# Knowledge Towards Prevention of Osteoporosis in Adolescent Girls: Effect of Educational Program

Jamileh Moghimi,[1] Zahra Safaei,[2] Behnaz Behnam,[2] and Raheb Ghorbani[3,*]

[1]Social Determinants of Health Research Center, Kawsar Hospital, Faculty of Medicine, Semnan University of Medical Sciences, Semnan, Iran
[2]Kawsar Hospital, Faculty of Medicine, Semnan University of Medical Sciences, Semnan, Iran
[3]Social Determinants of Health Research Center, Faculty of Medicine, Semnan University of Medical Sciences, Semnan, Iran

[*]*Corresponding author*: Raheb Ghorbani, Social Determinants of Health Research Center, Faculty of Medicine, Semnan University of Medical Sciences, Semnan, Iran, E-mail: r_ghorbani@semums.ac.ir; ghorbani.raheb93@gmail.com

## Abstract

**Background:** Osteoporosis is one of the most common disorders in women, affecting the quality of life by having the increasing risk of fractures. There are no data on awareness of adolescent girls as a vulnerable group about osteoporosis.
**Objectives:** The aim of this study was to assess the knowledge concerning osteoporosis among high school female students in Semnan, Iran and to evaluate the effect of educational program.
**Methods:** This pre and post-study was performed on 583 high-school female students, whom selected from 8 schools using multi-stage sampling. The study questionnaires were completed by interviewing students. All students participated in a single education session (about 2 hours) and the level of knowledge about osteoporosis, its risk factors and complications were assessed before and after education.
**Results:** The mean $\pm$ SD score for general knowledge regarding osteoporosis was 0.35 $\pm$ 0.35, about complications of osteoporosis was -0.18 $\pm$ 0.53 and about risk factors for osteoporosis was also 0.25 $\pm$ 0.21. The mean total knowledge about osteoporosis was the highest in third high school grade girls (P = 0.009), while no difference was observed in score of knowledge towards osteoporosis across the different educational fields (P = 0.156). The mean total score of knowledge toward osteoporosis was significantly increased after educational intervention compared to prior to the educational program with the mean $\pm$ SD pre-educational score 0.23 $\pm$ 0.19 (median 0.26) and post-educational score 0.45 $\pm$ 0.22 (median 0.48) (P < 0.001).
**Conclusions:** In conclusion, our results indicated that awareness of Semnan high schools girls on osteoporosis, especially about its complications is poor. Lack of awareness could be due to the lack of training. Thus, more training needed with a focus on understanding the causes of disease and its complications in order to resolve the problem and reduce the incidence of osteoporosis. So by increasing awareness regarding this disease, there is a potential for prevention and reduction of the complications.

*Keywords:* Osteoporosis, Knowledge, Education, Prevention

## 1. Background

Bone is a dynamic tissue that is renewable throughout life, especially in the first two decades of life. The renewing rate estimated at 20% in children and about 3% to 5% in adults (1). In order to protect the body bone strength and mobility have to be increased; bones can act as repository of calcium, phosphorus and other ions necessary for the homeostatic functioning (2). However, osteoporosis threatens bone strength throughout life.

Osteoporosis is characterized by reduced bone strength that is more common in postmenopausal women (3). This event is one of the disasters of the past century as in 1991; The world health organization declared osteoporosis as one of the four main enemy of mankind along with cancer, heart attack and stroke (4).

This disease is the most common metabolic bone disease characterized by decreased bone mass and deteriora-tion of bone tissue, and thus the bones are thin and prone to fragility (5). The risk of mortality from osteoporosis is equal to the risk of mortality from breast cancer and about four times greater than the risk for uterine cancer (6).

According to the reports of rheumatology research centers in Iran, 6 million of Iranian people are suffering from osteoporosis that of 5 million post-menopausal women 2.5 million have osteoporosis (7).

Osteoporosis is an important disease, which poses an economic burden globally, with an estimated nine million osteoporotic fractures worldwide in 2000. Pain as a consequence of fracture can persist for a long time, and consequently, there is an associated loss of mobility. Feeling of weakness, anxiety and fear of future fractures are all potential negative psychological outcomes resulting from osteoporotic fractures or even low bone density (8).

