, after intervention, less than three-quarters of study group had positive attitude compared with less than one-third of the control group.

This result agreed with *Estebarsari et al, (2018)*, indicated that after educational interventions, the mean scores of attitude significantly improved only in the intervention group ($p < 0.001$).

This result went in the same line with *Pourhaji et al, (2020)* reported that there was a significant interaction between the factors "group" and "test time" ($p < 0.05$, $p < 0.001$) of attitude of the intervention group. Although, no significant alternate became located in the mean score of above structures of the control group. Increasingly, the result of the current study was supported by *(Sullivan, et al, 2007)*, demonstrated that on controlling for the effect of

age, no significant difference between the experimental and control group was found at the pre-test for attitude. After the intervention, the experimental group scored significantly higher than the controls for attitude on the immediate, 3-month and 6-month post-tests. This result was in agreement with *Barzanji et al, (2013)* who indicated that there was low score of attitude of the studied sample regarding prevention of osteoporosis.

Also, the result of the current study was supported by *El-Said et al, (2021)* who revealed that there was no statistically significant difference between control and study groups regarding attitude before PPM application. However, there was a highly statistically significant difference was observed in attitude of the study group compared with the control group after three and six months of PPM application.

In the same context *Hurst and Wham, (2007)* in a study entitled "Attitudes and knowledge about osteoporosis risk prevention: a survey of New Zealand women", these women demonstrated average levels of knowledge about osteoporosis risk factors. They had low feelings and attitude of susceptibility towards development of osteoporosis, but most considered it to be a serious disease.

Regarding healthy practices and activities of the studied women regarding prevention of osteoporosis risks at menopause, the current study findings clarified that there was no statistically significant difference between control and study groups regarding all items of healthy practices and activities regarding dietary habits, practicing exercise, exposure to the sun, smoking and periodic check-up, taking medication and reducing the risk of falling before intervention ($P > 0.05$). However, there was a highly statistical significant improvement was observed in the study group compared with the control group after intervention ($p < 0.001$). Where, it was displayed that, more than one-quarter and less than one-third of both study and control groups respectively had satisfactory level of healthy practices and activities before intervention. Meanwhile, after intervention, less than two-thirds of study group had satisfactory level compared with more than one-quarter of the control group.

In the same context, *Tabasi et al, (2018)*, found that after the intervention, there was a significant difference in the mean scores of practices and physical activity in the intervention group, which is probably because of the effects of the intervention. This is consistent with the studies of *Lesan et al, (2003)*, *Estebarsari et al, (2010)* and *Shakouri et al, (2009)* and *Turner et al, (2004)* who carried out studies on "Application of Precede in reducing Tehranian firemen anxiety", "Planning and evaluation of an educational program based on Precede model to improve physical activity in female students", "Effect of health education program base on Precede model in controlling iron-deficiency anemia among high school girl students in Talesh" and "Design and implementation of

an osteoporosis prevention program using the health belief model" respectively.

Also, the result of the current study was supported by *El-Said et al, (2021)* who revealed that there was no statistically significant difference between control and study groups regarding practices and health promoting lifestyle before PPM application. However, there was a highly statistically significant difference was observed in practices and health promoting lifestyle of the study group compared with the control group after three and six months of PPM application.

This result went in the same line with (*Pourhaji et al, 2020*), reported that there was a significant interaction between the factors "group" and "test time" ($p < 0.05$, $p < 0.001$) of quality of life and osteoporosis preventive behaviors of the intervention group, although, no significant alternate became located in the mean score of above structures of the control group.

Increasingly, the result of the current study was supported by *Sullivan, et al, (2007)*, demonstrated that on controlling for the effect of age, no significant difference between the experimental and control group was found at the pre-test for behavioral change. After the intervention, the experimental group scored significantly higher than the controls for stage of behavioral change on the immediate, 3-month and 6-month post-tests.

