Health Belief Model Based Intervention for Improving Nursing Students' Knowledge and Behavior Regarding Osteoporosis Prevention

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Abstract

Osteoporosis is a preventable chronic disease that begins during childhood. It is a silent killer not diagnosed until an individual presents with a low impact fracture. Health belief model (HBM) based intervention increase awareness of risk factors and preventive behaviors. **Aim**: This study aimed to investigate the effect of health belief model based intervention on nursing students' knowledge and behavior regarding osteoporosis prevention. **Sample**: A convenient sample of 100 female nursing students was included. **Setting**: The study was conducted at Applied Medical Sciences Collage, nursing department in Al Dawadmi, from September -November 2013. Data were collected before and after one month from the intervention. **Results**: Students knowledge about osteoporosis was improved significantly post implementation of the HBM based intervention, also there was a significant difference between students perception regarding health believe subscale before and after the HBM based intervention. Also osteoporosis protective behaviors among students were significantly changed post the intervention and there was a significant correlation between their knowledge, perception and level of calcium intake & daily activity post the intervention. **Conclusion**: Osteoporosis is a pediatric disease with geriatric consequences which need HBM based educational intervention during the adulthood stage to improve adult female knowledge, maintain osteoporosis preventive behaviors, and improve their health believes.

<u>Key words:</u> Health belief model **(HBM)** based intervention, osteoporosis prevention, nursing students

1.   Introduction:

Osteoporosis is a growing global public health problem. In the US alone 24-28 million Americans have osteoporosis with 1.3 million fractures being attributed to the disease. This equates to 21% of postmenopausal women having the disease and 16% having associated fractures. In Hong Kong osteoporosis among the top five conditions that cause disability, the mortality rate for fractures of the hip is estimated at 20%, while up to 70% of sufferers remain permanently disabled. Incidence of osteoporosis among healthy Saudi individuals has been reported to be between 23% and 31% (Al-Habdan et al., 2009).   A WHO technical report (2003a) indicates that osteoporosis is three times more common in women, partly due to women having a lower peak bone mass than men as well as due to hormonal changes at menopause.

Osteoporosis is systemic skeletal disease characterized by low bone density and deterioration of bone tissue. Maximum bone density is attained by the age of 30 years (Rundle, 2006). Once peak bone mass has been achieved, there is a 1-2 % decline in bone mass each year until menopause, at this time, bone mineral density levels decrease rapidly due to low estrogen levels. It has been estimated that women lose up to 40% of their total bone mass after menopause. (Chang, 2006 , Al-Zu'bi, et al., 2010 & Wahba, et al., 2010). Adolescence is the period of development between the onset of puberty and adulthood from 11-20 years of age. It is a time of considerable skeletal growth with 90% of peak bone mass being accumulated during this time (Chan, et al., 2006 & Al-Zu'bi, et al., 2010).

A number of factors determine bone strength throughout the life, including family history, gender, ethnicity, age, menstrual status, dietery habitu és and amount of sun exposure, and weight bearing exercise (fiarfield & Fltecher, 2002; Flynn, 2003; and Prentice 2004). Calcium is crucial for achieving peak bone mass in an individual's twenties and thirties of life and for maintaining bone mass for later in life (USDHHS, 2004). Calcium is preserved in the skeleton and is drawn upon in times of reduced intake or excessive loss. The size of this reserve is controlled by the mechanical function of the skeleton, and the body maintains only as much bone as needed to support mechanical loads (Heaney, 2000). Calcium absorption declines with age; therefore, recommendations for dietary intake of calcium are higher for adults age fifty years and older (Morgan, 2008).

Vitamin D promotes bone formation and plays a part in protein synthesis in muscles and muscle contraction. It is recommended that young women take 11 μg (400 IU) of vitamin D per day (Nakamura K, 2005). Vitamin D is essential because it aids in the absorption and utilization of calcium. Vitamin D is supplied to the body through sunlight exposure (USDHHS, 2004). In summer Sun exposure midmorning or midafternoon for 5-10 minutes in moderately fair skin and 15-60 minutes in dark skin expose the arm and legs for 2-3 times weekly. In winter sun exposure in midday for 7-30 minutes in

moderately fair skin and 20minutes -3 hours in dark skin expose the arm and legs for 2-3 times weekly (Abushaikha, et al, 2009).

