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Original Paper

Osteoporosis Preventive Lifestyle and Vitamin D Status Among Nursing Students of Guilan University of Medical Sciences

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ABSTRACT

Introduction: Lifestyle is a dynamic chain, in such a way that choosing an appropriate lifestyle can affect the development or prevention of diseases, including osteoporosis.

Objective: The current study aimed at determining the osteoporosis preventive lifestyle and vitamin D status among the nursing students of Guilan University of Medical Sciences.

Materials and Methods: The current analytical, cross-sectional study was conducted on 185 nursing students of Guilan University of Medical Sciences selected by stratified sampling method. The study data were collected in two areas: demographic characteristics and different dimensions of lifestyle, including physical activities, nutrition (dietary), and habits by IPAQ (International Physical Activity) and food frequency questionnaire. The final score of dietary diversity ranges between 0 and 10. The higher score indicates the suitability of the dietary diversity in the subjects. If the total amount of consumed energy during physical activities in a week is 0-599, the physical activity score indicates a person with low physical activity, 600-3000 indicates moderate physical activity, and more than 3000 shows an severe physical activity. To measure vitamin D, blood samples were taken and reported as follow: deficient: 0-10 ng/mL, inadequate: 10-30 ng/mL, sufficient: 30-150 ng/mL, and toxic: more than 150 ng/mL. The obtained data were analyzed by descriptive statistics (mean, standard deviation, 95% confidence interval, and median) and inferential statistics (the Kruskal-Wallis, ANOVA, the Mann-Whitney, and Regression).

Results: The results of the current study showed that in the physical activity dimension, 44.9% of the subjects had low physical activity. In terms of diet, the dietary diversity Mean±SD score was 4.60±1.37. Regarding habits, 4.9% of the students used to smoke cigarettes, 30.22% smoked hookah, and only 12.4% of them had enough vitamin D. The amount of vitamin D considering hookah smoking and taking vitamin D supplementation was significant (P=0.0001). Comparing the physical activity score with the vitamin D status, the results showed that the subjects with severe physical activity had higher levels of vitamin D; however, this correlation was not statistically significant (P=0.145) since the Mean±SD vitamin D status in weak physical activity group was 20.69±15.65 ng/mL, and in the intensive physical activity group was 24.06±14.77 ng/mL.

Conclusion: The current study results showed that nursing students have an inappropriate condition regarding their lifestyle, nutritional habits, and physical activity, and the level of vitamin D to prevent osteoporosis. It is necessary to plan interventional and educational programs for a healthy lifestyle and appropriate behavioral habits.

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Highlights

- Based on the study results, the highest food dairy score in the university students belonged to the meat group and the lowest to vegetables.
- By consuming less hookah and taking more vitamin supplements, the serum level of vitamin D will rise in the students.
- About 75.7% of students had insufficient vitamin D levels.
- The obtained results showed that the level of vitamin D increases with the increase of students' age and their academic terms.

Plain Language Summary

The current study aimed at providing a lifestyle to prevent osteoporosis and maintain vitamin D status in students of nursing at Guilan University of Medical Sciences. Lifestyle means the interests, behaviors, and orientations of a person, group, or culture. Selection of the right lifestyle is a step forward to maintain health and prevent diseases, including osteoporosis.

Different dimensions of lifestyle include physical activities, nutrition (dietary), and habits. The results of the current study showed that about half of the subjects practiced just a low physical activity. According to the nutritional status, they were not at the appropriate place, either. Regarding their habits, 4.9% of students smoked cigarettes and 30.22% smoked hookah, and only 12.4% of them had enough serum level vitamin D. By consuming vitamin D supplements, as well as doing regular exercise, one could increase vitamin D level in the blood and prevent osteoporosis in the old age.

Introduction

Osteoporosis is a major public health problem associated with considerable complications and socio-economic burden [1]. It is known as a "silent disease", since it progresses without signs and symptoms and first manifests by itself complications, i.e. fractures [2]. According to some studies, over 200 million people in the world have osteoporosis [3]. Statistics show that females catch osteoporosis four times more than males [4].

Findings of the National Program for the Diagnosis and Treatment of Osteoporosis in Iran indicate that 50% of males over 50 and 75% of females over 50 have osteoporosis and osteopenia [3]. According to statistics, over 6 million Iranians have osteoporosis, and approximately 1 in every 3 females and 1 in every 12 males have osteoporosis [4]. Generally, two strategies are proposed to prevent osteoporosis and fracture: maximizing bone mineral density up to the third decade of life and minimizing bone density loss in middle age and aging stage of life. Since it is very difficult to increase bone density after young age, it is important to maximize bone density at a young age that plays a key role to prevent osteoporosis at middle and old age [5].

