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Effect of Health Belief Model on Obese Women Complaining of Vitamin D Deficiency

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A B S T R A C T

Background: Osteoporosis is a silent disease, especially in the premenopausal women, that may lead to many complications. Health belief model may be a beneficial method for increasing the knowledge, reinforce attitude and behavioural change towards osteoporosis. **Objective:** To assess the impact of educational intervention on the awareness and perception of osteoporosis risk in obese women with vitamin D deficiency in child-bearing period. **Method:** This is an interventional study conducted on women attending Zagazig university hospitals' outpatient clinics during the period from 2019 to 2022. Eighty obese women with vitamin D deficiency were randomly allocated into intervention or control groups. Health education program was implemented, and we used Osteoporosis Health Belief Scale (OHBS) and osteoporosis self-efficacy for assessment. **Results:** Intervention and control groups were not different as regards age (33.3±7.77 versus 34.95±9.06) or other demographic characteristics. Pre-intervention, OHBM and osteoporosis self-efficacy scale were not significantly different between the studied groups. Post-intervention, intervention group had significantly higher OHBM scores compared with control group, both subscales and total (102.9±3.95 versus 83.03±7.8). Post-intervention, intervention group had significantly higher self-efficacy scale (improvement); with a median (interquartile range) 71.25 (60.63 -76.88) in intervention group versus only 7.5 (5-15) in control group. Post-intervention, OHBM and the osteoporosis self-efficacy scales were significantly improved in the health education group. **Conclusion:** Health education raised obese women's knowledge about beneficial practices against vitamin D deficiency such as sun exposure, exercise and calcium intake and improved their confidence in avoiding osteoporosis.

INTRODUCTION

Osteoporosis (OP) is a significant public health issue. Poor bone density and microarchitectural degradation of the bone tissue are the hallmarks of this chronic, progressive systemic skeletal disease, which increases the risk of fractures and makes bones more brittle.[1]

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Globally, OP is indicated to have an impact on 200 million women all over the world, resulting in 8.9 million fractures per year. According to reports, 30% of women in both Europe and the United States have osteoporosis, with an estimated 40% of them being post-menopausal.[2]

In Egypt, 30% of the population was affected, mostly postmenopausal women (54% had osteopenia and 28.4% had osteoporosis). An Egyptian study stated that 16.7% of menopausal women experienced lumbar OP. Due to the development of various efficient pharmacological medicines for the treatment of those at high risk, OP awareness has expanded during the past 20 years.[3]

It is a hidden disease, especially in the premenopausal women, as it is associated with risk factors such as inadequate nutrition, physical inactivity, hormonal, drugs, and medical diseases. So, early detection gives a chance for better management and decreases its progression pattern, with long life expectancy. [4]

Programs based on the Health Belief Model (HBM) are cost-effective way to improve the skills and habits needed to develop behavioural changes, such as increasing calcium consumption and engaging in physical activity to prevent osteoporosis. The HBM is one of the theoretical frameworks that is frequently used to improve knowledge of healthy behaviour.[5]

Furthermore, through two methods, HBM is utilised to prevent osteoporosis, the first focuses on spreading awareness about osteoporosis and the second is associated with measures of self-efficacy and protective behaviour that support attitude and behavior changing.[6]

Recent evidence has indicated that vitamin D deficiency is becoming a global epidemic. Till now there is no consensus regarding to what extent HBM based education program could change behaviors related to vitamin D and calcium intake, so more studies are required. The research question under the study was “what is the effect of health belief model on changing behaviors of obese women with vitamin D deficiency?” Our hypothesis was health belief model is effective in changing behaviors that enhance getting sufficient vitamin D and calcium. The aim of the study was to assess the impact of educational intervention on the awareness and perception of osteoporosis risk in obese women with vitamin D deficiency in child-bearing period.

METHODS

This is an interventional study performed at Zagazig university hospitals' outpatient clinics in the duration between 2019 and 2022.