Costs imposed on the governments related to hip fracture and its surgical repairing is over 12 billion USD annu-

ally ([9](#)).

For chronic condition like osteoporosis, the health care system needs to focus on disease prevention through education and self-management support. Effective health education interventions have been identified as those which provide knowledge and skills and foster confidence as opposed to dependency ([10](#)).

The osteoporosis prevention and self-management course (OPSMC) were developed in Australia to increase the understanding about the disease and hence decrease anxiety, to promote healthy behaviors and to prevent the disease or facilitate effective management ([11](#)).

As women regardless of their age are more affected than men and since the women are members of the community and key components of half of the world's population, it is important to maintain their health and thus the need for prevention of osteoporosis in the population is very crucial. Schools are suitable sites for education in regards to health issues. The children need to have sufficient knowledge and skills, manners and values that will promote their health. In the meantime, the girls are more important than the boys because girls are future mothers and many of the concepts of diet are obtained by girls in this age range. Given the strong relationship between knowledge, manner and behavior of individuals, it is clear that if no desired knowledge was achieved in the girls, they cannot be expected to perform her duties as an effective link between their child and the family. So far, there are no data on awareness of adolescent girls as a vulnerable group about osteoporosis.

## 2. Objectives

The aim of this study was to assess the knowledge, concerning osteoporosis among high school female students in Iran and to evaluate the effect of educational program.

## 3. Methods

This is a pre and post-study on the effect of education on prevention of Osteoporosis in 583 high-school female students in Semnan, Iran, in 2013.

The first step, using multi-stage sampling, the Semnan was divided into four north, south, east and west regions and then, from each of the regions, two schools were selected by systematic sampling method (totally 8 of 16 high schools). After obtaining permission from Semnan Board of Education, the researchers were referred to each school and students were randomly selected from all grades. After explaining the general objectives of the study, informed consent was obtained from all subjects before enrollment

and the study questionnaires were completed by a trained person and by interviewing students.

The second step, students in each school were educated in a single session (about 2 hours). In this educational session, the subjects were informed about the purposes of education, osteoporosis, risk factors of osteoporosis, and also prevention of the complications of disease. Participants in eight School were educated in eight days. About two months after training, the participants were interviewed again.

The used questionnaire ([12](#)) consisted of two main parts. The first section included information on demographic characteristics such as grades, parents' education and occupation, place of residence, the presence or absence of underlying diseases. The second section consisted of three parts including:

1. First, two initial questions were asked; "Have you ever heard about osteoporosis?" and if the answer was yes, second question was asked as "What is the source of the information received?"; 2. 26 questions were asked about the level of knowledge towards osteoporosis that scored as agree, disagree or do not know ([12](#)); 3. The questions were about the history of consulting with your doctor about osteoporosis and willingness or unwillingness to talk with the doctor (2 questions) and also about willingness to participate in a training seminar for osteoporosis and duration of the proposed seminar (2 questions).

The questionnaire ([12](#)) translated to Persian and its validity was confirmed by three expert scientists. Its reliability was ascertained by means of pilot testing using a selected group of students.

The questions about the level of knowledge were categorized as General knowledge about osteoporosis (5 questions), Knowledge of the complications of osteoporosis (2 questions), and Knowledge of risk factors for osteoporosis (16 questions). The correct answer to each question was given a score of 1, the wrong answer to the question was given a score of -1, and a score 0 was given to the answer of "I do not know". In overall, the mean was calculated for each section. The average number close to 1 indicated a higher level of knowledge.

The study protocol was approved by local ethical committee of Semnan University of Medical Sciences.

### 3.1. Data Analysis

Statistical analysis was performed by Kolmogorov-Smirnov, Kruskal-Wallis, Wilcoxon tests using SPSS 18.0 software. P-value less than 0.05 considered statistically significant.

