Application of Health Belief Model for Osteoporosis Risk Prevention among Late Adolescent Female College Students

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Abstract: Nowadays osteoporosis is considered critical health issue and has been called the silent disease of the century. Aim of the study was to evaluate the effect of a health education intervention based on the Health Belief Model (HBM) on late adolescent female college students’ health beliefs and performances about osteoporosis preventive behaviors. An intervention study design was used. The study was conducted at Faculty of Nursing Ain Shams University. A purposive sampling technique was used to recruit one hundred forty two female nursing students. Data was collected through four tools: 1st tool was Arabic self-administered questionnaire, 2nd tool was osteoporosis knowledge test (OKT), 3rd tool was osteoporosis health belief scale (OHBS) and 4th tool was osteoporosis preventing behaviors survey (OPBS). Results showed that there was a highly statistical significant improvement in female college students' knowledge pre & post intervention and follow up at six months as total knowledge mean score (7.65±2.36, 10.82±7.30 and 19.33±7.30) respectively. Moreover, there was a statistical significant improvement in female college students' behavior action for osteoporosis prevention post intervention and at follow up "six months"; as (36.7 and 30.1%) of students had acceptable level of daily calcium intake and weekly exposure to sun respectively. While, at follow up 47.9 % of female college students' had acceptable level of weekly physical activity. Conclusion: the findings of present study confirmed that health education intervention based on HBM improve preventive health behaviors about osteoporosis among late adolescence female college students. This was clarified by significant increasing of late adolescence female college students' level of knowledge, changing their health belief toward osteoporosis and applying preventive behavior to reduce risk of osteoporosis. Recommendations: in the light of the results of the present study the following recommendations were suggested; application of educational program based on HBM for women at different stage of life is highly recommended to reduce risk of osteoporosis. Furthermore, integrate the osteoporosis topic for undergraduate student's curriculum to promote knowledge and awareness about osteoporosis preventive behavior.

Key words: Health Belief Model, Osteoporosis Risk Prevention, Late Adolescent Female College Students

INTRODUCTION

Osteoporosis is a disease described by decreased bone density and loss of bone micro architecture quality that lead to an increased risk of fracture. Bone density and bone mass reduce slowly and most symptoms cannot be seen until the first fracture occurs. This disease is one of the main causes of disability in adults [1].

Currently, osteoporosis represents an important health concern and has been entitled the silent disease of the century. It is an asymptomatic disease and its complications (fractures) can impose high and irrecoverable physical and financial losses to the society and patients. This disease is a critical health problem in health care facilities in developed and developing countries [2].

Osteoporosis is a serious public health problem; it is likely to affect 200 million women worldwide and causes more than 8.9 million fractures annually [3]. The years between 2000 and 2010 was named by WHO [4] as Bone and Joint Decade (BJD) that concerns bone and joint disease such as osteoporosis. It was also reported as the
fourth enemy of the human after heart failure, stroke and cancer and the main cause of fractures in the world. In Egypt, the problem affects almost 30 percent of the population and most recent studies indicate that almost 54 percent of post-menopausal women in the country have a primary form of the disease named osteopenia, while 28.4 percent have osteoporosis [5].

There are numerous factors which lead to osteoporosis; that are divided into unmodifiable risk factors including increased age, female gender, white race and family history. While, modified risk factors include dietary intake of calcium and vitamin D, physical activity, low body mass index, excessive alcohol use and smoking. Peak bone mass is developed by age 30 years. So, preventive actions of maximizing bone mass to reduce osteoporosis-related fractures in later life should start as early as possible [6]. Therefore, the purpose of prevention programs is to preserve bone mass in the 30- to 50-year age group. This group of people assumes the responsibilities of life and pay minimal attention to their health. They play crucial role in managing their families’ health. Therefore, their disability and behavior affect various aspects of health and behavior of their families [7].