Females attending Zagazig university hospitals' outpatient clinics are the target population. Inclusion criteria included adult females in childbearing period (18-50 years old) with serum 25 OH D level below 10 ng/ml and BMI more than 30 kg/m^2 were included in the study. Exclusion criteria included menopausal, pregnant and lactating female were excluded due to different nutritional need.

Considering the average knowledge score regarding osteoporosis before and after intervention is (9.47 ± 7.5 versus 15.2 ± 10.5 respectively)[7]. Thus, 80 people (40 per group) were chosen as the sample size, with a 95% confidence level and an 80% test power. The sample size was calculated suing Open-EPI.

There are 23 Zagazig university hospitals' outpatient clinics. The clinics are divided into 14 medical and 9 surgical clinics. By using simple random sampling technique, 2 medical (Family planning and chest) and 2 surgical (orthopaedic and ENT) clinics were selected. Total number of selected clinics is 4. Twenty patients were selected from each clinic by systematic random sample.

Tools of data collection: *First part,* modified Fahmy socioeconomic level Questionnaire.[8] *Second part,* Osteoporosis Health Belief Scale (OHBS)[9]: this test assesses attitudes towards osteoporosis-related health issues. It has 42 items and seven subscales that deal with health views (6 Items for each subscale): The vulnerability, degree of severity, physical activity advantages in addition to calcium intake advantages. Exercise and calcium intake obstacles and health motivation are also included. In the original OHBS**,** "Strongly agree," "agree," "undecided," "disagree," and "strongly disagree" were included on a 5-point Likert scale. One is severely disagreed, two are neutral, three are undecided, four are agree, and five are strongly disagree. For more simplicity of the results, the Likert scale was modified to be of 3 points instead of five which included “agree, undecided, disagree”. The score of three is to agree, two to undecided, and one to disagree. Validity of the questionnaire was tested with Cronbach alpha 0.893. The probable range of the total health belief score is 42 to 126. For each subscale score, a range of 6 to 18 is attainable. More

Table 1: Socio-demographic characteristic of the studied groups (n=80)

	Intervention (n=40)	Control (n=40)	Test*	P-value
Age/years				
Mean ±SD	33.3±7.77	34.95±9.06	0.875	0.384
Range	21-48	19-48		
BMI				
Mean ±SD	33.03±1.81	33.64±1.82	1.489	0.140
Range	30.1-36.1	30.5-36.5		
Education				
Primary	1 (2.5%)	7 (17.5%)	6.304	0.097
Preparatory	9 (22.5%)	6 (15.0%)		
Secondary	16 (40.0%)	18 (45.0%)		
University	14 (35.0%)	9 (22.5%)		
Occupation				
Housewife	30 (75.0%)	22 (55.0%)	3.516	0.061
Semi-professional/clerk	10 (25.0%)	18 (45.0%)		
Residence				
Urban slum	2 (5.0%)	8 (20.0%)	4.130	0.127
Rural	28 (70.0%)	24 (60.0%)		
Urban	10 (25.0%)	8 (20.0%)		
Social class				
Low	5 (12.5%)	11 (27.5%)	2.81	0.093
Medium	35 (87.5%)	29 (72.5%)		

** Chi square test, except in age and BMI it was independent samples t-test; SD, standard deviation*

negative health views are indicated by higher scores for the obstacles (barriers to exercise and barriers to calcium consumption), while higher scores for the other factors suggest extremely healthy beliefs. *Third part,* osteoporosis self-efficacy scale: Initiation, maintenance, and persistence in performing the activity are the three theoretical characteristics of efficacy expectation that are represented by the instrument's 21 items. [10] Participants were asked to mark an X on a line that was afterwards calibrated from 0 to 100 mm for analysis to show how confident they were in their ability to complete the exercise. A 10-cm line's upper anchor was extremely confident, but the lower anchor was not at all sure.

Group allocation: Females included in this study (80 females) were allocated randomly into 2 equal groups; intervention and control groups, based on whether they will receive health education or not. Females were given odd and even numbers, odd number was included in the intervention group and even number was included in the control group. Each female in both groups was interviewed at the beginning of the study and the questionnaire sheet was filled including socioeconomic level questionnaire, OHBS and osteoporosis self-efficacy scale.