Some risk factors for osteoporosis such as age, gender, and race are unchangeable. However, other items such as diet, lifestyle, and situations that increase the risk of falling may change [6]. Another important factor in bone mineral density is the role of vitamin D [7]. Vitamin D deficiency leads to a decrease in calcium absorption and ultimately the release of calcium from bones to maintain calcium in the blood circulation, and through secondary hyperparathyroidism, ultimately leads to osteomalacia and osteoporosis. Vitamin D is obtained in a limited amount of diet; vitamin D2 or ergocalciferol is derived from plants, fungi, and sunlight; vitamin D3 is derived from animal products, fish oil, eggs, and dairy products. The uptake of vitamin D occurs in the ileum and the jejunum [8].

Osteoporosis is a preventable disease, and the cheapest way to cope with it is primarily to observe the lifestyle and maximize bone mass [9]. According to what was said, people's lifestyle has a great impact on obtaining maximum bone mass. Lifestyle is a dynamic chain in all aspects of hu-

man life and has a great role in health [9]. By choosing a lifestyle, people carry out actions and activities to maintain and promote his/her health and prevent disease [10].

Dietary habits, smoking, alcohol, and physical inactivity are among the most important items related to people's lifestyle [11]. In general, lifestyle is associated with prevention of osteoporosis and is considered very crucial during adolescence and early adulthood. More than 20% of bone growth and about 50% of bone mass density occur in this period of age [9]. In both genders, the maximum bone mass gaining occurs at the age of 30, then with the gradual increase in age, the mass starts decreasing, in both genders. Based on the studies, a 10% increase in bone mass can reduce the risk of osteoporotic fractures up to 50% at an older age [10].

One of the critical periods for youngsters is the period of college or university, known as a dynamic transitional period that acts as a bridge between childhood and adulthood [9]. Studies show that students are apt to high-risk behaviors, physical inactivity, unhealthy diets, and inappropriate habits [11]. On one hand, lifestyle and vitamin D status are the most important determinants of bone health, and on the other hand, medical students, especially nursing students, have an important role in preserving and promoting health in college and are considered as a model of healthy behavior. In this regard, the current study aimed at investigating aspects of lifestyle, prevention of osteoporosis, and status of serum vitamin D in the nursing students of Guilan University of Medical Sciences in 2015. We believe that this is the first and most essential step towards understanding the preventive factors of such problems for health.

Materials and Methods

This analytical, cross-sectional study was conducted on male and female nursing students of Guilan University of Medical Sciences in the late spring and early summer of 2015. The study subjects were selected by stratified sampling method according to the academic term from male and female students of Shahid Beheshti School of Nursing and Midwifery, Rasht, and the Faculty of Nursing and Midwifery and Paramedical Sciences of Langrood (Nursing Faculty of Guilan University of Medical Sciences), based on the type of faculty (Rasht and Langrood). The sample size needed for the current study, based on the study results of Ahmadnia with 95% confidence interval, the absolute estimate of 5%, and 14% proportion of the lifestyle (in terms of student's nutrition) was obtained 185 from the sampling formula [9].

Then, the number of samples in each faculty, with respect to the population of each faculty to the total population of the study, was calculated. The total number of nursing students was 484, of which 314 were studying in the Faculty of Nursing and Midwifery and 170 students were studying in Nursing and Midwifery Faculty and Langrood Paramedical Faculty of Guilan University of Medical Sciences. The samples were selected from the faculties based on their students; 120 subjects from the Faculty of Nursing and Midwifery of Rasht and 65 from the Faculty of Nursing and Midwifery and Paramedical Sciences of Langrood.

A questionnaire consisting of two parts was used to collect data. The first part was a research-made questionnaire included demographic characteristics consisting of age, gender, Body Mass Index (BMI), birth order, year of education, marital status, economic status, parents' education, history of osteoporosis in the family, and the second part of the questionnaire focused on lifestyle related to osteoporosis, including three dimensions: 1. Nutritional status in terms of dietary diversity; 2. Habits; and 3. Physical activity. In the dimension of dietary habits, a questionnaire of diet frequency was used to collect data about food; the validity and reliability of the questionnaire were confirmed in the nutritional unit of Endocrinology Research Institute. The method of Kant et al. was used to score dietary diversity, consisting of 23 questions in five main food pyramids designed by the US Department of Agriculture, including 1. Bread and grain; 2. Vegetables; 3. Fruits; 4. Meats; and 5. Dairy products. Then the main groups were divided into 23 subgroups, which represent the diversity of food within each of the food groups of the pyramid [12-14].