Weight bearing exercise increases muscle size , increase the bone mineral density & strength of the growing skeleton as basketball, gymnastics, dancing, soccer, jogging, biking, aerobic exercises, gardening, weight lifting, jumping and tennis (Edmonds, et al. 2012   & Varghese, 2011). During weight bearing exercise, bone adapts to the impact of weight and the pull of muscle by building more bone cells. Adults should engage in at least 30 minutes of moderate physical activity preferably all days of the week (Knoll, 2012). In others words bone mass is responsive to the load placed on the skeleton. When activity is discontinued, there is a loss of muscle mass which indicates less need for bone. This, in turn, leads to the demineralization of bone. This process is worsened by other risk factors such as menopause (USDHHS, 2004).

During adulthood period consumption of dietary calcium has been decreased 90% in students and 50% in boys, while phosphorous consumption (soda) has increased which restrain the kidneys ability to process active vitamin D which is needed by the body to absorb calcium into the blood. Also adolescents and adults today are living a much more sedentary lifestyle. They have replaced physical activity with increased time spent using the computer, playing video games, and watching television (Edmonds, 2009 , Aghamirsalim, et al., 2012 & Vehei, et al., 2007). Without intervention, the number of postmenopausal patients seen with osteoporosis is expected to increase. Enhancing bone strength by health education may be effective in preventing osteoporosis among young women (Asakawa, Koyama and Yamagata, 2011).

Health Belief Model (HBM) is one of the most widely used frameworks for trying to understand health behavior.   It 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 (Vehei, et al., 2007).
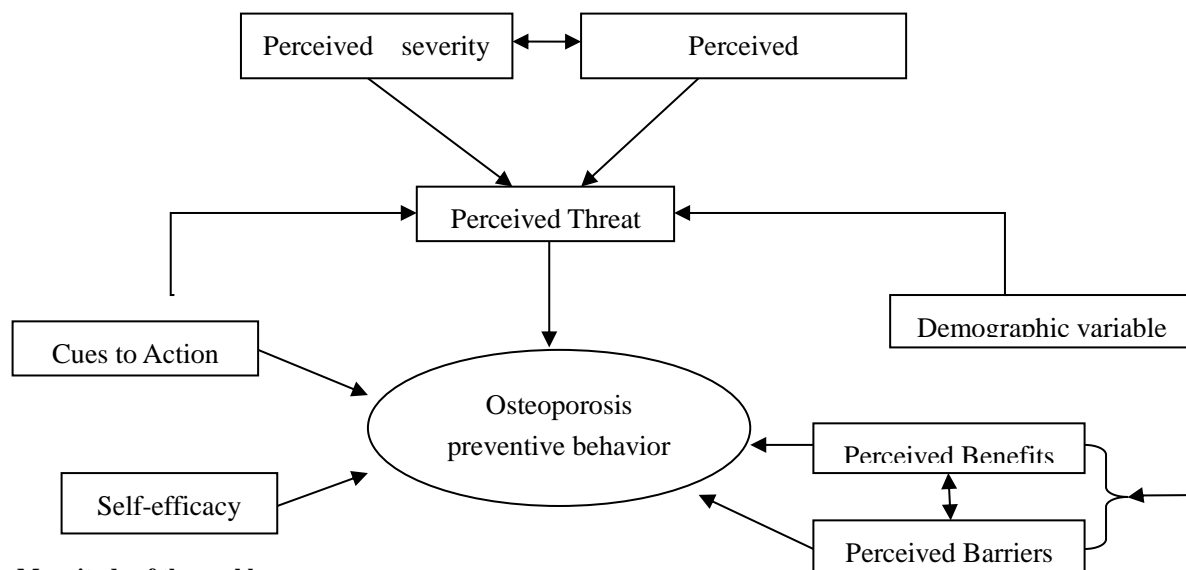
Magnitude of the problem:

During adulthood years young women consumption of calcium decrease while phosphorous consumption as soda increased and they replaced regular physical activity with increased time spent using the computer, video and watching television, this behavior put them in risk for developing osteoporosis so our aim to improve their knowledge, awareness, and change their behavior for osteoporosis prevention later on.