Osteoporosis is a major metabolic bone disorder that often results in hip fracture and is usually asymptomatic in its early stages. Since vast majority of bone formation occurs during childhood and adolescence, it is essential to begin prevention at an early age, although the ideal way for introducing this preventive behavior in youth has not yet been defined. Early recognition of risk factors for osteoporosis and development of prevention programs is needed to stop the increasing incidence of the disease and the highest cost of fracture treatment and health care [8].

Late Adolescence is a life stage begins at (17-19) seventeen years of age and continues until nineteen complete years of age. This stage includes the final phases of pubertal development as well as the achievement of significant psycho-social milestones [9].

However, osteoporosis is not curable rather than it can be avoided by increasing the physical activity level at all ages with sufficient intake of calcium, vitamin D in diet and prevention of fall. Discontinuation of smoking and alcohol intake can play a role. Also, mild daily exercise at least thirty minutes of walking can be preventive measures versus osteoporosis [10]. Establishment of healthy lifestyle behaviors must be began early especially for adolescence because most of them become self-centered and aren't concerned in healthy life. So, it isn't easy to change their behavior and lifestyle [11]. Improving bone strength through health education can be effective in osteoporosis prevention particularly among young females [12].

The health beliefs of each individual provide the motivation to learn and engage in health behaviors [13]. The Health Belief Model (HBM) proposes that health behaviors are linked with specific beliefs. Perceived susceptibility to osteoporosis, perceived severity of the disease, perceived benefits to osteoporosis prevention activities (that is, increased dietary calcium, increased weight bearing exercise), perceived barriers to action (that is, cost of interventions) and motivation to participate in osteoporosis prevention activities are reasons that explain the extent to which people engage in health promoting behaviors[14].

HBM is the most commonly used frameworks to understand health behavior. HBM is based on assumption that people are most likely to take health-related action (e.g., eat a healthy diet), if they feel that by doing so they can avoid adverse health condition. The model assures that to plan effective educational intervention, the individual or people’s perceived susceptibility (e.g., to osteoporosis); perceived severity of the illness and its consequences; perceived benefits in taking main actions to decrease risk; perceived barriers (e.g., costs of the recommended action) and cues to action (strategies for motivating the “readiness” to assume health actions) are required [15].

The role of nurses in caring for patients with osteoporosis or at risk for osteoporosis, irrespective of setting, includes improving patients’ knowledge about osteoporosis and motivating behavior change. Certain nursing actions include; discussing strategies to confirm bone health in adolescents as well as young adults and older patients, assessing patients’ risk for low bone density or osteoporosis and providing education to patients with or at risk of osteoporosis and their families about pharmacologic and non-pharmacologic treatment strategies [16].

Moreover, nurses are in a unique position to assess and protect health of these vulnerable populations who are at risk for osteoporosis. Nurse can design, implement and evaluate osteoporosis prevention programs to decrease prevalence of this debilitating disease [17]. Consequently, using HBM as method for osteoporosis prevention through two measures, first is based on increasing knowledge about osteoporosis and second is related to preventive behavior and self-efficacy measures that reinforce attitude and behavioral change for female [18].
Justification of the Study: Health education is important strategy in the prevention of osteoporosis and many studies have been performed to enhance knowledge of women, using workshops and group discussions. The challenge for osteoporosis prevention programs is to promote early detection of risk factors and to foster the adoption of healthy behaviors in women from adolescence to perimenopause [19]. Moreover, adolescence female consumption of calcium decreases while, phosphor consumption as soda increases. Furthermore, this age group replaced regular physical activity with increased time spent using computer, watching video and television. All this behaviors put them in risk for developing osteoporosis. So, this study pointed to improve their knowledge, awareness and change their behavior for osteoporosis prevention later on in life. Therefore, there is an immediate need to increase osteoporosis awareness and subsequent beliefs, not only in older women, but also in younger women. Because lifestyle practices are formed early in life and may be convey to adulthood.

Aim of the Study: to evaluate the effect of a health education intervention based on HBM on late adolescent female college students’ health beliefs and performances about osteoporosis preventive behaviors through:

- Evaluate improvement of knowledge level post intervention among late adolescent female college students.
- Investigate changes of health beliefs post intervention among late adolescent female college students.
- Evaluate promotion of health practice to prevent osteoporosis among late adolescent female college students.