In rating the variety of dietary of bread and grain, seven subgroups (1. Refined bread, 2. Biscuits, 3. Pasta, 4. Whole grains, 5. Corn products, 6. Rice, and 7. [Refined] flour) are identified. For the group of fruits, there are also two subgroups (1. Fruits, 2. Juices). There are 7 subgroups for vegetables (1. Vegetables, 2. Potatoes, 3. Tomatoes, 4. Other starchy vegetables, 5. Leguminous vegetables, 6. Green vegetables, and 7. Yellow veggies). Meat is divided into four subgroups (1. Red meat, 2. Poultry, 3. Fish, and 4. Eggs). For dairy products, three subgroups are identified (1. Milk, 2. Yogurt, and 3. Cheese). Finally, the week and month are converted to daily calculation. If a person consumes at least half a share of a subgroup food in one day, he or she is considered as a consumer of that subgroup. The maximum awarded score for the diversity of food in each of these 5 groups is 2. Finally, a total score of 10 is calculated by adding the total number of these numbers. Therefore, the minimum dietary diversity score is 0 and the maximum score is 10. If the dietary diversity

score is around 10, it indicates the suitability of dietary diversity in the subject.

For example, if a person consumes whole grain, rice, and biscuits from the group of bread and grain, his or her food rating from that group is (7÷3)×2=0.85, where 3 is the number of daily consuming subgroups of a person in the grain group, 7 represents the subgroups in the bread and grain group, and 2 is the maximum score given to each group, which is fixed [12, 13].

The second part of the researcher-made questionnaire of lifestyle is related to habits, including questions about smoking, hookah, consumption of calcium supplements, vitamin D, fish oil, weight loss drugs, sun exposure duration and on what time of the day, and the use of skin protection. These questions were reported by descriptive statistics test. The content validity method was used to assess the scientific validity of the questionnaire. In this regard, the questionnaire was submitted to 10 members of the academic staff of Guilan University of Medical Sciences for their review and after analyzing their comments the final version was prepared and edited. The instrument reliability was calculated by test-retest with a 78% of the correlation coefficient.

The third part of the lifestyle questionnaire considered physical activity, in which the short form of the International Physical Activity Questionnaire (IPAQ) was used [9, 15-17]. According to the designed questionnaire, the pattern and intensity of physical activity in the past seven days were measured. Meanwhile, any activity that lasted less than 10 minutes was removed. Intensive physical activities refer to the ones that require a lot of physical force and cause more severe breathing than normal condition, such as aerobics, high-speed biking, climbing, basketball, soccer, running, heavy lifting, and digging (gardening). These activities require more than 6 calories per minute.

Activities that require a moderate physical force and may cause breathing a little faster than normal, such as medium speed biking, badminton, and cleaning a room, and require 3-6 calories per minute are called moderate physical activities. Moreover, the time spent on walking, such as walking at work, at home, and going from one place to another is also considered. In addition, the time allocated for sitting down, such as sitting at work, at home, doing homework, watching TV, and sitting with friends were considered.

To assess the intensity and the level of physical activity, the scoring protocol is used by multiplying the constant value of the activity level with the duration of activity in minutes by the number of activity days per week (MET/cal/week). The constant value of the level (MET) for walking is 3.3, for the medium-intensity physical activity is 4, and for the intensive physical activity is 8. Then, in order to take into account the overall physical activity of the subject during the week, the values obtained from the three physical activities, walking, moderate, and intensive activities are summed up. If the total energy during the week is 0-599 MET minutes a week, the subject is considered a person with low physical activity, 600-3000 MET minutes a week is considered a person with moderate physical activity, and more than 3000 MET minutes a week is considered a person with intensive physical activity. This questionnaire is used in various studies in the country and its validity and reliability are confirmed [9, 15].

In the current study, 25(OH)-Vitamin D was measured by the Enzyme-Linked Immunosorbent Assay (ELISA) technique and then categorized as follows: Deficiency: 0-10 ng/mL; Inadequate: 10-30 ng/mL; Sufficient: 30-150 ng/mL; Toxic: >150 ng/mL. Blood sampling was conducted in the spring and early summer at the college lab after obtaining the subjects' consent. From each subject, 3-5 mL venous sample blood was taken by sampler (expert nurse) between 8-10 AM. Then, the samples were sent to Poorsina lab after at most 3-4 hours.