This result was in agreement with *Barzanji et al, (2013)*, who illustrated that there was lack of awareness about osteoporosis. Practice score was the most worrying condition compared with the two other domains (i.e., knowledge and attitude). *Sharifi et al, (2017)* who conducted "The Effects of an Educational Intervention Based on the Health Belief Model and Self-Regulation on Women's Eating Behaviors during Menopausal Transition", indicated that the educational intervention improved women's knowledge, attitudes, and healthy practices.

Within the PRECEDE-PROCEED Model, **enabling and reinforcing factors** are defined as factors that make it possible (or easier) for individuals or populations to change their behavior or their environment. Enabling factors include resources, conditions of living, societal supports, and skills that facilitate a behavior's occurrence. So, it is important to ascertaining which factors have the ability to cause each of these behaviors to occur or to inhibit their occurrence. These factors are themselves grouped into three types: predisposing, reinforcing, and enabling factors *Simeon et al, (2020)*.

Increasingly, the result of the current study was consistent with *Khan et al, (2014)* who mentioned that there was lack of awareness about osteoporosis and unsatisfactory level of performance about osteoporosis prevention measures among study participant. The results of present study revealed an urgent need of a targeted educational and awareness program for women belonging to different age groups. Educational programs based on the

parameters of the PRECEDE-PROCEED Model should be designed and implemented on a large scale

Concerning the **correlation** between total knowledge, total attitude and total healthy practices and activities, the results of the present study showed that there was that there was a highly statistically significant positive correlation between total knowledge score and total attitude of both study and control groups before and after intervention ($P < 0.001$). Moreover, there was a highly statistically significant positive correlation between total knowledge score and total healthy practices and activities of both study and control groups before and after intervention ($P < 0.001$).

The result of the current study was supported by (*El-Said et al, 2021*) who revealed that there was no statistically significant difference between control and study groups regarding practices and health promoting lifestyle before PPM application. However, there was a highly statistically significant positive correlation between total health-promoting lifestyle score and educational and ecological assessment phase structures of PRECEDE – PROCEED model (predisposing, reinforcing, and enabling factors) of both groups before, after three and six months of program application ($P < 0.00$). These results illustrated that the improvement of knowledge could lead to improvement of practice and affect attitude positively and vice versa

Increasingly, the result of the current study was consistent with (*Khan et al, 2014*) who mentioned that a correlation between different domains of questionnaire was also assessed. A positive correlation was observed between knowledge and attitude, a positive correlation was observed between knowledge and practices. In the same context (*Hurst and Wham, 2007*) demonstrated that there was a significant correlation was found between knowledge and health motivation, and belief in the benefits of calcium and exercise for the prevention of osteoporosis was highly predictive of health motivation scores. Also, (*Alshammari, 2014*) reported that there was a significant correlation was found between their knowledge scores and their attitude level scores.

Conclusion:

Application of PPM was effective in improvement of perimenopausal women's predisposing factors of osteoporosis (knowledge and attitude), healthy practices and activities, reinforcing factors, enabling factors.

Recommendations:

- Educational programs intended for women in the climacteric period must be extended about menopause, symptoms, long term consequences, and effective ways of dealing with it and such education should be supplemented with an educational manual or similar materials.

- Integration of PECEDE-PROCEED Model Based health education into the curriculum of nursing colleges.
- Health education programs concerning bone health for perimenopausal women should be strengthened to raise their awareness regarding the association between menopause and BMD.
- Emphasize the importance of routine measurement of BMD and serum calcium level every year for all pre and post-menopausal females is needed for early detection and prevention of osteoporosis.

Further researches:

- It is crucial to conduct an extensive future studies with larger sample probability sizes of perimenopausal women from different regions of Egypt to enhance the accuracy of the findings and be able to apply PRECEDE-PROCEED Model Based intervention program in health system to increase the level of awareness towards osteoporosis.
- Development of a national program, including periodical workshops regarding the osteoporosis prevention in Egypt for nurses in health services centers.

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