HEALTH BELIEF MODEL FOR PREVENTION OF OSTEOPOROSIS AMONG ADOLESCENT GIRLS

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ABSTRACT

Background: Osteoporosis is a current silent epidemic disease of high importance due to its high prevalence
and complications among women.it is a preventable disease whose high risk population includes adolescent
girls. Aim of the Study: evaluate the effect of applying health belief model on prevention of osteoporosis
among adolescent girls through: assessing knowledge and reported practices of adolescent girls about
osteoporosis according to their beliefs, developing and implementing program for adolescent girls based on
domains of health belief model and evaluating the effectiveness of the health belief model on their
improvement of knowledge and reported practices of adolescent girls regarding to osteoporosis.

Subjects and Methods: Research design: Quasi experimental study design (one group pre and post-test) was conducted for
this study. Setting: The study was conducted at schools of Mrs. Aisha, Secondary Girls Alqadima (Mohamed
Gaber Qusla) and Secondary Girls Alhaditha in Beni-Suef city. Study subjects: the sample composed of 130
adolescent girls chosen randomly through multistage sampling. Tools: Two tools were used in the study
including: First tool: interviewing Questionnaire that assesses socio-demographic data, knowledge and
practices regarding osteoporosis. Second tool: Osteoporosis Health Belief model Scale to assess beliefs of
adolescent girls about osteoporosis. Results: revealed that minority of the studied girls had satisfactory
knowledge preprogram which improved after implementation the educational program. There was also
improvement in their reported practices regarding osteoporosis after implementing the program through
applying health belief model and more than two fifth of them had positive beliefs regarding disease.
Conclusions: the knowledge and reported practices of adolescent girls about osteoporosis improved after
implementing the educational program through applying health belief model. Recommendation: Applying
health belief model on wide range of female's age group.

Keywords: Health belief model, Adolescent girls, Osteoporosis.

I. INTRODUCTION

Osteoporosis is a global health issue that increases the fragility of the bone as a result of low bone mass density
and deterioration of the micro architectural particularly of the hip, spine, wrist, and shoulder. Osteoporosis
decreases the life quality of the individuals in physical, social, psychological, and economical aspects increasing
the risk for mortality and morbidity. Osteoporosis affects more than 200 million people worldwide. An estimated
75 million people in Europe, the United States, and Japan have osteoporosis, resulting in an osteoporotic fracture
every 3 seconds. By 2050, the worldwide incidence of hip fracture in men is projected to increase by 310% and

The pathogenesis of osteoporosis has genetic, hormonal and environmental influences, thus characterizing the
disease as multifactorial. Age and sex are the most common non modifiable risk factors for developing
osteoporosis. Modifiable factors, such as knowledge and health beliefs, offer an opportunity for women to engage
in behaviors that delay the onset or progression of osteoporosis (Al-Muraikhi et al., 2017 & Rosen, 2020).

Osteoporosis has no clinical manifestations until there is a fracture. This is an important fact because many
patients without symptoms incorrectly assume that they must not have osteoporosis. On the other hand, many
patients with achy hips or feet assume that their complaints are due to osteoporosis. This is unlikely true in the
absence of fracture. In comparison, pain is common in osteomalacia in the absence of fractures or other bone deformities (Rosen & Drezner, 2018).

Although it has typically been considered an adult disorder, it is becoming increasingly clear that osteoporosis might be rooted in childhood and adolescence. Bone matrix mineralization takes place during these stages of life, and therefore subjects reach peak bone mass at the end of this growth phase. If this peak is not optimal, it will facilitate the development of osteoporosis in adulthood (Galindo-Zavala et al., 2020).

Adolescence is the phase of life between childhood and adulthood, from ages 10 to 19. It is a unique stage of human development and an important time for laying the foundations of good health. Adolescents experience rapid physical, cognitive and psychosocial growth. This affects how they feel, think, make decisions, and interact with the world around them. Despite being thought of as a healthy stage of life, there is significant death, illness and injury in the adolescent years. Much of this is preventable or treatable. During this phase, adolescents establish patterns of behavior – for instance, related to diet, physical activity, substance use, and sexual activity – that can protect their health and the health of others around them, or put their health at risk now and in the future (WHO, 2021).

Health Belief Model (HBM) is one of the most widely used frameworks for trying to understand health behavior. It is based on the premise that people are most likely to take health-related action (e.g., eat a healthy diet), if they feel that by doing this action they can avoid a negative health condition. This model asserts that to plan a successful educational intervention, the individual or group’s perceived susceptibility (to osteoporosis); perceived severity of the disease and its consequences; perceived benefits in taking certain actions to reduce risk; perceived barriers (e.g., costs of the advised action) and cues to action (strategies for activating the “readiness” to undertake health actions) are required (Wayne, 2019).