***Intervention*:** The first group (40 females in the intervention group) was subjected to an educational program based on health belief model. The second group (40 females in the control group) were not subjected to any health education. After 12 weeks, all the participants in the study either intervention or control group were interviewed again for re filling the same questionnaires again. Intervention was applied as follows: First session, 20-minutes session was conducted after filling the questionnaires the massage given to the participants included the following what is osteoporosis, risk factors, seriousness and consequences of osteoporosis in addition to prevention including exercise and adequate calcium intake.

Table 2: Pre-intervention osteoporosis health belief subscales among the studied groups

	Intervention (n=40)		Control (n=40)		Test*	P value
	Mean ±SD	Range	Mean ±SD	Range		
Susceptibility	8.4±2.97	6-12	9.05±3.01	6-13	1.062	0.288
Severity	12.75±1.69	11-17	12.9±1.53	11-17	0.416	0.679
Benefits of exercise	9.4±2.92	6-13	9.4±2.34	6-12	0.00	1.00
Benefits of Calcium	13.8±2.45	12-18	12.95±1.62	12-17	1.831	0.071
Barriers to exercise	16.45±2.01	12-18	15.8±2.59	12-18	1.252	0.214
Barriers to Calcium	15.95±1.65	12-17	15.45±2.08	12-17	1.189	0.238
Health motivation	6.95±1.41	6-12	6.7±0.72	6 - 9	0.996	0.322
Total health belief	83.7±8.52	72-101	82.25±8.02	68-100	0.783	0.436

**Independent samples t-test; SD, standard deviation*

During the session, the participants were shown an educational material (booklet) that contained pictures for simplifying the information. After the end of the session, participants were given the booklet. Follow up, the participants were followed up for 3 months and interviewed again in family medicine department for reinforcing the massage. The follow up sessions was every 2 weeks.

Statistical analysis: The software used was Windows SPSS 26.0 (SPSS Inc., Chicago, IL, USA). The mean, standard deviation, and median (range) were used to convey quantitative data, while absolute frequencies (number) and relative frequencies (%) were used to express qualitative data.

When comparing two regularly distributed data sets, the Student's t-test was employed; however, the Mann Whitney U test was utilized for variables that weren't normally distributed. The paired t test was utilized to analyze the pre- and post-intervention outcomes of regularly supplied measures, whilst the Wilcoxon ranked sign test was employed to analyze measures with non-normal distribution. The Chi-square test was used to compare the percentages of category variables. A p-value of less than 0.05 is regarded as statistically noteworthy.

RESULTS

Our study involved 80 females allocated randomly into 2 equal groups (40 females in each group); intervention and control groups.

Table (1) illustrated that regarding age, BMI, education, occupation, the place of residence, and social status, there were statistically insignificant differences among studied groups, assuring that they were comparable.

Table (2) illustrated that regarding the osteoporosis health belief subscales (Susceptibility, degree of severity, Benefits of sport, benefit of calcium, barriers to exercise, barriers to calcium, Health motivation), as well as the overall health belief score, there were statistically insignificant differences among groups prior to the intervention.

Table (3) illustrated that there were high statistically significant differences among studied groups concerning post-intervention OHBS in all subscales and total health belief with higher values of susceptibility, severity, benefits of exercise, benefit of Calcium, health motivation and total health belief and lower values of barriers to exercise and to calcium were in intervention group who received health education compared with control group.

Table (4) illustrated that there was highly statistically significant improvement in Osteoporosis Health Belief subscales and total score when comparing pre and post-intervention scores of intervention group with higher values of susceptibility, severity, benefits of exercise, benefit of calcium, health motivation and total health belief in post-intervention values and lower values of barriers to exercise and to calcium when compared with pre-intervention values.

