

Nutrition Education and Osteoporosis Risk Factors in Early Decades of Life

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Abstract Objective: To examine the effectiveness of nutrition course on dairy products, fruits and vegetables frequency consumption in university female students. Method: A total of 152 pharmacy students who were enrolled in a course of nutrition at the school of pharmacy involved in the study. Frequency Consumption of dairy products, fruits and vegetable were collected and analyzed before and after the course of nutrition. Results: After the course of nutrition, a statistically significant ($P < 0.05$) increase in consumption for milk, dairy products, fruits and vegetable was found. Conclusion: Class-based nutrition education can be an effective strategy to motivate young adult toward dietary behaviors modification to maximize bone peak bone mass and in tern reduces the risk of osteoporosis.

Keywords: dairy products, females, nutrition course, osteoporosis, young adults

1. Introduction

Osteoporosis is the most common metabolic bone disorder affecting millions worldwide, especially elderly. It is characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and increased susceptibility to fractures. Hip, spine, and wrist are the most common sites of fracture although any bone can be affected [1,2,3]. Osteoporosis is more prevalent in women than in men [4,5] The impact of fractures is significant from both economical and quality of life prospects. Osteoporotic fractures cause pain and disabilities which have significant adverse impacts on the quality of life of affected individuals [6,7] conomically it causes significant costs to the health care system. The cost of fractures in the USA, as an example, was nearly \$8 billion in 2005 and by 2025; it is predicted to be approximately \$ 25.5 billion [1,6] The risk of osteoporosis increases with age. Although the symptoms rarely appear before the age of thirty, the disease process begins much earlier [8,9].

Two major stages of life are critical in the development of osteoporosis. The first is bone growth stage that occurs below the age of 30, where more than 90% of peak bone mass is achieved by the end of adolescence [9,10]. While the second stage is bone losing stage where bone strength and density start to decline in later adulthood [11]. Accordingly, reducing the risk of osteoporosis in later life requires the attainment of the highest bone density during the first three decades of life [11].

Factors that may lead to less than optimal bone mass density development and consequently osteoporosis include among others low body mass index, low levels of

physical activity, poor nutrition and other factors including smoking, caffeine, intake and the use of certain medications [12,13].

To maximize bone mass, diet should deliver an adequate supply of dietary calcium, and vitamin D besides increasing physical activity during the first three decades of life [14,15]. Thus calcium and vitamin D deficiencies during this period of life increase the risk of osteoporosis in older people [14-20]. Although calcium and vitamin D are the primary focus of nutritional prevention of osteoporosis in later life, available literatures were also clarified the importance of fruits and vegetables consumption in the prevention of the disease. Fruits and vegetables contain important modifiable protective nutrients for bone health such as magnesium, potassium, vitamin A, K, E, C and carotenoid [1,11,21].

Previous studies have reported low degree of awareness about osteoporosis especially among women in developed countries [22,23], which highlighted the need for educational interventions that are directed toward increasing the population's knowledge of osteoporosis risk factors. These educational interventions have proved to be effective in changing the dietary habits to healthier ones as evident in a number of studies [3,24,25]. However osteoporosis is far from being limited to the developed regions of the world. The disease prevalence is, in fact, increasing in the developing countries [20,26] including Jordan, which has witnessed a fast rise in the prevalence of osteoporosis. In a cross-sectional study conducted by Shilbayeh [27], high prevalence of osteoporosis and osteopenia was detected among the Jordanian female population.

To reduce the risk of osteoporosis in the Jordanian society, we hypothesized that dietary behaviors modification is an effective approach to maximize bone

mass during adolescence and young adulthood, and this can be accomplished through nutritional education. To test this hypothesis, a prospective a single cohort study was conducted to assess the impact of 15-week class-based nutrition course on dietary behaviors of university female students. The Faculty Research Committee reviewed the study and decided that it was exempt from IRB review.