Research Hypothesis: Application of educational program based on HBM will improve preventive health behaviors about osteoporosis among late adolescence female college students.

Operational Definition
Perceived Severity: It refers to subjective assessment for severity of health problem and its potential consequences
Perceived susceptibility: it refers to subjective assessment of risk for developing a health problem.

Perceived Benefits: Health-related behaviors are also influenced by the perceived benefits of taking action.

Perceived Barriers: Refer to an individual's assessment of the obstacles to behavior change.

MATERIALS AND METHODS

Research Design: An intervention study design was used.

Setting: the study was conducted at Faculty of Nursing - Ain shams University.

Sample size, type and technique:

A purposive sampling technique was used to recruit (142) one hundred forty two female nursing students according to the following sample statistic calculation.

\[ n = \frac{Z^2 \cdot \alpha^2 \cdot P(1-P)}{d^2} \]

Total number of female nursing students’ in Faculty of Nursing Ain Shams University at academic year 2013-2014 was (440 students). That was divided into three grades, "first grade included (193 students), second grade included (157 students) and third grade included (90 students)". As fourth grade students were excluded based on inclusion criteria. Sampling technique was done through two approaches. First is called proportional sampling that involves determining size of sample from each grade in relation to total sample size. Second, use simple random sampling technique to obtain the sample from each grade. So the number of selected students in first year was 68 students, 54 students was selected in second year and 20 students was selected in third year.

Inclusion Criteria:

- Female college student's less than or within 19 years old.
- Willing to participate in the study.

Exclusion Criteria:

- Female college student's previously participated in an osteoporosis preventive educational session.
- Female college student's taking hormonal contraceptive methods.

Tools of Data Collection: Four tools of data collection were used as follow
Arabic Self-Administered Questionnaire: That was designed by researchers after reviewing the relative literature named "Application of health belief model for osteoporosis risk prevention among late adolescence female college students". This tool was used to assess socio-demographic data and biological characteristics of the sample such as (age, weight, height, family history of osteoporosis). A reliability coefficient for internal consistency was 0.80.

Osteoporosis Knowledge Test (OKT) adopted from the revised version of OKT by Ivana et al. [20]. The scale consists of five subscales: risk factors, exercise, calcium, vitamin D and general. It is a 24-items tool consisting of multiple choice questions regarding knowledge of facts of osteoporosis. The test items address a variety of topics, including the relationship of activity levels, exercise and dietary intake of calcium to prevent osteoporosis. Each item was rated using 3 point scale "3= agree, 2= neutral and 1= disagree". Total score was ranged from 1-72. Reliability coefficient for internal consistency was 0.72.

Osteoporosis Health Belief Scale (OHBS) adopted from Horan et al [21] for investigating beliefs associated with exercise and calcium intake. It consists of 42 items measuring 7 subscales: susceptibility, severity, benefits of exercise, benefits of calcium intake, barriers to exercise, barriers to calcium intake and health motivation. Researchers selected 28 items from this questionnaire for measuring susceptibility (4 items), severity (4 items); benefits of exercise (4 items); barriers to exercise (4 items), benefits of calcium intake (4 items); barriers to calcium intake (4 items); and health motivation (4 items). The response for the items in each subscale ranged from agree=3 to disagree=1. The range for the total scale was 28-84. A reliability coefficient for internal consistency was 0.84.