2.   Subjects & methods:

Aim: This study aimed to investigate the effects of health belief model based intervention on nursing students' knowledge and behavior regarding osteoporosis prevention

Research questions:

1.   Is participant's knowledge will be improved significantly after the HBM based intervention?
2.   Is participant's perception about susceptibility and seriousness of osteoporosis will be changed after the HBM based intervention?
3.   Is participant's behavior action for osteoporosis prevention will be changed significantly after the HBM based intervention?

4.   Is there a significant correlation between students' knowledge, calcium intake and physical activity performed?

Type of the study:

It is an intervention study.

Design:

Quazi experimental research design was used.

Sample:

A Convenient samples of 100 female students from different academic levels of nursing program and willing to participate were included, their age ranged from 17-24 years. Exclusion criteria included having chronic illness, pregnant, and case of osteoporosis.

Setting:

Nursing department, Applied medical Sciences collage for female in Al Dawadmi, Shaqra University, Ministry of higher education, K.S.A., giving Bachelor degree in nursing and medical laboratory sciences post 4 years studying plus 1 year internship.

Tools:

Data were collected through:

1.   Osteoporosis Knowledge Test (OKT):   It has 26 items that measure adolescence knowledge toward osteoporosis; answers were coded by assigning "1" for correct answer and "0" for incorrect answer. Total maximum score was 26. OKT was translated and used by the researchers. It has the knowledge about osteoporosis, exercises, food sources of calcium, recommended intake and supplementation of calcium & Calcium absorption. It created and validated by Kim et al. (1991a)

2.   Osteoporosis Health Beliefs Scale (OHBS): It measure adolescence beliefs about osteoporosis. It was translated and used by the researchers. It has 7 subscales related to: Perceived susceptibility & seriousness to osteoporosis, Perceived importance of regular exercise & dietary calcium intake, Perceived barriers to exercises & calcium intake and Perceived health motivation. It used a 5 – point Likert scale from "strongly disagree" - " strongly agree". Answers were coded and scored by assigning "1" for" strongly disagree" answer and "5" for "strongly agree" answers. Each scale consists from 6 questions, possible score for each subscale ranged between "6-30" with a low score indicating low perception and high score indicating high perception. Scale interpretation the above 6 subscale from (6-18 low perceived, & high perceived 19-30) in relation to perceived health motivation subscale negative view of health 6-18 positive view of health from 19-30). It created and validated by Kim et al., (1991b).

3.   Osteoporosis Preventing Behaviors Survey: Designed and validated by Edmonds, 2009,   it was translated and used by the researchers. It is a self-report descriptive survey that addresses osteoporosis preventing behaviors as follow:

    a.   Calcium intake questions: It includes 4 questions related to amount of different calcium rich food taken weekly and calcium supplement. For analysis of the behavior calcium intake (note acceptable less than 650mg/ day, almost acceptable 650-1300mg/day and acceptable more than 1300 mg/day).

    b.   Physical Activity (exercises) questions: It is a two-item self-assessment instrument that asks adolescents to answer how many days out of the past seven days were they physically active for a total of 30 minutes, and over a typical week how many days during the week were they   physically active for a total of 30 minutes. The maximum score possible for each question is 7 points. Scores for each question are added and the sum is divided by two (A score of less than 5 means that physical activity is not acceptable a score from 5 and more means that physical activity is acceptable) .

    c.   Sun exposure questions: It consists from 3 questions related to exposure to sun, time of exposure, and duration of exposure. If the adolescent exposed to the sun daily for 15-30 minutes it mean acceptable, If exposed to the sun weekly for 15-30 minutes it mean almost acceptable. If exposed to the sun weekly less than 15-30 minutes it mean not acceptable. All tools used pre and post the intervention.

Ethical considerations:

Confidentiality of information was guaranteed for each study subject. Potential participant' agreement was a prerequisite to be included in the study.

Administrative design:

An official permission was obtained from dean of the collage before conducting the study.