Osteoporosis is a preventable disease, and primary prevention should begin as soon as possible because a rapid increase in bone density occurs at a young age. Proper knowledge can influence the adoption of osteoporosis prevention behaviors, but due to a lack of adequate education, adolescents have low knowledge and are less concerned about the risk of osteoporosis compared to cancer and cardiovascular diseases. Adolescents usually do not believe that they are at risk for the osteoporosis. So health education is one of the most efficient ways to prevent diseases and encourage health promotion. Using models like the health belief model (HBM) has a significant impact on achieving these goals (Mousaviasl et al., 2016).

Community health nurses should take urgent steps through motivation and to create awareness about osteoporosis in the community especially among adolescent girls by conducting osteoporosis screening camps, do periodical appraisal of Body Mass Index, calcium, vitamin D and Bone Mineral Density levels and provide health education about life style modification such as doing regular aerobic exercises, exposure to sun light, maintaining normal body weight, eating calcium rich foods, intake of calcium and vitamin D supplements and to select the right choice of drug such as calcium supplements along with minerals in order to prevent osteoporosis among women. Taking these preventive measures at the right time will reduce the occurrence of osteoporosis, prevent osteoporotic fractures during elderly and thereby it improves the quality of life of pre and post-menopausal women (Cecily, 2016).

Significance of the study:
Osteoporosis is a very old disease, as it was already present in ancient Egyptians Zaki et al examined 74 skeletons and performed a DXA scan on these ancient Egyptians. In modern Egypt, the incidence of osteoporosis occurrence as follows: among those between 40 and 50 years of age, 42% of women and 43% of men had low BMI, whereas a third of the elderly population of both sexes (65 to over 80 years of age) was osteoporotic. The unexpectedly high prevalence of low bone mass density among Egyptians, especially adults, could be attributed to increased smoking, reduced physical activity, and increased consumption of soft drinks, in addition to low calcium intake, low omega 3 fats in diets, and increased animal protein intake (Sobeih, Abd Elwahed, 2018).

Adolescence is critical periods for the growth and development of the body, including the bones. Half of the peak bone mass (PBM) is attained during this time and adequate attainment during this period is beneficial for reducing fracture risk later in life. Although 60% of PBM is genetically determined, there are many other influential factors, including dietary intake of calcium and vitamin D, use of medications, the presence of obesity, physical activity, and certain chronic diseases (type 1 or type 2 diabetes, inflammatory bowel disease, cystic fibrosis). If adequate PBM is not achieved due to any of these factors, the patient is at risk for later osteoporosis.
and fracture. However, precise evaluation of BMD status during childhood and adolescence may allow individuals with low BMD to undergo positive interventions, making it important both for individuals and for the society as a whole (Song et al., 2019).

II. AIM OF THE STUDY

This study aimed to: evaluate the effect of applying health belief model on prevention of osteoporosis among adolescent girls through:

- Assessing knowledge and reported practices of adolescent girls about osteoporosis according to their beliefs.
- Developing and implementing program for adolescent girls based on domains of health belief model.
- Evaluating the effectiveness of applying the health belief model on their improvement of knowledge and reported practices of adolescent girls regarding to osteoporosis.

Hypothesis: The knowledge and reported practices of adolescent girls about osteoporosis will be improved after applying health belief model.

III. METHODOLOGY:

1-Technical Design:

Research design:
A Quasi experimental study design (one group pre and post-test) was conducted for this study.

Research setting:
Beni-Suef is one of the governorates of Egypt, situated in the center of the country, and located about 120 km south of Cairo on the west bank of the Nile River. It includes, 8 cities, 39 rural local units annexed by 222 villages (71.4% rural, 28.6% urban). It has an area of 10,954 km2 and estimated population of 2,597,000 individual that constitutes 3.2% of total population in Egypt. School students aged 5-18 years (1,488,500) constitute 57.3% of total population in Beni-Suef government (Central agency of public mobilization and statistics (CAPMAS) (2011).

The study was conducted at three schools of Mrs. Aisha, Secondary Girls Alqadima (Mohamed Gaber Qusla) and Secondary Girls Alhaditha in Beni-Suef city.

Research sample:
Multistage random sample technique was used for selection of adolescent girls as the following:

- First stage: three schools were chosen randomly from total five schools.
- Second stage: second year from each school was chosen.
- Third stage: one class was chose from each school.

Size of sampling: sample was carried on 130 adolescent girls

Tools of data collection: to achieve the aim of the study, data was collected by using the following tools:

Tool I: interviewing Questionnaire was used to collect data and include three parts

a) First part: was designed to assess socio-demographic data of adolescent girls and it was included Name of school, The father's educational status, The mother's educational status, Father's occupation, Mother's occupation, Family Income, medical history of fracture and family history of osteoporosis and anthropometric measurement that include weight, height to assess BMI of adolescent girls. The researcher checked the scale for accuracy. Weight was measured to the nearest 0.1 kg with an electronic scale with adolescent girls wearing light clothing and without shoes. Adolescent girls height was measured to the nearest 0.1 cm with a wooden stadiometer placed on a flat surface (WHO and UNICEF, 2009)
Scoring system for BMI
According the BMI, adolescent girls were classified into: BMI was less than 18.5; it falls within the underweight range, BMI was 18.5 to <25, it falls within the normal and BMI was 25.0 to <30, it falls within the overweight range. It was calculated by the equation: BMI = Weight in Kg / Height² in meters. (WHO, 2021)

b) Second part: was designed to assess knowledge of adolescent girls' about osteoporosis (pre/post) through asking questions. It covered Knowledge about osteoporosis, Exercise as a protective behavior against osteoporosis, Sources and importance of calcium and vitamin D and their body requirements, Drinking soft drinks and caffeine and their harm and Importance of sun exposure.