Osteoporosis preventing behaviors survey (OPBS) adopted from Edmonds [22] is a 9-items multiple-choice self-report instrument addressing OPB that included dietary and supplemental intake of calcium (4 questions related to amount of different calcium rich food taken weekly and calcium supplement). For analysis the behavior of calcium intake is (not acceptable less than 650mg /day, almost acceptable 650 = 1300 mg / day and acceptable more than 1300 mg / day). Physical activity "exercises" questions: is two items self-assessment instrument that ask adolescent female to answer how many days out of the past seven days they were physically active for a total of 30 minute and over a typical week how many days during the week they were physically active for a total 30 minutes. The maximum score possible for each question is in 3points. Scores for each question are added and the sum is divided by two (A score of less than 3 means that physical activity is not acceptable, a score from 3 and more means that physical activity is acceptable).Sun exposure questions: consists from 3 questions related to exposure to sun, time of exposure and duration of exposure. If adolescent female exposed to sun daily for 15-30 minutes it means acceptable, if exposed to sun weekly for 15-30 minutes it means almost acceptable, if exposed to sun weekly for less than 15-30 minutes it means not acceptable. A reliability coefficient for internal consistency was 0.82.

Also there was a supportive material as educational booklet that included overview of osteoporosis "definition of osteoporosis, description of bone health (anatomy of bone, bone growth and bone loss), risk factors for osteoporosis (modifiable and unmodifiable), diagnostic screening for bone density and complications".

Validity and reliability of the Tools: tools were reviewed by a panel of three experts in obstetric and gynecological nursing field to test the face and content validity. Each of the experts was asked to examine tools for content coverage, clarity, wording, length, format and overall appearance. Modifications were done according to the comments "rephrasing and cancelling for eight questions".

Pilot Study: After the development of tools a pilot study was carried out on 10% of the total sample size (14 students). The purposes of the pilot study were to ascertain the relevance and content validity of tools, estimating the exact time needed for each student and detect any problem that might face the researchers and interfere with data collection. Tools of data collection took 30-35 minutes to be completed. After conducting the pilot study, the necessary changes were performed; some questions were rephrased and others cancelled and the tools were reconstructed and made ready for use. These females were excluded from the study sample.

Ethical Consideration: The approval was obtained from Scientific Research Ethical committee in Faculty of Nursing at Ain Shams University before starting the study. Then the permission from faculty dean was taken. Researchers introduced themselves to female students in each grade then informed them about the purpose of the study in order to obtain their acceptance to share in this study. Researchers ensured that, the study posed no risk or hazards on their health and their participation in the study was voluntary. Students' who were willing to participate in the study were approached by researchers.
and asked for verbal consent to confirm their acceptance and all events that occurred during data collection were considered confidential.

**Steps of Data Collection:**

- Researchers collected data through four days per week from 9 am to 2 pm (depending on free or break time of students). Data collection period started and completed through beginning of September 2013- to end of June 2014.
- Formal permission was obtained from the head of each department at nursing faculty.
- Researchers divided studied students who were selected based on sampling criteria randomly into 4 groups each group included 35 or 36 students.
- The researcher collected each group separately for data collection "pre and post intervention and follow up" depending on their schedule
- Prior to data collection researchers introduced themselves and explained the purpose of the study.
- Tools were distributed and explained to students to fill them (pre-test).
- After completing the pre-test, the students were attended an educational & training sessions.
- The HBM based intervention was implemented in three sessions for each group. Each session took 45 minutes in the following technique:

  1st session related to the knowledge provided which aimed to enhance the awareness about Healthy Bones and broad overview of osteoporosis aspects (modifiable and unmodifiable), diagnostic screening for bone density, preventive behavior & complications, exercises, sun exposure and health beliefs items. Content focusing on barriers to osteoporosis behaviors and susceptibility to osteoporosis were specifically highlighted

  2nd session related to the practical part: it aimed to train late adolescent females to choose healthy diet, make exercises, researcher demonstrate educational video about exercises and sun exposure. Also roles play in problem solving situation were used to solve calcium intake & exercises barriers. In addition several education methods were used as group discussion, demonstration and re-demonstration. Visual aids were used as posters. At the end of the sessions educational booklet was distributed.

- In addition, participants met with the program developers for three sessions over a 3-weeks period and were given assignments to complete between program sessions. Assignments included participants keeping a diary between sessions of their nutritional intake, focusing on calcium and caffeine intake and other nutrients related to osteoporosis prevention.
- Evaluation and follow up; researchers conducted several interviews with selected students for filling tools of data collection post intervention immediately and follow up after six months to evaluate the effectiveness of the educational program.