Table (5) illustrated that there was statistically insignificant difference when comparing the studied groups regarding Osteoporosis Self-Efficacy Scale total score pretreatment, but there was statistically significant difference when comparing among studied groups post treatment with highest values were

Table 3: Post-intervention osteoporosis health belief subscales among the studied groups

	Intervention (n=40)		Control (n=40)		Test*	P value
	Mean ±SD	Range	Mean ±SD	Range		
Susceptibility	17.95±0.32	16-18	9.1±3.16	6-13	-8.037	<0.001
Severity	17.88±0.40	16-18	13.15±1.51	11-17	19.044	<0.001
Benefits of exercise	17.85±0.53	16-18	9.5±2.25	6-13	22.807	<0.001
Benefits of Calcium	17.85±0.43	16-18	13.03±1.59	12-17	18.503	<0.001
Barriers to exercise	7±2.17	6-12	15.93±2.55	12-18	-16.829	<0.001
Barriers to Calcium	6.85±1.82	6-11	15.55±1.99	12-18	-20.354	<0.001
Health motivation	17.53±0.55	16-18	6.8±0.79	6-9	70.236	<0.001
Total health belief	102.9±3.95	98-112	83.03±7.8	69-102	14.369	<0.001

**Independent samples t-test; SD, standard deviation*

Table 4: Pre- and post-intervention scores of osteoporosis health belief scale in intervention group

	Pre-intervention (n=40)	Post-intervention (n=40)	Test*	P value
	Mean ±SD	Mean ±SD		
Susceptibility	8.4±2.97	17.95±0.32	-5.698	<0.001
Severity	12.75±1.69	17.88±0.40	-19.7	<0.001
Benefits of exercise	9.4±2.92	17.85±0.53	-18.5	<0.001
Benefits of Calcium	13.8±2.45	17.85±0.43	-18.54	<0.001
Barriers to exercise	16.45±2.01	7.0±2.17	-10.03	<0.001
Barriers to Calcium	15.95±1.65	6.85±1.82	23.99	<0.001
Health motivation	6.95±1.41	17.53±0.55	28.1	<0.001
Total health belief	83.7±8.52	102.9±3.95	-46.7	<0.001

**Paired t test; SD, standard deviation*

reported in health education group. Also, there was statistically significant difference when comparing among the studied groups percent of change with highest change was in health education group.

DISCUSSION

Egypt has a high obesity rate. According to WHO data, Egypt's obesity prevalence is rated 18th in the world, with a total prevalence of 39.82% and a prevalence of 49.49% among females.[11] Significantly reduced vitamin D levels are also seen in obese patients.[12] The HBM is one of the conceptual frameworks that is commonly used to increase understanding of healthy behavior. This method is usually used to organise and produce a successful educational intervention.[5]

In the current study we reported that there were statistically insignificant differences before intervention between the studied groups regarding OHB subscales and total health belief score. This finding is in line with that of Samia et al.[13] whose study found an insignificant difference between groups undergoing intervention and controls at baseline. Moreover, Jeihooni et al.[14] found that among the two groups, there was significant difference in knowledge, perceived vulnerability, perceived severity, perceived benefits, perceived obstacles, or self-efficacy prior to the intervention.

Because they were unaware about osteoporosis, it's likely that they thought they were not at high risk for the disorder. The low perceived risk of developing osteoporosis may also be explained by the absence of any physical signs. There is a notion that states that most people do not think they are sick until they begin to have physical symptoms.[3]

Our findings clearly illustrated that after intervention, there were highly statistically significant differences between the studied groups regarding OHB Scale post-intervention with higher values of susceptibility, severity, benefits of exercise, benefit of Calcium, health motivation and total health belief and lower values of barriers to exercise and barriers to calcium were in groups undergoing intervention opposed to

Table 5: Pre- and post-intervention scores of osteoporosis self-efficacy scale in the intervention group

	Pre-intervention (n=40)	Post-intervention (n=40)	Test*	P value
	Median (IQR)	Median (IQR)		
Pre-intervention total percentile score	10 (6.38-18.65)	7.5 (5-14.17)	-1.556	0.120
Post-intervention total percentile score	71.25 (60.6-76.9)	7.5 (5-15)	-7.724	<0.001
Within groups test**	-5.517	-1.158		
P value	<0.001	0.247		

* Mann Whitney U test **Wilcoxon ranked sign test; IQR, interquartile range

controls. Additionally, within the health education group, there were highly statistically significant variations in the pre- and post-intervention scores of OHB scales, with a notable improvement in the post-intervention scales as compared with the pre-intervention ones.