Scoring System for knowledge:
For knowledge items, the correct answers were predetermined according to literature review, a correct response was scored 1 and the incorrect one was scored zero. For each area, knowledge was considered satisfactory if percentage score was 60% and above and unsatisfactory if percentage score was less than 60%.

Third part: was designed to assess reported practices of adolescent girls' (pre/post) through asking questions. It covered practice regarding exercise, calcium intake, caffeine and soft drinks intake and sun exposure.

Scoring System for practice:
For practices items, the correct answers were predetermined according to literature review, a correct response was scored 1 and the incorrect one was scored zero. For each area, practices was considered adequate if the percentage score was 60% or more and inadequate if the percentage score less than 60%. Inadequate practice if less than 60%.

Tool II: Osteoporosis Health Belief model Scale was designed to assess beliefs of adolescent girl's about osteoporosis, it was adopted from Kim et al., (2013) and it was included Perceived susceptibility and seriousness of osteoporosis, Perceived benefits of exercise, Perceived benefits of calcium intake, Perceived barriers of exercise, Perceived barriers of calcium intake, Perceived cues of action (health motivation) and self-efficacy.

Scoring system of Health Belief model:
Possible responses was measured using a 3-point Likert scale for each variable were “disagree”, “to some extent”, and “agree”. A score was given for each response from 1 to 3, whereby higher scores indicated a stronger feeling of each variable. Unless perceived barrier disagree scored 3, to some extent 2 and agree 1

Tool validity and reliability:
The Validity: Study tools that were designed submitted to a panel of five reviewers and experts from community health nursing department, faculty of nursing, Ain Shames University. Each one of the experts on the panel was asked to examine the instrument for content coverage, clarity, wording, length, format, and overall appearance. Modifications of tools were done according to panel judgment.

The reliability was done by Cronbach's Alpha coefficient test which revealed that each of the two tools consisted of relatively homogenous items as indicated by the moderate to high reliability of each tool.

II. Administrative Design:
For ethical reason, primary approval obtained from the Research and Ethics committee at Faculty of Nursing, Ain-shams University, also, an official permission was obtained from Mobilization and Statistics Center about the selected schools to conduct the study. Each participant informed about the purpose of the study and its significance. They were informed as well, that participation in the study is completely voluntary, as well as they have the right to withdraw from the study at any point without any penalty. Additionally, all participants were assured that their anonymity and confidentiality secured through coding the data. Moreover, participants were informed that the data not reused for any research purposes without their permission.

III. Operational design:
The study to be completed passed through different phases included: preparatory phase, pilot study and field work phase.

Preparatory phase:
A review of recent, current, national and international related literature in various aspects of the problems to design the study tools, then tools of data collection were tested for content validity through pilot study to determine the adolescent girls needs by using pretest based on the collecting data on the adolescence knowledge and their practices.

Pilot study:
It was conducted for 10% adolescence were chosen randomly to test the content, the aim of the pilot study was to evaluate clarity, visibility, applicability, as well as the time required to fulfill the developed tools. According to the obtained results, modifications such as omission, addition and rewording were done. The number of the pilot study was excluded from the study sample.

Field Work:
- Approval was taken from research of ethics committee, faculty of nursing, Ain Shams University.
- An official permission including the title and purpose of the study were submitted from the concerned authorities in the Mobilization and Statistics Center to get an approval for data collection to conduct the study in the selected schools.
- After obtaining a permit the researcher started to interviewed the adolescence to explain the aim and program content in the three schools, 3 days per week (Tuesday, Wednesday and Thursday), one day for each school from 9 am to 2pm for data collection pre and post study.
- Data collection was carried out in the period from November 2019 up to March 2020.
- The actual duration was three months, "as periods of examination and holidays were excluded". The assessment phase (pretest) was done for 130 adolescent girls of secondary schools and took two weeks to be fulfilled.
- Implementation of the program took 6 hours for 8 weeks divided into 8 sessions every session around 45 minutes, according to its content and the teaching method used the lecture group, discussion, teaching material and used Arabic booklet and audiovisual materials.

Program construction:
Phase 1: Assessment:
The researcher selected some factors to assess study sample which related the health belief model can be applied to adolescence as following: This model may be useful to planners of osteoporosis prevention, particularly regarding the benefits of, and barriers to, intended behavior change .Predict dieting, exercising, and sunlight exposure behaviors of adolescence. Even more relevant to osteoporosis prevention, the model has been integrated into numerous theoretical perspectives for behavior change for preventing juvenile osteoporosis.