## 4. Results

Regarding the field of education, out of 583 students 104 were in experimental sciences, 99 in Mathematics, 90 in Humanities, 95 in technical sciences fields and others educated in first year of high school. In terms of residence, 96.7% were resident of the city and others were residents in the rural area. Underlying disorders were observed in only 9 girls. 77.0% of fathers and 67.0% of mothers had diploma or college degree. Most fathers (43.4%) were self-employed and most of the mothers (80.2%) were housekeepers.

### 4.1. Before Educational Intervention

The mean ± standard deviation (SD) value for general knowledge toward osteoporosis was 0.35 ± 0.35, about complications of osteoporosis was -0.18 ± 0.53 and about risk factors for osteoporosis was also 0.25 ± 0.21 with the mean total knowledge score 0.23 ± 0.19. There was a significant association between education grade and level of knowledge toward osteoporosis (P = 0.009), that the score of total knowledge was the highest in third grade high school students (Table 1). But no difference was observed in score of knowledge towards osteoporosis across the different educational fields p= 0.156 (Table 2). There was also no relationship between knowledge of students toward osteoporosis and the level of education of fathers (P = 0.561) or mothers (P = 0.165).

The most common source of information about osteoporosis was family (36.8%) followed by media (32.8%), however friends have expressed as the most uncertain source of information (0.4%). Moreover, 26.1% expressed that had not heard of the disease yet. Also, 93.1% did not consult with the physicians about osteoporosis; however 67.8% expressed their willingness to talk with a physician about the disease. In overall, 72.2% have declared their willingness to participate in a seminar about osteoporosis and 47.6% of them proposed the time of seminar for up to two hours.

### 4.2. After Educational Intervention

The mean total score of knowledge toward osteoporosis was significantly increased after educational intervention compared to prior of that with the mean ± SD pre-educational score 0.23 ± 0.19 (median 0.26) and post-educational score 0.45 ± 0.22 (median 0.48) (P < 0.001). Assessing the answers to all questions showed improvement in the level of knowledge toward osteoporosis (P < 0.05), except for the answers of two questions of Walking when buying protects you against osteoporosis (P = 0.113) and Salty diet may cause calcium loss (P = 0.946), indicating unchanged knowledge level (Table 3).

## 5. Discussion

This study show that the level of knowledge of female high school students toward osteoporosis and its related risk factors was significantly improved after educational sessions, however their knowledge about disease complications remained negligible. Also, improvement of the knowledge was similarly revealed in different educational fields, but increased over the years of education. Also, we showed that only 73.9% informed previously about osteoporosis which was lower compared to the reports from other provinces such as Tehran showing that the knowledge about osteoporosis was about 97.9% (13).

In a study on Canadian female students, it was indicated that the knowledge and practice of the students was considerably minimal regarding osteoporosis, its risk factors and the prevention facts with emphasizes on calcium usage and exercise (9).

Based on our results, we conclude that information about osteoporosis in the media and schools are very minimal and needs to be given more attention. Education is necessary for all students, regardless of literacy or level of education of their parents. Meanwhile in our study; the most important source for obtaining information was families. Our study could effectively improve the level of knowledge towards osteoporosis and its risk factors by educational session. In a study by Randi Schoenfeld et al. (2010), implementing internet-based education could successfully enhance their knowledge about osteoporosis (14).

Similar to our study, in a study in southern Iran, educational session could significantly improve the knowledge of students about this disease (15).

Francis et al. (2009) showed significant success in preventing osteoporosis and its risk profile in young women by implementing educational sessions when compared to the controls (8).

In other studies on adults and even the elderly, the level of knowledge about osteoporosis was notably minimal. Barzanji et al. (2013) also showed that about 86% of adults were informed about osteoporosis and their level of knowledge were associated with their education and occupation state (16).

In other studies, low awareness about this disease and its related risk factors was expressed emphasizing on necessity for educational sessions and courses even in advanced ages (17-19).