The study of Pinar et al.[15] stated that Previous to the intervention, there was widespread acceptance of the perception of osteoporosis' susceptibility, seriousness, and health motivation, but there was little acceptance of the perception of the advantages of exercise and calcium intake in the two groups. Furthermore, Samia et al.[13] discovered that the intervention group's mean belief score was considerably higher than the control groups in terms of osteoporosis vulnerability and extent.

Furthermore, a study conducted by Ghaffari et al.[16] demonstrated that the experimental group's post-intervention OHB outcomes were much better than those of the control group. Additionally, he showed a statistically significant increase in the mean score of all subscales among females receiving assistance at baseline, after the intervention, and two months later. Additionally, Khani et al.[17] demonstrated that the intervention group significantly improved information, self-efficacy, internal cues to action, perceived vulnerability, severity of perception, expected advantages, perceived hurdles, dietary habits, and walking performances both immediately after the intervention and six months later compared with the control group.

Jeihooni et al.[14] found that with the exception of perceived barriers, the experimental group showed a substantial increase in all of the aforementioned subscales between the intervention and six months afterwards, which considerably decreased opposed to the control group.

Mansour et al.[7] stated that the mean scores for health motivation, seriousness, benefits of exercise, vulnerability to osteoporosis, and advantages of calcium consumption were all considerably higher post-intervention compared with pre-intervention. While the post-intervention average score for activity and calcium intake barriers decreased, the difference was only statistically significant for the latter.

These findings showed that the intervention had a positive effect on the participants' perceptions about the need to change to prevent osteoporosis. Additionally, the intervention may have significantly reduced the participants' mean score in the perceived barriers domain. This result demonstrated that the intervention had given the participants the idea that they might alter their behaviour in terms of osteoporosis prevention and start following healthy eating and exercise regimens.

In this study the researcher found that there was statistically insignificant difference when comparing the studied groups regarding Osteoporosis Self-Efficacy Scale total score pretreatment but was more effective significantly when comparing among the studied groups post treatment with highest values were reported in health education group. This could be because of their comprehension of self-efficacy assessments, which are a good indicator of engaging in behaviour to avoid osteoporosis. Mansour et al.[7] found OSES noted a substantial improvement after the intervention when the study sample's pre- and post-intervention scores were compared. Moreover, Sedlak et al.[18] reported that young women who participated in a three-hour education Programme had lower Osteoporosis Self-Efficacy Subscales OSES ratings. On the other hands, Evenson et al.[19] reported that vitamin D or OSES did not show any notable differences among studied groups .This may be explained by that knowledge is not necessarily followed by practice.

This notwithstanding study has several limitations related to limited sample size and the fact that it was conducted at just one institution. Studies with male

patients who are at risk for osteoporosis are also advised to be done, in addition to those with female patients. Additionally, just after finishing the educational program, posttest measures were performed.

CONCLUSIONS

The study's investigator concluded that education sessions based on the health belief model significantly increased the knowledge, enhanced health beliefs, and confidence of obese women in preventing osteoporosis. Further research is suggested to ascertain the connection between demographic characteristics and social and behavioral obstacles to calcium intake in diverse cultural contexts. It is recommended that Vitamin D level is measured after intervention in the future studies.

Ethical Approval

The Institutional Review Board (IRB) of Zagazig University's Department of Medicine approved the research procedure [IRB#:5729-19-11-2019]. Ethics and confidentiality were respected. After receiving complete information, each research subject provided their informed consent. The study's goals and the fact that the data would only be used for scientific study were explained to the participants. The patients also had the choice to accept, or reject being included in the study.

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