After obtaining the approval of the Ethics Committee (Ethical code: IR.GUMS.REC.1393.13) and the necessary permissions, the data collection was started at colleges. First, the study objectives were explained to the subjects and they were assured that their information would be kept confidential. After obtaining their consent, the questionnaires were filled and following the measuring of height and weight parameters, blood sampling was started. Serum vitamin D levels were measured by taking venous blood samples (3-5 mL) by a sampler (an expert nurse). The collected data were analyzed in SPSS version 16 using descriptive statistics (frequency, mean, standard deviation, and median) and inferential statistics (Kruskal-Wallis and ANOVA). For multiple analyses in the current study, we used multiple linear regression model. The significance level of the tests was considered as $P<0.05$.

Results

The subjects' Mean±SD age was 22.1±1.3 years, their Mean±SD BMI was 22.57±3.61 kg/m^2. About 49.2% of the subjects were females and 50.8% males; 92.4% of the subjects were single; 40.5% had up to $300 family income; 37.3% had educated fathers and 41.6% had educated mothers with a high school diploma; 15.7% reported the history of osteoporosis in the family. Regarding the dietary diversity score, the diversity of the main groups of

the food pyramid was not the same, for example, the students' dietary diversity Mean±SD score was 4.60±1.37. The top Mean±SD score belonged to the diversity of the meat group (1.31±0.49), and the lowest one belonged to the diversity of vegetables (0.53±0.35).

With regard to the habits, 4.9% of the study subjects were cigarette smokers; 17.8% consumed hookah leisurely; 5.94% used to smoke it weekly, and 48.6% smoked monthly; 53% of the subjects were exposed to sun rays during the whole daytime and 64.5% within the period from 9 AM to 3 PM. Among the subjects, 13% always used sun protection, 1.6% weight loss drugs, 5.4% used calcium supplements, 1.1% fish oil supplements, and 8.1% vitamin D supplements. Regarding physical activity, 44.9% of the study subjects had low physical activity, 37.8% moderate, and 17.3% intensive physical activity.

According to the results of the current study, 12.4% of the subjects had enough, and 75.7% had insufficient vitamin D level. The Mean±SD serum vitamin D level in the subjects was 21.31±15.69 ng/mL. ANOVA was used to compare the food diversity dimension of osteoporosis preventive lifestyle with respect to the state of serum vitamin D. Regarding the mean scores in 5 food pyramid categories, only the mean score in the group of vegetables and legumes was

Table 1. Comparing serum vitamin D level with respect to variables of habits of osteoporosis preventive lifestyle

Serum Vitamin D Level					
Variables of Habit Dimension		**Mean±SD**	**Min**	**Max**	**Sig.**
Cigarette smoking	Yes	21.22±4.84	16	31	0.126*
	No	21.32±5.16	7	129	
Hookah smoking	Sometimes	23.79±9.58	14	69	0.0001**
	Yes	17±2.65	14	19	
	No	20.85±16.85	7	129	
Exposure to direct sunlight during the day	Yes	20.47±13.76	7	93	0.933**
	No	35.69±28.47	11	129	
	Sometimes	21.32±13.99	7	85	
Using skin protection	Always	22.83±17.89	8	85	0.297**
	Often	20.84±16.75	7	93	
	Sometimes	17.50±7.82	7	49	
	Rarely	23.86±13.69	9	74	
	Never	21.55±18.57	7	129	
Using weight loss drugs	Yes	18.33±11.06	8	30	0.840*
	No	21.36±15.77	7	129	
Using calcium supplements	Yes	27.78±21.27	10	74	0.385*
	No	20.98±15.35	7	129	
Consumption of fish oil supplements	Yes	21.50±7.78	16	27	0.586*
	No	21.31±15.76	7	129	
Consumption of vitamin D supplements	Yes	37.07±21.69	12	85	0.0001*
	No	19.92±14.32	7	129	

* The Mann-Whitney U test; ** The Kruskal-Wallis test

Table 2. Comparing physical activity dimension of osteoporosis preventive lifestyle with respect to vitamin D status

Mean Amount of Spent Energy / Physical Activity		Vitamin D Status (ng/mL)			Total	Mean±SD	Sig.*
		Deficient (0-9)	Inadequate (10-30)	Sufficient (30-150)			
Low activity (0-599 MET minutes per week)	N	8	65	10	83	20.69±15.65	0.145
	%	9.6	78.3	12	100		
Medium activity (600-3000 MET minutes per week)	N	13	49	8	70	20.80±16.22	0.145
	%	18.6	70	11.4	100		
Intensive activity (more than 3000 MET minutes per week)	N	1	26	5	32	24.06±14.77	0.145
	%	3.1	81.3	15.6	100		
Total	N	22	140	23	185	21.31±15.69	0.145
	%	11.4	75.7	12.4	100		

* The Kruskal-Wallis test

significant (P=0.04). It should be noted that total scores of food diversity in terms of vitamin D was not significant (P=0.083).