In general, lack of awareness in schools could be due to the lack of training in this area. Receiving more training from the media, public health centers and private sectors will be helpful. There is a potential for resolving the problem and reducing the incidence of osteoporosis and its complications by focusing more on understanding the

**Table 1.** The Mean ± (SD) of Knowledge Score About Osteoporosis According to High School Grade Before Educational Intervention

| Knowledge About: | High School Grade | | | P-Value |
|---|---|---|---|---|
| | First Year (n = 195) | Second Year (n = 187) | Third Year (n = 201) | |
| Osteoporosis (General) | 0.34 ± 0.34 | 0.31 ± 0.38 | 0.41 ± 0.33 | 0.013 |
| Complication of osteoporosis | -0.11 ± 0.54 | -0.22 ± 0.55 | -0.22 ± 51 | 0.059 |
| Risk factors of osteoporosis | 0.24 ± 0.19 | 0.22 ± 0.20 | 0.27 ± 0.24 | 0.045 |
| Total | 0.23 ± 0.17 | 0.20 ± 0.19 | 0.26 ± 0.19 | 0.009 |

**Table 2.** Mean ± SD Knowledge Score About Osteoporosis in Different Science Fields Before Educational Intervention

| Knowledge About: | Science Field | | | | P-Value |
|---|---|---|---|---|---|
| | Experimental (n = 104) | Mathematics (n = 99) | Humanities (n = 90) | Technical (n = 95) | |
| Osteoporosis (General) | 0.42 ± 0.35 | 0.38 ± 0.33 | 0.26 ± 0.36 | 0.36 ± 0.38 | 0.027 |
| Complication of osteoporosis | -0.24 ± 0.50 | -0.19 ± 0.51 | -0.13 ± 0.59 | -0.31 ± 0.51 | 0.143 |
| Risk factors of osteoporosis | 0.28 ± 0.25 | 0.24 ± 0.24 | 0.23 ± 0.17 | 0.24 ± 0.23 | 0.490 |
| Total | 0.27 ± 0.20 | 0.24 ± 0.19 | 0.21 ± 0.17 | 0.22 ± 0.21 | 0.156 |

causes of disease and its complications. Also training the students with various level of family education can help in achieving our goal. Based on our data, the level of parent's education regardless of their social and cultural levels along with the implementation of training program has a direct effect in resolving the problem. Also, the parent-teacher associations can have a critical role in solving the issue.

Furthermore, due to the reliability of physicians as a source of health information's, this group can assist more prominently in increasing public knowledge about the disease, and providing the necessary information to the patients and their families. It has been also recommended that the government consider implementing the programs which are necessary for the promotion of public awareness on osteoporosis as a priority of health policies.

Lack of awareness could be due to the lack of training so with more training by focusing more on understanding the causes of disease and its complications, resolving the problem reducing the incidence of osteoporosis and its complications can be easily possible.

One of the limitations was the lack of suitable audiovisual facilities to conduct optimum education in girls' schools. Further studies without such a limitation may increase the attraction of education and learning in students.

Finally, our results indicated that the awareness of Semnan girls high schools on osteoporosis, especially about its complications is poor. Short - term training (about 2 hours) significantly increases their awareness and decreases the risk of morbidity in those who are in the age of marriage. Therefore, it is recommended that health centers conduct necessary educations in girls' schools through cooperation of related specialists.

## Footnotes

**Authors' Contribution:** Jamileh Moghimi, study conception, design, writing article; Raheb Ghorbani, design, data analysis, writing article; Behnaz Behnam, study conception, design; Zahra Safaei, study conception, design.