Pilot study:

A pilot study was carried out on 10 female students to test the clarity and simplicity of the questions. Necessary modifications were done by exclusion of some items. Subjects who shared in pilot study were excluded later from the main study sample.

Methods:

A review of local and international related references was carried out to get acquainted with the various aspects of the research problem and the study tools. Data were collected from September -November 2013. Students were met during their

educational day at the activity lecture for 50 minutes for each class according to their schedule. Tools were distributed and explained to students in the class to answer the study tools (pre- test format).

Health Belief Model(HBM) based intervention:

- It was designed by the researchers aimed to increase students' knowledge & perception about osteoporosis, change their health beliefs and motivate them to achieve desired behavior action for osteoporosis prevention. It has knowledge about osteoporosis aspect, seriousness & susceptibility, preventive behavior & complications, exercises, sun exposure, health beliefs items, Students were also motivated to read the nutritional label of the food content.

- The practical part of the intervention was lengthy and comprehensive to train participants to: Choose healthy diet, participate in exercises in sport room of the collage, the researchers demonstrate video instructions about exercise and sun exposure. Also role play in problem solving situation were used to solve calcium intake & exercises barriers. Students were shown slides of pre & post photos of patient bone to increase their perception of susceptibility. Several educational methods as group discussion, role play, demonstration and re-demonstration as well as, visual aids were used as posters, handouts, booklets. The intervention was implemented in simple Arabic language in 6 sessions each session 50 minutes; [1st] for orientation & filling the questionnaires (pre- test), [2nd] – [3rd] for all theoretical information, [4th] – [5th] for practical parts, [6th] for revision, answering questions (posttest) and   ending the study.

Statistical analysis:

The Statistical Package for the Social Sciences (SPSS) version 15 was used to analyze the data. Descriptive statistics, including frequencies, percentages, measures of central tendency and means were calculated for each item. Paired T-test was used to compare between student's knowledge about osteoporosis before and after intervention while Wilcoxon Signed Ranks test was used to identify differences among the pre- and post- test measures for others study variable such as perceived susceptibility and severity, perceived benefits and barriers, health motivation, and taking health action. Spearman correlation was utilized to cheek the relationship between students' daily calcium intake, level of students' weekly physical activity, and others study variable such as students' Knowledge about osteoporosis, perceived susceptibility and seriousness, perceived benefits and barriers of calcium & exercises and health motivation.

Results:

Table 1 represent students' Knowledge about osteoporosis before and after HBM based intervention it was clear from this table that students total knowledge   score about osteoporosis were improved   significantly post HBM model based intervention with total mean score 10.11   pre compared which 15.38   post the intervention with significant differences were found. **Table 2** reflects Students' response for Osteoporosis Health Believe Scale before and after intervention, where we found that their perception level about Osteoporosis were improved significantly after the HBM model based intervention, 37% of them highly perceived osteoporosis susceptibility after the intervention compared with 7% before the intervention , 70 % highly perceived seriousness of osteoporosis after intervention compared with 23% before the intervention and 77% highly perceived benefit of exercises after compared with 36% before the intervention.   From this table we found also four fifth of the adolescent (79%) had positive view toward their health after the intervention compared with 19% before the intervention.

Table (1): Students' Knowledge about osteoporosis before and after HBM based intervention n=100.

Osteoporosis Knowledge	Before intervention	After intervention	T value	P value
	Mean $\pm$ SD	Mean $\pm$ SD		
Knowledge of Risk Factors of Osteoporosis	3.42 $\pm$ 1.07	4.75 $\pm$ 98	-9.173	.000
Knowledge of Exercises and Osteoporosis	3.2 $\pm$ 66	4.98 $\pm$ 1.08	-14.481	.000
Knowledge of Calcium and Osteoporosis	3.47 $\pm$ 98	5.65 $\pm$ 96	-15.705	.000
Total Knowledge about Osteoporosis	10.11 $\pm$ 1.78	15.38 $\pm$ 1.75	22.283	.000

Table 3 represent students   Behavioral Action for Osteoporosis Prevention (pre/ post Intervention).a significant difference were appeared in students' behavioral action for osteoporosis prevention after HBM based intervention   where we found 50% of adolescent consume 650-1300 mg/ day calcium and their behavior consider almost acceptable post the intervention compared with 20% only pre the intervention , 60% of adolescent also exercise more than 5 times / week and their behavior consider acceptable   compared with 30% before the intervention and 31% of adolescents weekly exposed to sun more than 15 – 30 min after the intervention compared with 16% before the intervention.