The nursing educational programs were designed by the researcher based on data obtained from pre assessment tools.

Phase 2: Program Implementation:
Program implementation based on conducting session plans using different educational methods, and media in addition to the use of guiding booklet specifically designed and developed based on adolescent girls assessment need. Time was opened for attendance to ask questions and to receive the corresponding answers as well as to express their feedback toward the teaching session. Media used posters, laptop, guidance booklet which includes instruction and information for adolescent girls as a reference during and after program implementation.

Phase 3: Program evaluation:
This phase aimed to evaluate the level of improvement in adolescent girls knowledge, health practices and their lifestyle through implementation of program .This was done through giving posttest similar to the pretest, evaluation administered to study subjects after completion of the program in order to estimate the effect of program on adolescent girls knowledge and practices related to osteoporosis and measuring the effect of applying the health believe model in order to improve their health status and healthy practice.

IV: Statistical Design:
Data were revised, coded, analyzed and tabulated using the number and percentage distribution and carried out in the computer. Using appropriate statistical method.

**The following statistical techniques were used**

Percentage, Mean Value, Standard Deviation, Chi-square (X²), Pearson's r test and proportion probability (P-value).

**Significance of results:**

- When $P > 0.05$ it is statistically not significant difference.
- When $P < 0.05$ or $< 0.02$ it is statistically significant difference.
- When $P < 0.01$ or $P < 0.001$ it is high statistically significant difference.

**IV. RESULTS**

**Table 1:** shows that, father's educational status of adolescent girls had 53.5%, 53.7% respectively high educated in Mrs. Ashis and Althanawia Banat Alqadima School, while 56.5% high educated in Althanawia Banat Alhaditha School. Besides, mother's educational status of adolescent girls had 41.1% high educated in Mrs. Ashis school, while 31.7% high educated in Althanawia Banat Alqadima School and 37% high educated in Althanawia Banat Alhaditha School. Regarding to father occupation, 55.8% employed in Mrs. Ashis school, while 58.5% employed in Althanawia Banat Alqadima School and 60.9% employed in Althanawia Banat Alhaditha School. Besides mother occupation, 41.9% employed in Mrs. Ashis school, while 26.8% employed in Althanawia Banat Alqadima School and 28.3% employed in Althanawia Banat Alhaditha School. Finally, 58.1% of adolescent girls in Mrs. Aisha school had family income that suffices the basic needs while 68.3% of them in Althanawia Banat Alqadima school and 82.6% of them in Althanawia Banat Alhaditha school.

**Figure 1:** demonstrates that 8.5% of adolescent girls had family history of osteoporosis while, 91.5% of them hadn't family history of osteoporosis.

**Figure 2:** reveals that, 26.2% of adolescent girls had history of fracture while 73.8% of them hadn't history of fracture.

**Figure 3:** clears that 13.1% of adolescent girls had overweight while, 73.1% of them had normal weight and 13.8% of them had underweight.

**Table 2:** shows that, only 7.7% of the adolescent girls had satisfactory knowledge about disease and calcium & vitamin D preprogram, and this percentage improved to 43.8%, 50% respectively post program. Besides, 32.3% of the adolescent girls had satisfactory knowledge about importance of sun exposure pre-program, and this percentage improved to 88.5% post program.

**Figure 4:** denotes that, 16.9% of the adolescent girls had satisfactory knowledge preprogram, and this percentage improved to 93.8% post program.

**Table 3:** denotes that, 69.2% of the adolescent girls had satisfactory practices regarding calcium intakes preprogram, and this percentage improved to 86.9% post program. Besides, 29.2% of the adolescent girls had unsatisfactory practices regarding drinking soft drinks and caffeine preprogram, and this percentage decreased to 17.7% post program. Finally, 56.2% of the adolescent girls had satisfactory practices regarding sun exposures preprogram, and this percentage improved to 78.5% post program.

**Figure 5:** clears that, 29.2% of the adolescent girls had adequate practice regarding disease preprogram, which improved to 73.8% post program.

**Table 4:** represents that 16.9% of adolescent girls had positive beliefs toward susceptibility and seriousness of disease with mean value 17± 5.78, while 72.3% of them had positive beliefs toward benefits of exercise with mean value 15.12 ± 3.26 and 70.8% of them had positive beliefs toward benefits of calcium with mean value 15.03 ± 3.40. Finally, total mean value of health beliefs is 100.32 ± 17.59.

**Figure 6:** shows that, 46.2% of the adolescent girls had positive beliefs regarding disease, while 58.8% of them had negative beliefs regarding disease.
Table 5: showed that, there was highly significant positive correlation between most basic item of health belief model and total knowledge of adolescent girls preprogram.

Table 6: showed that, there was highly significant positive correlation between all basic item of health belief model and total practice of adolescent girls preprogram.