**Conflict of Interests:** The authors declare that they have no competing interests.

**Table 3.** Response Status (%) to Each Question Before and After Educational Intervention

| Question | Response Status (%) | | | | | | P-Value |
|---|---|---|---|---|---|---|---|
| | Before Intervention | | | After Intervention | | | |
| | Correct | False | Do not Know | Correct | False | Don not Know | |
| **Osteoporosis is preventable** | 63.3 | 13.0 | 23.7 | 84.9 | 8.9 | 6.2 | < 0.001 |
| **Osteoporosis has no treatment** | 47.7 | 20.1 | 32.1 | 63.5 | 19.1 | 17.4 | < 0.001 |
| **Calcium supplements may be used for prevention** | 58.3 | 8.1 | 33.6 | 83.1 | 5.6 | 11.3 | < 0.001 |
| **Vitamin D is also used in prevention** | 41.2 | 6.3 | 52.5 | 65.5 | (8.0 | 26.5 | < 0.001 |
| **Female hormones such as estrogen may be used for prevention** | 18.7 | 5.0 | 76.3 | 31.2 | 10.5 | 58.3 | < 0.001 |
| **Osteoporosis is directly due to a hip fracture** | 22.5 | 22.5 | 55.1 | 37.0 | 28.7 | 34.3 | < 0.001 |
| **Osteoporosis can lead to death** | 17.5 | 53.9 | 28.6 | 44.1 | 42.6 | 16.0 | < 0.001 |
| **Aging increases the risk of osteoporosis** | 78.7 | 8.1 | 13.2 | 91.5 | 3.8 | 4.7 | < 0.001 |
| **The risk for osteoporosis in men is higher** | 43.2 | 8.4 | 48.4 | 76.6 | 5.4 | 18.0 | < 0.001 |
| **The risk for osteoporosis is higher in some more races** | 35.7 | 20.1 | 44.3 | 49.9 | 20.1 | 29.9 | < 0.001 |
| **Smoking may increase the risk of osteoporosis** | 70.2 | 8.7 | 21.1 | 85.7 | 3.3 | 11.1 | < 0.001 |
| **Sunlight is effective in preventing osteoporosis** | 60.7 | 9.1 | 30.2 | 83.3 | 6.0 | 10.7 | < 0.001 |
| **Tea consumption reduces the risk of osteoporosis** | 37.6 | 8.9 | 53.5 | 69.5 | 7.8 | 22.7 | < 0.001 |
| **Coffee consumption may increase the risk of osteoporosis** | 25.6 | 14.2 | 60.2 | 65.3 | 10.7 | 24.0 | < 0.001 |
| **Heredity can affect the development of osteoporosis** | 39.3 | 27.3 | 33.4 | 59.5 | 20.3 | 21.1 | < 0.001 |
| **Small size may increase the risk of osteoporosis** | 14.8 | 51.6 | 33.6 | 21.1 | 47.9 | 31.0 | 0.021 |
| **If someone in your family have osteoporosis you may be at risk** | 15.3 | 57.1 | 27.6 | 30.9 | 43.7 | 25.4 | < 0.001 |
| **Diet rich in calcium helps prevent osteoporosis** | 71.5 | 7.2 | 21.3 | 87.7 | 6.2 | 6.2 | < 0.001 |
| **Lack of exercise may increase the risk of osteoporosis** | 61.9 | 16.1 | 22.0 | 85.8 | 7.3 | 6.9 | < 0.001 |
| **Menopause increases the risk of osteoporosis** | 41.2 | 8.7 | 50.1 | 67.0 | 9.6 | 23.4 | < 0.001 |
| **Some drugs may increase the risk of osteoporosis** | 66.9 | 9.6 | 23.5 | 83.7 | 8.0 | 8.3 | < 0.001 |
| **Walking when buying protects you against osteoporosis** | 14.9 | 46.3 | 38.8 | 19.6 | 43.9 | 36.5 | 0.113 |
| **High-salt diet may cause the loss of calcium in the body** | 33.4 | 16.8 | 49.7 | 34.3 | 16.9 | 48.8 | 0.946 |

# References

1. Berendsen AD, Olsen BR. Bone development. *Bone.* 2015;**80**:14–8. doi: 10.1016/j.bone.2015.04.035. [PubMed: 26453494].

2. Kovacs CS. Calcium, phosphorus, and bone metabolism in the fetus and newborn. *Early Hum Dev.* 2015;**91**(11):623–8. doi: 10.1016/j.earlhumdev.2015.08.007. [PubMed: 26363942].

3. Khadilkar AV, Mandlik RM. Epidemiology and treatment of osteoporosis in women: an Indian perspective. *Int J Womens Health.* 2015;**7**:841–50. doi: 10.2147/IJWH.S54623. [PubMed: 26527900].