**Statistical Analysis:** The data were analyzed using SPSS version 18.0. Frequency and percentage distribution, mean and standard deviation were used. The ANOVA test was used for within-group comparisons and regression analysis.

**RESULTS**

Table 1 shows that mean age of the studied nursing female students was 18.32±0.89. Concerning place of residence 62.0% of the studied students reside in rural area.

Table 2 reveals that there was a highly statistical significant improvement in female collage students' knowledge post intervention immediately and follow up (six months).

Table 3 illustrates that there was a highly statistical significant change in female collage students' health believe regarding osteoporosis pre and post intervention immediately and follow up (six months).

Table 4 shows that there was a statistical significant improvement in female collage students' behavior action for osteoporosis prevention post intervention immediately and follow up (six months); as 36.7 and 30.1% of students had acceptable level of daily calcium intake and weekly exposure to sun at follow up "six months" respectively. While, 47.9% of students had acceptable level of weekly physical activity at follow up.

Table (5) indicates that the highly statistically significant independent predictor of female nursing students' healthy behavior towards daily calcium intake post intervention were knowledge about osteoporosis, perceived susceptibility, perceived severity, benefits of calcium intake and health motivation were [positive predicator $\beta = 2.166$, 0.421, 0.045, 0.050 and 0.050] respectively. While, barriers to calcium intake was [negative predictor $\beta = -0.062$]. The model explains 45.4% of female nursing students' healthy behavior towards daily calcium intake post intervention, as indicated by the value of $r$-square.
Table 1: Distribution of the studied students according to socio-demographic characteristics (n = 142)

<table>
<thead>
<tr>
<th>Items</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>90</td>
<td>63.4</td>
</tr>
<tr>
<td>19</td>
<td>52</td>
<td>36.6</td>
</tr>
<tr>
<td>(mean±SD)</td>
<td>18.32±0.89</td>
<td></td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>54</td>
<td>38.0</td>
</tr>
<tr>
<td>Rural</td>
<td>88</td>
<td>62.0</td>
</tr>
</tbody>
</table>

Fig. 1: Distribution of the studied students according to their family history of osteoporosis

Table 2: Comparison of female nursing student's knowledge regarding osteoporosis pre, & post intervention and follow up

<table>
<thead>
<tr>
<th>Knowledge score</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>Follow up (six months)</th>
<th>ANOVA test (F)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of risk factors</td>
<td>3.42±1.07</td>
<td>4.75±1.98</td>
<td>5.92±1.62</td>
<td>9.17</td>
<td>0.001**</td>
</tr>
<tr>
<td>Knowledge of exercises.</td>
<td>3.42±0.66</td>
<td>4.82±1.30</td>
<td>5.02±1.88</td>
<td>14.26</td>
<td>0.001**</td>
</tr>
<tr>
<td>Knowledge of calcium.</td>
<td>3.47±0.98</td>
<td>5.65±0.96</td>
<td>5.89±1.53</td>
<td>15.91</td>
<td>0.001**</td>
</tr>
<tr>
<td>Total Knowledge.</td>
<td>7.65±2.36</td>
<td>10.82±7.30</td>
<td>19.33±7.30</td>
<td>20.28</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

Table 3: Comparison of female nursing student's osteoporosis health believe subscale pre, post intervention and follow up