2. Methods

The participants of this study consisted of one hundred and fifty two female pharmacy students (70.4% of the total students in the class) who are registered for a nutrition course in the faculty of pharmacy, Jordan University of Science and technology during spring 2009. The course of nutrition which is offered to pharmacy students who are at least in the third year level covers normal and clinical nutrition. Lectures were given two times per week for 50 minutes each. Participants were informed about their full freedom to either fill out the questionnaire or not and they were also assured that participation in the study will not affect their grades in the course.

Participants were allowed to complete a guided self-filling questionnaire in the beginning of the course to serve as a baseline. The baseline questionnaire assessed participant's demographic characteristics (gender, age, height, weight) and consumption frequency of dairy products fruits, and vegetables. Consumption frequency of dairy products (milk, yogurt, cheese, and labanah, a soft cream cheese made from yogurt), fruit, and vegetable intake were determined as follows: one or more serving per day, 3-6 servings per week and 1-2 servings per week and one serving a month or none. A serving of fruits and vegetable was defined as discussed elsewhere [28] while a dairy serving is defined as: 1 cup of milk or yogurt, 2 full table spoons (1oz) of labanah, and a piece of cheese, 1 ounce (about the size of domino or two fingers). Cheese and labanah intake were assessed separately from other dairy products for several considerations. First, labanah is known to be more preferable to Jordanian society over other dairy products. Second, different dairy products supply variable amounts of calcium [29]. Third adolescence and young adults are more susceptible to increase in soft drinks consumption instead of milk [30,31].

To examine the impact of educational intervention on dietary behaviors, participants were asked to complete the baseline questionnaire at the end of the semester.

3. Data Analysis

Data obtained from the questionnaire at the beginning of the nutrition course was compared to those collected at the end of the semester. Proportions of participants in each category were compared before and after the nutrition course using statistical software Minitab 14. P values < 0.05 were considered statistically.

4. Results

One hundred and fifty two female students have participated in the study, the average age of the

participants was 21.7 ± 1.2 years and the average body mass index of participants was $22.4 \pm 3.1 \text{ kg/m}^2$. In 43% of participants, the frequency of milk and yogurt consumption was essentially one serving a month or none. In 21% of participants the milk and yogurt intake was one or more serving per day. After the course of nutrition significant percentage of participants has shifted to more frequent milk and yogurt consumption groups (49% vs. 21%, $p < 0.001$), (Figure 1).

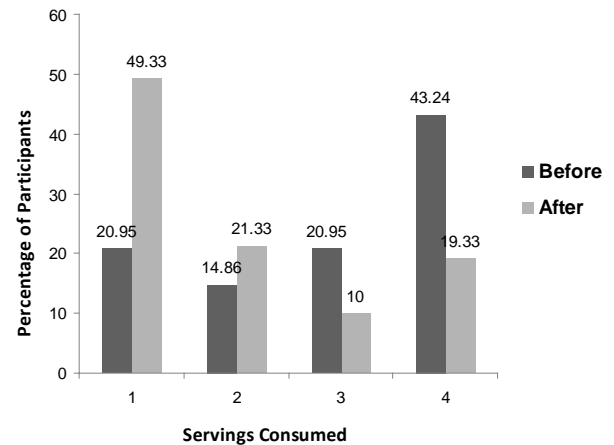


Figure 1. Milk and yogurt consumption of studied population before and after educational intervention

1 = one or more serving per day, 2 = 3-6 servings per week, 3 = 1-2 servings per week, 4 = once a month or none.

Statistically significant increase in participants who took more servings of milk and yogurt and significant reduction in number of participants who consumed less frequent milk and yogurt were found after educational intervention.

After the course of nutrition, a significant increase in the participants who took one or more serving per day of cheese and labanah (35% vs. 48%, $p < 0.001$) was detected. In addition, a significant reduction among those consuming cheese and labanah once or twice weekly (28% vs. 9%, $p < 0.001$) was observed (Figure 2).