4. Lim SY, Bolster MB. Current approaches to osteoporosis treatment. *Curr Opin Rheumatol.* 2015;**27**(3):216–24. doi: 10.1097/BOR.0000000000000169. [PubMed: 25760281].

5. Vaezi AA, Pazokian M, Yekefallah F, Samieefard F. Study of lifestyle and preventive behaviors of osteoporosis among adolescents in Qazvin. *SSU.* 2012;**20**(3):259–68.

6. Berarducci A. Senior nursing students' knowledge of osteoporosis. *Orthop Nurs.* 2004;**23**(2):121–7. [PubMed: 15103798].

7. Forouzi M, Haghdoost AA, Saidzadeh Z, Mohamadalizadeh S. Study of knowledge and attitude of Rafsanjanian female teachers toward prevention of osteoporosis. *J Birjand Univ Med Sci.* 2009;**16**(1):71–7.

8. Francis KL, Matthews BL, Van Mechelen W, Bennell KL, Osborne RH. Effectiveness of a community-based osteoporosis education and self-management course: a wait list controlled trial. *Osteoporos Int.* 2009;**20**(9):1563–70. doi: 10.1007/s00198-009-0834-0. [PubMed: 19194641].

9. Gammage KL, Francoeur C, Mack DE, Klentrou P. Osteoporosis health beliefs and knowledge in college students: the role of dietary restraint. *Eat Behav.* 2009;**10**(1):65–7. doi: 10.1016/j.eatbeh.2008.10.006. [PubMed: 19171323].

10. Wagner EH. The role of patient care teams in chronic disease management. *BMJ.* 2000;**320**(7234):569–72. [PubMed: 10688568].

11. Laslett LL, McNeil JD, Lynch J. Patient education–the forgotten link in managing osteoporosis. *Aust Fam Physician.* 2004;**33**(3):121–4. [PubMed: 15054974].

12. Ungan M, Tumer M. Turkish women's knowledge of osteoporosis. *Fam Pract.* 2001;**18**(2):199–203. [PubMed: 11264272].

13. Menshadi F, Azari A, Kuhpayeh Zadeh J, Ghasemi M. Knowledge, attitude and practice of osteoporosis among a group of iranian adolescent females (2007). *J Modern Rehabil.* 2009;**2**(3):47–54.

14. Randi Schoenfeld E, Ng P, Henderson K, Wu SY. Using the internet to educate adolescents about osteoporosis: application of a tai-

lored web-education system. *Health Promot Pract.* 2010;**11**(1):104–11. doi: 10.1177/1524839908321730. [PubMed: 19098263].

15. Kamjoo A, Shahi A, Dabiri F, Abedini S, Hosseini Teshnizi S, Pormehr Yabandeh A. The effectiveness of education about osteoporosis prevention on awareness of female students. *Bimonth J Hormozgan Univ Med Sci.* 2012;**16**(1):60–5.

16. Barzanji AT, Alamri FA, Mohamed AG. Osteoporosis: a study of knowledge, attitude and practice among adults in Riyadh, Saudi Arabia. *J Community Health.* 2013;**38**(6):1098–105. doi: 10.1007/s10900-013-9719-4. [PubMed: 23780302].

17. Ni Chroinin D, Glavin P, Power D. Awareness of osteoporosis, risk and

protective factors and own diagnostic status: a cross-sectional study. *Arch Osteoporos.* 2013;**8**:117. doi: 10.1007/s11657-012-0117-9. [PubMed: 23297105].

18. Nguyen VH, Wang Z. Osteoporosis Knowledge of Students in Relevant Healthcare Academic Programs. *J Osteoporos.* 2012;**2012**.

19. Pluskiewicz W, Adamczyk P, Czekajlo A, Grzeszczak W, Drozdzowska B. Influence of education, marital status, occupation, and the place of living on skeletal status, fracture prevalence, and the course and effectiveness of osteoporotic therapy in women in the RAC-OST-POL Study. *J Bone Miner Metab.* 2014;**32**(1):89–95. doi: 10.1007/s00774-013-0471-8. [PubMed: 23690162].