Table (1): Distribution of adolescent girls according to their schools and demographic data (n=130)

<table>
<thead>
<tr>
<th>Demographic characteristic</th>
<th>Mrs. Aisha (n=43)</th>
<th>Althanawia Banat (n=41)</th>
<th>Althanawia Banat Alqadima (n=41)</th>
<th>Althanawia Banat Alhaditha (n=46)</th>
<th>X2 p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The father's educational status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not read and write</td>
<td>1 2.3</td>
<td>4 9.8</td>
<td>3 6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>4 9.3</td>
<td>3 7.3</td>
<td>0 0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>15 34.9</td>
<td>12 29.2</td>
<td>17 37.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High education</td>
<td>23 53.5</td>
<td>22 53.7</td>
<td>26 56.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The mother's educational status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not read and write</td>
<td>6 14.0</td>
<td>5 12.2</td>
<td>2 4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>2 4.6</td>
<td>9 22.0</td>
<td>9 19.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>17 39.5</td>
<td>14 34.1</td>
<td>18 39.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High education</td>
<td>18 41.9</td>
<td>13 31.7</td>
<td>17 37.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father's occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee</td>
<td>24 55.8</td>
<td>24 58.5</td>
<td>28 60.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free business</td>
<td>19 44.2</td>
<td>17 41.5</td>
<td>18 39.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother's occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee</td>
<td>18 41.9</td>
<td>11 26.8</td>
<td>13 28.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>House wife</td>
<td>25 58.1</td>
<td>30 73.2</td>
<td>33 71.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sufficient the basic needs</td>
<td>25 58.1</td>
<td>28 68.3</td>
<td>38 82.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not enough to cover the basic needs</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sufficient for basic and entertainment needs</td>
<td>18 41.9</td>
<td>13 31.7</td>
<td>8 17.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure (1): Percentage distribution of the adolescent girls according to their family history of osteoporosis (n=130).

Figure (2): Percentage distribution of the adolescent girls according to their history of fracture (n=130).

Figure (3): Percentage distribution of the adolescent girls according to their body mass index (n=130).
Table (2): Distribution of adolescent girls according to their knowledge pre/post program (n=130).

<table>
<thead>
<tr>
<th>Item (a)</th>
<th>Preprogram</th>
<th>Post program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Satisfactory</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>Knowledge about disease</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Knowledge about exercise</td>
<td>10</td>
<td>7.7</td>
</tr>
<tr>
<td>Knowledge about calcium &amp; vitamin D</td>
<td>90</td>
<td>69.2</td>
</tr>
<tr>
<td>Knowledge about soft drink caffeine intake</td>
<td>15</td>
<td>11.5</td>
</tr>
<tr>
<td>Knowledge about importance of sun exposure</td>
<td>42</td>
<td>32.3</td>
</tr>
</tbody>
</table>

Figure (4): Percentage distribution of the adolescent girls according to their total knowledge pre/post program (n=130).

Table (3): Distribution of adolescent girls according to their adequate practices regarding disease pre/post program (n=130):-

<table>
<thead>
<tr>
<th>Item (a)</th>
<th>Pre program</th>
<th>Post program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practices of adolescent girls regarding exercise</td>
<td>9</td>
<td>6.9</td>
</tr>
<tr>
<td>Practices of adolescent girls regarding calcium intake</td>
<td>90</td>
<td>69.2</td>
</tr>
<tr>
<td>Practices of adolescent girls regarding drinking soft drinks and caffeine</td>
<td>38</td>
<td>29.2</td>
</tr>
<tr>
<td>Practices of adolescent girls regarding sun exposure</td>
<td>73</td>
<td>56.2</td>
</tr>
</tbody>
</table>

Figure (5): Percentage distribution of the adolescent girls according to their total practices pre/post program (n=130)
Table (4): Distribution of the adolescent girls according to their basic item of health belief model preprogram (n=130)

<table>
<thead>
<tr>
<th>Health belief model</th>
<th>Negative health beliefs</th>
<th>Positive health beliefs</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Perceived susceptibility and seriousness</td>
<td>108</td>
<td>83.1</td>
<td>22</td>
</tr>
<tr>
<td>Perceived benefits of exercise</td>
<td>36</td>
<td>27.7</td>
<td>94</td>
</tr>
<tr>
<td>Perceived benefits of calcium</td>
<td>38</td>
<td>29.2</td>
<td>92</td>
</tr>
<tr>
<td>Perceived barrier of exercise</td>
<td>79</td>
<td>60.8</td>
<td>51</td>
</tr>
<tr>
<td>Perceived barrier of calcium</td>
<td>114</td>
<td>87.7</td>
<td>16</td>
</tr>
<tr>
<td>Perceived cues of action</td>
<td>50</td>
<td>38.5</td>
<td>80</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>69</td>
<td>53.1</td>
<td>61</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>53.8</td>
<td>60</td>
</tr>
</tbody>
</table>

Figure (6): Percentage distribution of adolescent girls according to their total health beliefs regarding disease preprogram (n=130)

Table (5): Correlation between mean values health belief model of adolescents girls and their satisfactory knowledge preprogram.