Table 4 represent correlation Matrix for students' daily calcium intake and weekly physical activity, it was observed 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 level of physical activity.

Table (2): Students' response for Osteoporosis Health Believe Scale before and after intervention n=100.

Osteoporosis Health Believe Subscales	Before intervention No (%)	Post intervention No (%)	Test*	P value
1. Perceived Susceptibility:				
• Low perceived (6-18)	93 (93%)	63(63%)	-4.62	.002
• High perceived (19 - 30)	7(7%)	37(37%)		
2. Perceived Seriousness:				
• Low perceived (6-18)	77(77%)	30(30%)	-6.225	.002
• High perceived (19 - 30)	23(23%)	70(70%)		
3. Perceived Benefit of Exercises:				
• Low perceived (6-18)	64(64%)	23(23%)	-5.632	.002
• High perceived (19 - 30)	36(36%)	77(77%)		
4. Perceived Benefit of Calcium Intake:				
• Low perceived (6-18)	77(77%)	21(21%)	-6.791	.001
• High perceived (19 - 30)	23(23%)	79(79%)		
5. Perceived Barriers to Exercises				
• Low perceived (6-18)	55(55%)	81 (81%)	-3.833	.023
• High perceived (19 - 30)	45(45%)	19(19%)		
6. Perceived Barriers to Calcium Intake				
• Low perceived (6-18)	53(53%)	92(92%)	-5.547	.002
• High perceived (19 - 30)	47(47%)	8(8%)		
7. Health Motivation:				
• Negative view(6-18)	81(81%)	21(21%)	-7.318	.000
• Positive view(6-18)	19(19%)	79(79%)		

*Using Wilcoxon Signed Ranks Test.

Table (3) Students' Behavioral Action for Osteoporosis Prevention (pre/ post Intervention) n=100.

Behavioral Action for Osteoporosis Prevention	Before No (%)	After No (%)	*Test	P value
1) Daily calcium intake.				
• Not acceptable(less than 650mg/day)	77 (97%)	30(30%)	-8.005	.001
• Almost acceptable (650- 1300 mg/ day)	20(2%)	50(50%)		
• Acceptable (more than 1300mg/day)	3(1%)	20(20%)		
2) Weekly physical activity.				
• Not acceptable (less than 5 times /week)	70(%)	40(40%)	-8.718	.002
• Acceptable (more than 5 times / week)	30(%)	60 (60%)		
3) Weekly sun exposure:				
• Not acceptable (less than 15 - 30 min/ week)	80(80%)	55(55%)		.003
• Almost acceptable (weekly exposed to sun more than 15 – 30 min)	16(16%)	31(31%)	-8.090	
• Acceptable (daily exposed to sun 15 – 30 min)	4(4%)	14(14%)		

*Using Wilcoxon Signed Ranks Test.

Table (4) Correlation Matrix for students' daily calcium intake and weekly physical activity n=100.

Items	Daily calcium intake	weekly physical activit
Knowledge about Osteoporosis	.035*	.045*
Perceived Susceptibility to Osteoporosis	.047*	.634
Perceived Seriousness of Osteoporosis	.342	.435
Perceived Benefit of Exercises	.011*	.021*
Perceived Benefit of Calcium Intake	.001**	.789
Perceived Barriers to Exercises	.053	-.042*
Perceived Barriers to Calcium Intake	.069	.079
Health Motivation	.035*	.024*

** Correlation is significant at the 0.01   * Correlation is significant at the 0.05 level

3.Discussion:

This This study aimed to investigate the effects of health belief model based intervention on female nursing students' knowledge and behavior regarding osteoporosis prevention   According to this study results the students' knowledge about osteoporosis, calcium intake and exercise level were in adequate in pre intervention period. This was in agreement with Asakawa, Koyama and Yamagata, who found in their study that, young women have the lowest levels of nutritional intake, exercise, and health awareness of all the age groups, probably because they are at an age where they have almost no concern about health (Asakawa, Koyama and Yamagata, 2011). Also in this study there was significant differences between participants' osteoporosis total knowledge average score before and after the intervention so the first research question was accepted. This finding agree with Chan , et al in 2006 ;   whom mentioned the same results. In addition, Ailinger et. al in 2005, mentioned that individuals who had received pervious information about osteoporosis had more knowledge and awareness. Abushaikha et. al in 2009, agree with this study finding where he report health education programs have been shown to be effective in improving knowledge and awareness among the public.