<table>
<thead>
<tr>
<th>Osteoporosis health believe subscale</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>Follow up (six months)</th>
<th>ANOVA test (F)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived susceptibility</td>
<td>5.68±1.07</td>
<td>4.66±0.98</td>
<td>4.12±0.03</td>
<td>8.54</td>
<td>0.001**</td>
</tr>
<tr>
<td>Perceived severity</td>
<td>4.06±0.15</td>
<td>8.98±2.45</td>
<td>10.05±2.32</td>
<td>11.36</td>
<td>0.001**</td>
</tr>
<tr>
<td>Benefits of exercise</td>
<td>4.62±1.04</td>
<td>7.25±2.33</td>
<td>11.89±2.03</td>
<td>13.44</td>
<td>0.001**</td>
</tr>
<tr>
<td>Benefits of calcium intake</td>
<td>4.72±0.93</td>
<td>9.57±2.89</td>
<td>10.67±2.14</td>
<td>15.72</td>
<td>0.001**</td>
</tr>
<tr>
<td>Barriers to exercise</td>
<td>12.87±1.64</td>
<td>9.22±0.82</td>
<td>6.33±1.04</td>
<td>12.87</td>
<td>0.001**</td>
</tr>
<tr>
<td>Barriers to calcium intake</td>
<td>9.62±1.68</td>
<td>7.01±0.27</td>
<td>5.63±0.95</td>
<td>10.43</td>
<td>0.001**</td>
</tr>
<tr>
<td>Health motivation &quot;positive&quot;</td>
<td>5.11±0.76</td>
<td>7.89±1.68</td>
<td>11.03±0.28</td>
<td>11.25</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

Table 4: Comparison of female nursing student's healthy behavior performance for osteoporosis pre, & post intervention and follow up

<table>
<thead>
<tr>
<th>Behavior action</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>Follow up (six months)</th>
<th>Cochrane's Q</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Calcium intake</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not acceptable &quot;less than 650 mg/day&quot;</td>
<td>74.6</td>
<td>28.2</td>
<td>7.0</td>
<td>23.07</td>
<td>0.001**</td>
</tr>
<tr>
<td>Almost Acceptable &quot;650 – 1300 mg/day&quot;</td>
<td>24.6</td>
<td>56.3</td>
<td>56.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptable &quot;more than 1300 mg/day&quot;</td>
<td>0.8</td>
<td>15.5</td>
<td>36.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not acceptable &quot;less than 3 times / week&quot;</td>
<td>85.9</td>
<td>33.8</td>
<td>7.7</td>
<td>28.35</td>
<td>0.001**</td>
</tr>
<tr>
<td>Almost Acceptable &quot;3 -5 times /week&quot;</td>
<td>10.6</td>
<td>52.1</td>
<td>44.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptable &quot;more than 5 times / week&quot;</td>
<td>3.5</td>
<td>14.1</td>
<td>47.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly exposure to sun</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not acceptable &quot;less than 30 minutes / week&quot;</td>
<td>70.4</td>
<td>47.8</td>
<td>12.6</td>
<td>33.89</td>
<td>0.001**</td>
</tr>
<tr>
<td>Almost Acceptable &quot;more than 30 minutes / week&quot;</td>
<td>21.1</td>
<td>38.0</td>
<td>57.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptable &quot;daily exposed to sun 15-30 minutes&quot;</td>
<td>8.5</td>
<td>14.2</td>
<td>30.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Regression analysis for factors affecting female nursing students' behavior action regarding daily calcium intake post intervention

<table>
<thead>
<tr>
<th>Items</th>
<th>Beta</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% C I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge about osteoporosis</td>
<td>2.166</td>
<td>12.027</td>
<td>0.001**</td>
<td>2.008 to 2.323</td>
</tr>
<tr>
<td>Perceived susceptibility</td>
<td>.421</td>
<td>7.766</td>
<td>.001**</td>
<td>.247 to .594</td>
</tr>
<tr>
<td>Perceived severity</td>
<td>.045</td>
<td>8.160</td>
<td>.003**</td>
<td>.004 to .087</td>
</tr>
<tr>
<td>Benefits of calcium intake</td>
<td>.050</td>
<td>7.985</td>
<td>.004**</td>
<td>.000 to .099</td>
</tr>
<tr>
<td>Barriers to calcium intake</td>
<td>-.062</td>
<td>-7.187</td>
<td>.023*</td>
<td>-.165 to .041</td>
</tr>
<tr>
<td>Health motivation &quot;positive&quot;</td>
<td>.050</td>
<td>8.802</td>
<td>.423</td>
<td>.174 to .73</td>
</tr>
</tbody>
</table>

r square = 45.4, F= 8.715, p value 0.001**

Table 6: Regression analysis for factors affecting female nursing students' behavior action regarding weekly physical activity post intervention