<table>
<thead>
<tr>
<th>Health belief model</th>
<th>Total knowledge of adolescent girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-program</td>
</tr>
<tr>
<td></td>
<td>R</td>
</tr>
<tr>
<td>Perceived susceptibility and seriousness</td>
<td>0.46</td>
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<tr>
<td>Perceived benefits of exercise</td>
<td>0.499</td>
</tr>
<tr>
<td>Perceived benefits of calcium</td>
<td>0.503</td>
</tr>
<tr>
<td>Perceived barrier of exercise</td>
<td>0.48</td>
</tr>
<tr>
<td>Perceived barrier of calcium</td>
<td>0.36</td>
</tr>
<tr>
<td>Perceived cues of action</td>
<td>0.507</td>
</tr>
</tbody>
</table>
Table (6): Correlation between health belief model of adolescent girls and their adequate practice preprogram.

<table>
<thead>
<tr>
<th>Health belief model</th>
<th>Total practice of adolescent girls</th>
<th>Pre-program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>p</td>
</tr>
<tr>
<td>Perceived susceptibility and seriousness</td>
<td>0.120</td>
<td>0.174</td>
</tr>
<tr>
<td>Perceived benefits of exercise</td>
<td>0.495</td>
<td>0.000**</td>
</tr>
<tr>
<td>Perceived benefits of calcium</td>
<td>0.542</td>
<td>0.000**</td>
</tr>
<tr>
<td>Perceived barrier of exercise</td>
<td>-0.479</td>
<td>0.000**</td>
</tr>
<tr>
<td>Perceived barrier of calcium</td>
<td>-0.598</td>
<td>0.024*</td>
</tr>
<tr>
<td>Perceived cues of action</td>
<td>0.538</td>
<td>0.000**</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.472</td>
<td>0.000**</td>
</tr>
<tr>
<td>Total</td>
<td>0.491</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

V. DISCUSSION

Osteoporosis is a disease characterized with decreased bone density and or loss of bone microstructure, which can lead to an increased risk of fracture. It is estimated that more than 200 million people worldwide have osteoporosis (Kashfi et al., 2019).

The current study aimed to evaluate the effect of applying health belief model on prevention of osteoporosis among adolescent girls. Regarding distribution of the adolescent girls according to their family history of osteoporosis, the current study demonstrated that minority of adolescent girls had family history of osteoporosis. More than one quarters of adolescent girls had history of fracture. Minority of adolescent girls had overweight, and underweight while, nearly three quarters of them had normal weight. From the researcher point of view, these findings support the need to promote healthy lifestyle among young generations to control the increasing rate of osteoporosis especially among those with positive family history.

This result was in agreement with Jeihooni et al. (2017) who conducted study entitled "Application of health belief model in prevention of osteoporosis among secondary school girl students" and found that one third of participants had history of fracture. Conversely, this result was in disagreement with Mokhtari et al. (2019) who conducted study entitled "Investigating preventive behaviors of osteoporosis using the Health Belief Model in girls health volunteers in the health care centers" and found that more than half of participants had family history of osteoporosis.

Regarding distribution of adolescent girls according to their total knowledge about disease pre/post program, the current study revealed that minority of the adolescent girls had satisfactory knowledge about disease preprogram, and this percentage improved to nearly half post program. From the researcher point of view, this result may be due to training program were very important for adolescent girls and enhance knowledge of them.

This result was supported with Ali et al. (2020) who conducted study entitled "The Effect of Application of Health Belief Model on Osteoporosis' Knowledge and Preventive Behaviors among adolescents girls" and found two thirds of participants improved their knowledge about osteoporosis after implementation of training program. Also, in the same line with Kheirollahi et al. (2017) who conducted study entitled" Puberty health status among adolescent girls: a model-based educational program" and found majority of participants had satisfactory knowledge after training program.

Regarding distribution of adolescent girls according to their total knowledge about exercise as a protective behavior against osteoporosis, the current study demonstrated that more than two thirds of the adolescent girls had satisfactory knowledge about exercise preprogram, and this percentage increased to majority post program. From the researcher point of view, this result may be due to adolescent girls were interested on attendance training program about osteoporosis to prevent risk of incidence of disease in future.

This result was in agreement with Khani et al. (2017) who conducted study entitled "The effect of an educational program based on health belief model and social cognitive theory in prevention of osteoporosis in
adolescences girls" and found that half of participants had satisfactory knowledge after implementation training program.

Regarding distribution of adolescent girls according to their correct knowledge about the sources and importance of calcium and vitamin D, and their body requirements, the current study showed that minority of the adolescent girls had satisfactory knowledge about calcium and vitamin D pre programs, and this percentage improved to half post program. From the researcher point of view, this result may be due to healthy nutrition were important for adolescent girls to help them how avoiding and reducing risk of incidence of osteoporosis in future.