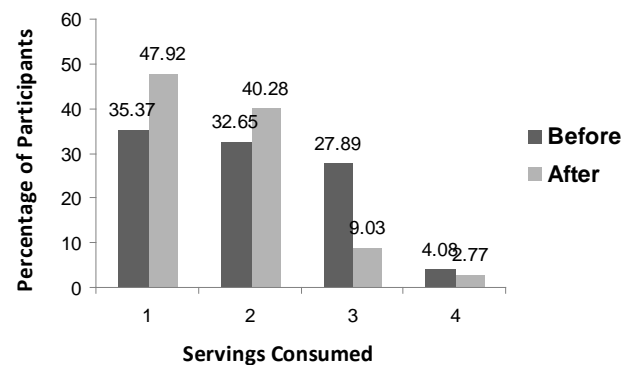


Figure 2. Cheese and labanah consumption of studied population before and after educational intervention

1 = one or more serving per day, 2 = 3-6 servings per week, 3 = 1-2 servings per week, 4 = once a month or none.

Statistically significant increase in participants who took more servings of cheese and labanah and significant reduction in number of participants who consumed less frequent cheese and labanah were found after educational intervention.

Regarding fruits and vegetables consumption, statistically significant increase in proportion of participants consuming fruits and vegetables was also found. The majority of participants have shifted to the more frequent fruits and vegetable consumption group

(Figure 3, Figure 4). Approximately 42% of participants reported once or twice weekly consumption of fruits, and 20% reported once or more daily consumption of fruits before nutrition course. These percentages have changed significantly to 20% and 37% respectively after nutrition course. Number of participants who reported that they consume fruits once a month or none were also significantly decreased (13% vs. 3% $P < 0.001$) after the nutrition course (Figure 3).

For vegetables on the other hand, a statistically significant increase in participants who consume one or more per day and 3-6 servings per week was observed after nutrition course ($P < 0.01$ and $P < 0.05$ respectively); Figure 4.

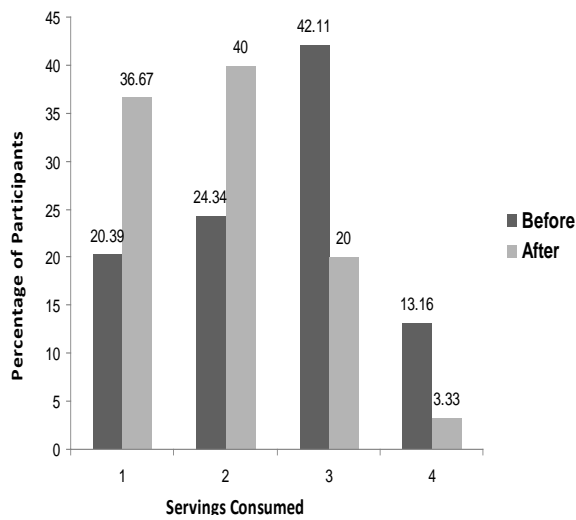


Figure 3. Fruits consumption of studied population before and after educational intervention

1= one or more serving per day, 2 = 3-6 servings per week, 3 = 1-2 servings per week, 4 = once a month or none. Statistically significant increase in number of participants consuming more fruits and significant decrease in number of participants who consumed less frequent fruits were found after educational intervention.

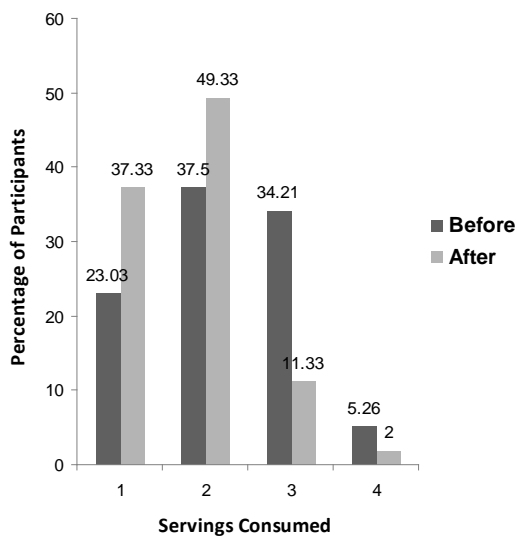


Figure 4. Vegetables consumption of studied population before and after educational intervention

1= one or more serving per day, 2 = 3-6 servings per week, 3 = 1-2 servings per week, 4 = once a month or none. Statistically significant increase in number of participants consuming more vegetables and significant decrease in number of participants who consumed less frequent vegetables were found after educational intervention.