<table>
<thead>
<tr>
<th>Items</th>
<th>Beta</th>
<th>t</th>
<th>Sig.</th>
<th>95.0% C I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge about osteoporosis</td>
<td>2.43</td>
<td>14.56</td>
<td>0.001**</td>
<td>2.06 to 2.65</td>
</tr>
<tr>
<td>BMI</td>
<td>-.023</td>
<td>-10.36</td>
<td>.001**</td>
<td>-.245 to .721</td>
</tr>
<tr>
<td>Perceived susceptibility</td>
<td>.541</td>
<td>7.072</td>
<td>.001**</td>
<td>.233 to .568</td>
</tr>
<tr>
<td>Perceived severity</td>
<td>.351</td>
<td>8.45</td>
<td>.001**</td>
<td>.015 to .146</td>
</tr>
<tr>
<td>Benefits of exercises</td>
<td>.633</td>
<td>12.985</td>
<td>.001**</td>
<td>.671 to .997</td>
</tr>
<tr>
<td>Barriers to exercise</td>
<td>-.233</td>
<td>-6.66</td>
<td>.03*</td>
<td>-.122 to .097</td>
</tr>
<tr>
<td>Health motivation &quot;positive&quot;</td>
<td>.582</td>
<td>9.04</td>
<td>.001**</td>
<td>.321 to .453</td>
</tr>
</tbody>
</table>

r square = 40.8, F= 8.34, p value 0.001**

Fig. 2: Distribution of the studied students according to their BMI pre and during follows up:
BMI: (normal=>17, over weight= 17-24, obesity=<24)

Table (6) shows that the highly statistically significant independent predictor of female nursing students behavior action towards weekly physical activity post intervention were knowledge about osteoporosis, perceived susceptibility, perceived severity, benefits of exercises and health motivation were [positive predictor $\beta = 2.43, 0.541, 0.351, 0.633 and 0.582$] respectively. While, BMI and barriers to physical activity were [negative predictor $\beta = -0.023 and 0.233$] respectively. The model explains 40.8% of female nursing students' healthy behavior towards weekly physical activity post intervention, as indicated by the value of r-square.

**DISCUSSION**

Osteoporosis is a bone metabolic disorder described by reduction of bone mass, impairment of bone structure, increasing bone fragility and increasing fracture risk. Prevention of osteoporosis during childhood and adolescence is one of the most important concerns [23]. So, this study was conducted to evaluate the effect of a health education intervention based on HBM on late adolescent female college students’ health beliefs and practices about osteoporosis preventive behaviors.
The results of the study showed that the average age of the studied sample was (18.32±0.89 years) the researchers selected this age stage, which is the late stage of adolescence due to the importance of raising awareness about the risk of osteoporosis by modifying the wrong behavior and habits that may cause the disease among adolescence. The current study result is supported by Kamjoo et al. [18] who mentioned that educational intervention had a significant impact on high school girls' knowledge of osteoporosis prevention methods. This could be explained by late adolescence is a period of time characterized by readiness for learning and behavior change through increase their perceived susceptibility, overcome the perceived barriers and motivation to adopt osteoporosis preventive behaviors.

The study findings indicated that total and subtotal osteoporosis knowledge score was low at pre intervention then improved post intervention which is consistent with results of Ghaffari et al. [23] who trained middle school girls on osteoporosis prevention and mentioned that compare the mean scores in knowledge domains of "perceived susceptibility, severity, barriers and benefits" before, after and 2 months after intervention were significant (P<0.001).