This result was supported with Norozi et al. (2020) who conducted study entitled "The effect of educational intervention based on the health belief model on osteoarthritis-preventive behaviors in adolescents women" and found that more than half of participants improved their knowledge about nutrition after implementation training program.

Regarding distribution of adolescent girls according to their correct knowledge about drinking soft drinks and caffeine and their harm, the current study revealed that minority of the adolescent girls had satisfactory knowledge about drinking soft drinks and caffeine preprogram, and this percentage increased to majority post program. From the researcher point of view, this result may be due to training program introduced good information to enhance life style of adolescences girls.

Similarity, this result was in agreement with Vahedian-Shahroodi et al. (2019) who conducted study entitled "The impact of health education on nutritional behaviors in female students with osteoporosis: An application of health belief model" and found that majority of participants had satisfactory knowledge about drinking soft drinks and caffeine post program. Conversely, this result was in disagreement with Komeili, & Jalili, (2017) who conducted study entitled "The Effect of Educational Intervention Based on the Health Belief Model on Improvement of Preventive Behaviors Towards Osteoporosis among Girls" and found that one quarter of participants had satisfactory knowledge about drinking soft drinks and caffeine preprogram.

Regarding distribution of adolescent girls according to their correct knowledge about importance of sun exposure, the current study cleared that nearly one third of the adolescent girls had satisfactory knowledge about importance of sun exposure preprogram, and this percentage improved to majority post program. From the researcher point of view, this may be due to less of health educations program conducted by health care providers to prevent osteoporosis among adolescence.

In the same line Rakhshanderou et al. (2017) who conducted study entitled "Application of health belief model to survey determinants of osteoporosis–related preventive behaviors among adolescents" and found that majority of participants had satisfactory knowledge about importance of sun exposure post program.

Regarding distribution of the adolescent girls according to their total knowledge pre/post program, the current study denoted that nearly one fifth of the adolescent girls had satisfactory knowledge preprogram, and this percentage improved to majority post program. From the researcher point of view, this result may be due to adolescent girls were careful on attendance training program that help them to prevent osteoporosis and enhance their life style.

This result was supported with Kashfi et al. (2019) who conducted study entitled "The effect of education based on based health belief model on osteoporosis and bone mineral density among adolescences girls" and found that majority of participants had satisfactory knowledge after implementation training program. And also this result was in agreement with Ali et al. (2020) who conducted study entitled "The Effect of Application of Health Belief Model on Osteoporosis' Knowledge and Preventive Behaviors among adolescences girls" and found that two thirds of participants improved their knowledge about osteoporosis after implementation of training program.

Regarding distribution of adolescent girls according to their reported practice regarding exercise, the current study clarified that minority of the adolescent girls had satisfactory practices regarding exercise preprogram, and this percentage improved to post program. From the researcher point of view, this result may be due to the effectiveness of educational program based on health belief model among adolescent girls.

This result was in agreement with Baharzadeh et al. (2017) who conducted study entitled "Using of health belief model to promote preventive behaviors against osteoporosis among adolescences girls" and found that majority of participants had adequate practices regarding exercise post program.
Regarding distribution of adolescent girls according to their reported practice regarding calcium intake, the current study presented that more than two thirds of the adolescent girls had adequate practices regarding calcium intakes preprogram, and this percentage improved to majority post program. From the researcher point of view, this result may be as a result of active participation of adolescences girls in educational sessions through discussion, and the frequent review of knowledge by the investigator and interest of the adolescences girls with the teaching methods used in the education.

This result was in agreement with Fathi et al. (2017) who conducted study entitled "Effects of a nutrition education intervention designed based on the Health Belief Model (HBM) on preventing osteoporosis in adolescences girls" and found that majority of participants improved their practices about calcium intakes post program.

Regarding distribution of adolescent girls according to their reported practice regarding intake of caffeine and soft drinks, the current study evident that nearly one third of the adolescent girls had inadequate practices regarding drinking soft drinks and caffeine preprogram, and this percentage decreased to minority post program. From the researcher point of view, this result may be due to the value of the educational program on improving knowledge level of adolescent girls regarding intake of caffeine and soft drinks.

This result was accordance with Nourian et al. (2020) who conducted study entitled "Effect of lifestyle modification education based on health belief model in adolescences girls with osteoporosis" and found that one third of the adolescent girls had inadequate practices about drinking caffeine preprogram. Conversely, this result was in disagreement with Salem & Said, (2018) who conducted study entitled "Effect of health belief model based nutrition education on dietary habits of secondary school adolescent girls in Sharkia governorate" and found that majority of the adolescent girls had satisfactory practices about drinking caffeine post program.

Regarding distribution of adolescent girls according to their reported practice regarding sun exposure, the current study evident that more than half of the adolescent girls had adequate practices regarding sun exposures preprogram, and this percentage improved to more than three quarters post program. From the researcher point of view, this result may be as result of the success of the present HBM based educational program in improving knowledge of adolescent girls.