5. Discussion

The results of this study provide evidence that class-based nutrition education is a practical and an effective method to reduce osteoporosis risk factors among university female students. It seems to work through promoting positive dietary changes that can maximize peak bone mass. After the nutrition course, the consumption of dairy products, fruits and vegetables were markedly increased as compared to baseline.

Calcium, the essential mineral of bone is mostly found in a one class of food, namely milk. Therefore milk and milk products are the major sources of dietary calcium. Although Calcium is also available in none milk sources including nuts, seeds, broccoli, and sardine with bones [28], these food items are not commonly used by Jordanians on a daily bases. Much research has focused on calcium and vitamin D, but other nutrients maintain bone health too [32,33]. There is a close relationship between vitamin K and osteoporosis. Vitamin K is involved in the formation of osteocalcin, and other proteins specific for bone formation [34,35]. Vitamin C is an essential cofactor for formation of collagen, a protein that helps in strengthening bones. Bone matrix contains over 90% of collagen. In addition, vitamin C is a powerful reducing agent, capable of scavenging reactive oxygen species which are involved in the bone resorption [36]. Vitamin A is needed for bone remodeling process but, high intake of this vitamin has been postulated to be associated with osteoporosis [37]. Minerals such as magnesium, sodium and potassium may also have a role in the development and prevention of osteoporosis. Magnesium and potassium help in maintaining bone mineral density while excess of sodium is associated with bone loss since sodium intake is a strong determinant of urinary excretion of calcium [38]. Thus diets rich in fruits and vegetables are also essential for bone health since they contain such bone protective nutrients [21]. After the course of nutrition, the majority of participants have shifted to more frequent fruits and vegetable consumption group. This finding is in agreement with the finding of Ha and Caine-Bish [38].

Adolescence and early adulthood are distinct periods of life. The populations' of this subgroups are more susceptible to develop unhealthy dietary behaviors such as reduction in milk and increase in soft drinks intake [30,31], which can predispose them for chronic diseases later in life [40]. Based on the presented data, it seems that adult Jordanian females do not prefer milk or yogurt over cheese and labanah since 43.24% take milk once a month or none and only 4.08% of adult Jordanian females take cheese and labanah once a month or none. Labnah supplies the lowest amount of calcium per serving, about 100mg/oz as compared to other milk and milk products [29]. After the course of nutrition, the majority of participants have shifted to more frequent milk and yogurt intake. This finding indicates that nutrition education can make changes in the type of milk products and in the quantity of dietary calcium consumed too, and this finding is in agreement with Friedman and Snetselaar [40].

The findings of this research indicate the followings. First, a high percentage of participants consume inadequate amounts of dietary Calcium and other protective nutrients essential for bone health which may predispose them for osteoporosis later in life. Such

harmful dietary behavior may be attributed to reduced knowledge about osteoporosis risk-related dietary behaviors. Second, class-based educational intervention is effective in reducing the risk factors of osteoporosis among the studied population. Third, Adolescents and young adulthood are a proper life stage for nutritional education intervention because they are in an age of bone mass build up. These findings are in agreement with other previously published studies [3,15,22,24,25,41].

6. Conclusions

1. We found that, young female's students responded well for educational intervention related to decrease the risk of osteoporosis.

2. A class-based nutrition course may represent simple and cost effective strategy to reduce osteoporosis risk factors in early decades of life through increases the awareness and educational knowledge of osteoporosis risk factors and motivate participants toward healthier dietary behavior modification.

Statement of Competing Interests

The authors have no competing interests.

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