The present study showed that the intervention significantly affect female nursing student's beliefs regarding osteoporosis in all domains of the HBM. Consequently, female nursing student's mean scores of perceived susceptibility, severity of the problem and benefits of the preventive behaviors in osteoporosis significantly increased. These findings showed that the intervention had positive effects on female nursing student's beliefs about the importance of change behavior regarding osteoporosis prevention. Moreover, the intervention significantly reduced female nursing student's mean score in the domain of perceived barriers. This finding showed that the intervention induced this belief in the female nursing student's that it is possible to change behavior regarding osteoporosis prevention and adopt proper diet and increase activity with exercise programs. This study finding is in the same line with the results of Shojaeazad et al. [24] who evaluated the relationship between the application of HBM and the prevention of osteoporosis in female health volunteers in health care centers in Khoramabad and reported that the mean scores of awareness and various structures of the model (perceived susceptibility, perceived severity, perceived benefits and perceived barriers) were increased significantly in the case group after intervention (P<0.05). The result of our study showed that there was a statistical significant improvement in female collage students' behavior action for osteoporosis prevention post intervention and at follow up "six months"; as more than one third of students had acceptable level of daily calcium intake and weekly exposure to sun at follow up "six months" respectively. This study finding was in accordance with KhaniJeihooni et al. [1] who found that women had a moderate performance in nutritional performance for osteoporosis prevention. In addition, this study results also consistent with other research findings by Lesan et al. [25] that conducted a study to determine the relationship between food habits and osteoporosis preventive behaviors in female teachers and mentioned that relatively good performance of women can be attributed to their high level of education. This could be justified by perceptions of personal susceptibility and belief about seriousness of disease is important for influencing behavioral change in disease prevention programme. In addition, the nature of theoretical and practical study at faculty of nursing were prerequisite factors for female collage students' proficient skill has been shown to be positively related to changing behavior and maintaining this change.

Moreover, the results of present study revealed that during follow up nearly half of students had acceptable level of weekly physical activity as walking half an hour for 3 times per week and others regular go to the gem centers. This result is concordant with similar study carried by Sanaeinasab et al. [26] who reported that the mean scores of nutrition and exercise performances in the intervention group significantly increased compared to those of the control both immediately and six months after the intervention. Our study finding also, is supported with Jung et al. [27] who reported an increase in walking and calcium intake in the intervention group after intervention.

Regression analysis showed that OHBS subscale variables accounted for significant variance in dietary calcium intake were knowledge about osteoporosis, perceived susceptibility, severity, benefits of calcium intake and health motivation. The previous study finding is consistent with previous research finding of Gammage & K lentrou [28] who found that subscale barriers to calcium was the only significant predictor of dietary calcium intake in the model. In addition, health beliefs explained 16% of the variance in dietary calcium intake.

Furthermore, regression analysis indicated that OHBS subscale variables accounted for significant variance in weekly physical activity post intervention
were knowledge about osteoporosis, perceived susceptibility, severity, benefits of exercises and health motivation. This study finding is in agreement with Hassan and Gameel [29] who mentioned that there was a significant correlation between students' knowledge about osteoporosis and daily calcium intake level and weekly physical activity level also a significant correlation was found between health motivation, daily calcium intake level and weekly physical activity. Also, the finding of this study is in the same line with Chang [30] who reported osteoporosis knowledge most significant predictor of calcium intake & physical activity level.

Finally, women through different stage of their life are at risk for osteoporosis. Therefore, educational program based on HBM is essential for building women’s capacity for health promotion and prevention of osteoporosis throughout lifecycle.

CONCLUSIONS

The findings of present study confirmed that health education intervention based HBM improved preventive health behaviors about osteoporosis among late adolescence female college students. This was clarified by significant increasing late adolescence female college students' level of knowledge, changing their perception toward osteoporosis and motivating them to apply preventive behavior to reduce risk of osteoporosis and its consequences.

Recommendations: in the light of results of the present study the following recommendations are suggested; application of educational program based on HBM for women at different stage of life is highly recommended to reduce risk of osteoporosis and its consequences. Furthermore, integrate osteoporosis topic for undergraduate student's curriculum to promote their knowledge and awareness about osteoporosis preventive behavior. The current study was implemented only for female's students so the researchers recommended further research on wide scale involve male's students, because osteoporosis is a prevalent risk among males also.

REFERENCES