This result was in agreement with Parandeh et al. (2019) who conducted study entitled "The effect of educational text message based on health belief model on osteoporosis preventive behaviors in adolescences girls" and found that majority of adolescent girls had adequate practices about sun exposures post program. Conversely, this result was in disagreement with Tol et al. (2017) who conducted study entitled "Application of Health Belief Model (HBM) to promote preventive against osteoporosis among female students of High School" and found that minority of adolescent girls had adequate practices about sun exposures preprogram.

Regarding distribution of adolescent girls according to their total practices, the current study clears that more than one quarter of the adolescent girls had adequate practice regarding disease preprogram, which improved to nearly three quarters post program. From the researcher point of view, this result may be due to training program help adolescent girls to enhance their practice.

Similarity, this result in the same line with Abdeyazdan et al., (2017) who conducted study entitled "Evaluating the effect of lifestyle education based on health belief model for adolescences girls with osteoporosis" and found that more than two thirds of participants had adequate practice about disease post program. Also, this result was supported with Khani et al., (2017) who conducted entitled "The effect of an educational program based on health belief model and social cognitive theory in prevention of osteoporosis in adolescences girls" and found that one third of participants had adequate practice about disease preprogram.

Regarding total health belief model of adolescent girls regarding disease, the current study showed that more than two fifth of the adolescent girls had positive beliefs regarding disease, while more than half of them had negative beliefs regarding disease. From the researcher point of view, this result may be due to increase health belief model for adolescences girls in their activities.

This result was supported with Ali et al. (2020) who conducted study entitled "The Effect of Application of Health Belief Model on Osteoporosis' Knowledge and Preventive Behaviors among adolescences girls" and
found that about two fifth of participants had positive beliefs regarding disease. And also, this result was in agreement with Kashfi et al. (2019) who conducted study entitled "The effect of education based on based health belief model on osteoporosis and bone mineral density among adolescences girls" and found that majority of participants had negative beliefs regarding disease.

Regarding correlation between mean values health belief model of adolescent's girls and their satisfactory knowledge preprogram, the current study showed that there was highly significant positive correlation between most basic item of health belief model and total knowledge of adolescent girls preprogram. According to researcher opinion, the finding of the present study could be due to knowledge can play an essential role in shaping individuals’ health beliefs and participation in proper health maintenance practices. Thus, it is a basic component for behavior change along with individuals’ beliefs and attitudes.

This result was accordance with Amraei et al. (2020) who conducted study entitled "Using an educational program based on health belief model to improve the preventive osteoporosis" and found that there was highly significant positive correlation between item of health belief model and total knowledge of participants. Conversely, this result was in disagreement with Mohamed et al. (2018) who conducted study entitled "Osteoporosis Preventive Behaviors among Women Based on the Health Belief Model and Self-Efficacy in Tanta City" and found that there was no significant positive correlation between item of health belief model and total knowledge of participants.

Regarding correlation between health belief model of adolescents' girls and their adequate practice preprogram, the current study showed that there was highly significant positive correlation between all basic item of health belief model and total practice of adolescent girls preprogram. Finding of the present study reflect the effect of HBM component to motivate the adolescent girls to engage with preventive health behaviors to avoid osteoporosis.

In the same line with Jeihooni et al. (2017) who conducted study entitled "Application of health belief model in prevention of osteoporosis among secondary school girl students" and found that there was highly significant positive correlation between all item of health belief model and total practice of secondary school girl students. Also, this result was supported with Ghoreishi et al. (2020) who conducted study entitled "The Effect of Educational Intervention Based on The Health Belief Model on using vitamin D Supplements Among Female High School Students" and found that statistically significant positive correlation between calcium & self-efficacy and total practice of participants.

VI. CONCLUSION

Based on the current study results and research hypothesis, the following can be concluded:

The knowledge and reported practices of adolescent girls about osteoporosis improved after implementing the educational program through applying health belief model. More than two fifth of the adolescent girls had positive beliefs regarding disease, while more than half of them had negative beliefs regarding disease. Also highly significant positive correlation between most basic item of health belief model and total knowledge of adolescent girls preprogram. Finally, there was highly significant positive correlation between all basic item of health belief model and total practice of adolescent girls preprogram.

RECOMMENDATIONS

In the light of these findings it can be recommended that:

- More comprehensive interventions on the benefits and barriers of calcium intake and use of other behavioral modification theories. It is advised that researchers explain social and behavioral barriers in calcium intake in different cultural contexts.

- Applying health belief model on wide range of female’s age group including adolescents, young women, and middle aged and elderly women.

- Investigate contributing factors of osteoporosis among young adults to improve understanding and management.

- Study the correlation between demographic characteristics and behavioral, social barriers in calcium intake in different cultural contexts.

REFERENCES


Rosen, C.J. (2020). The epidemiology and pathogenesis of osteoporosis. Endotext [Internet].