According to the current study finding, health believed model based intervention increases students' perception about osteoporosis susceptibility and seriousness post the intervention and so second research question was accepted, also we found more   than two thirds of the participants had positive view of health post intervention this finding agree with   Chan , et al in 2006 ;   whom mentioned that health believed model based education increase average score   of perceived susceptibility and increase perception   about seriousness of osteoporosis and motivate positive view of health. Also Saw et al, in 2003, reported that a high perception of susceptibility may also relate to degree of knowledge.

Tsai in 2008 mentioned that an individual's dietary behavior can be altered by increasing their knowledge and changing internal beliefs. Also he mentioned that interventions that focus on osteoporosis awareness, calcium self-efficiency, health motivation, as well as overcoming personal barrier to calcium intake may be the most effective methods for osteoporosis prevention. This was in agreement of this study results, we found that participants' osteoporosis preventive behavior (as daily calcium intake, daily physical time activity & sun exposure time) were improved significantly post the intervention so the third research question was accepted. Also this finding agree with Chan, et al in 2006 ; whom mentioned that health motivation has been found to be related to the degree of people readiness to engage in healthy behavior, also he mentioned that calcium intake level were increased after applying health believed model based education. In addition, Hurst & Wham in 2007 support this study finding and reported that perception of personal susceptibility and seriousness of the problem are important influences in their behavior. Also Manios et al 2007 found that an HBM based intervention program increase dietary calcium intake

Chang's in 2006a found that osteoporosis knowledge most significant predictor of calcium intake & physical activity level and Weinstein 1988 reported that levels of osteoporosis knowledge are significantly predicting daily calcium intake level. This was in congruent with this study finding which stated that there was a significant correlation between participants' knowledge about osteoporosis and daily calcium intake level and weekly physical activity level so the fourth research question was accepted. However, this was inconsistent with Wallace & Baller 2002 whom mentioned that no association between osteoporosis knowledge and calcium intake. Also a significant correlation was found between health motivations and daily calcium intake level and level of physical activity. Sedlak et al 2007 and Wallace & Ballard 2002 found that perceived susceptibility to osteoporosis is significant predictor of dietary calcium intake. They agree with the finding of the current study, which revealed that there was a significant relation between perceived susceptibility to osteoporosis and daily calcium intake. This finding not agree with Varghese 2011, who concluded that Iranian young female would have relevant knowledge about osteoporosis but their attitude and practice were less than their knowledge.

4. Study limitations:

The limitation related to convenient sample method is that a claim for representative of the population cannot made also there is no longitudinal follow up and participants   were tested only after one month post the intervention .

5. Conclusion:

Through HBM based intervention we have the opportunity to prevent this geriatric age disease and its consequences that cause poor quality of life and intensifying health care costs. HBM based intervention appeared to be more effective in increasing participants' awareness, changing their perception toward osteoporosis and motivating them to apply preventive behaviors to reduce the risks of the osteoporosis & its consequences.

4. **Recommendations**:

1. There is a need to implement public health actions to improve vitamin D status through wide spread vitamin D supplementation, modest skin sunshine exposure, and increase of vitamin D containing foods.
2. Increasing osteoporosis awareness among the public and health professionals must be made to improve recognition and knowledge of osteoporosis and its consequences.
3. In schools and universities students should instructed to consume healthy high calcium and vitamin D diet, avoid soda & fast food and maintain active life style.
4. Longitudinal studies with large sample size should be conduct to investigate the impacts of health belief mode based educational intervention on preventive behavior actions for osteoporosis prevention.

Acknowledgment:

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