Regarding the comparison of habits with quantitative individual and social variables of preventive lifestyle in terms of vitamin D, since the distribution of vitamin D was not normal, we used the Mann-Whitney test if the habits were two options, and the Kruskal-Wallis test if they were multi-options. There was a significant relationship between age and academic term, in terms of the state of vitamin D (P=0.0001), so that by increasing age and academic term, the level of vitamin D increased.

Regarding the habits dimension of osteoporosis preventive lifestyle with respect to vitamin D, the use of hookah and vitamin D supplementation was significant (P=0.0001), i.e. the lower the amount of hookah usage, the higher the level of vitamin D, and the higher the use of vitamin D supplement, the higher the level of vitamin D (Table 1).

The descriptive statistics showed the relationship between physical activity score and the state of vitamin D. The subjects with severe physical activity had higher levels of vitamin D, but this higher level was not statistically significant (P=0.145) (Table 2). The results of the regression model with backward method to determine the strongest factors associated with vitamin D (considering the probability of entering and exiting as 0.1 and 0.5 of information) showed that among the studied variables, the score of the third group in food pyramid (dairy) was the strongest factor related to the amount of vitamin D, in such a way that with increasing one unit to this group, the amount of vitamin D increases 4.077±2.029 (Table 3).

Discussion

The results of the current study on dietary diversity of the studied subjects showed that the highest percentage of deficiency belonged to the grain and vegetables followed by the dairy group. In the current study, the Mean±SD of dietary diversity score was found 4.60±1.37, which mostly had a diet score of less than 5. Similarly and with regard to

Table 3. Regression coefficients of vitamin D predictors

Variable	Non-Standard Coefficient		Standard Coefficients	T-Test	Sig.	95% Confidence Interval	
	Regression Coefficient	Standard Error				Lower	Upper
Fixed value	18.192	2.029	-	8.968	0.0001	14.188	22.196
Score of the third group (diary)	4.077	2.029	0.152	2.009	0.046	0.071	8.083

the nutritional dimension, a study by Nola et al. entitled "Differences in Eating and Living Habits among the Medical Students of the First and Sixth Years", indicated that only 22.5% of the students ate regular breakfast in a daily diet [11]. Another study entitled "The Relationship between Dietary Diet and Nutrition in Primary School Students in Ardabil" showed that the Mean±SD score of consumed food groups was 3.62±1 and the dietary diversity among school children had a low score [18].

While another study entitled "An Investigation of Energy-Affiliated Relationship and Dietary Diversity Score among Female Students of the University of Medical Sciences" showed that their Mean±SD score of dietary diversity was 6.78±1.12 [12]. According to researchers, these differences in findings can be due to differences in the characteristics of the studied population and the number of study samples. However, geographical and food culture factors should be considered, too. It seems that students do not pay enough attention to choosing the right nutritional diet as a young population. The researcher believes that the students of the medical sciences department are less educated about the importance of healthy eating and a greater variety of diets.

With regard to habits, the current study showed that very few students were cigarette smokers. In Ahmadnia study, none of the students were smokers [9]. In another study, more than one-third of the students were smokers [11]. In Lehmann study, nearly half of female nursing students smoked 10-20 cigarettes a day [19]. It can be said that smoking tendency in Iranian culture is lower than other societies, which confirms cultural differences and various views existing in communities. On the other hand, since the current study was conducted through the interview, there is a possibility of an unrealistic response, which is one of the research limitations.

With regard to physical activity, the results showed that most of the subjects had little physical activity. Likewise, the results of a study entitled "Examining the Physical Activity and Smoking Behavior among Health Students" showed that nearly half of the studied subjects had a low physical activity [20]. A study by Moeini et al. entitled "Application of the BASNEF Model in Assessing the Regular Physical Activity of High School Girls in Hamedan" showed that 46.2% of students had low physical activity, 28% moderate activity, and 25.8% intensive activity [21]. Low physical activity among the students may be due to intensive curriculum and lack of free time so that students are busy with computer, the Internet, and TV programs.

According to the current study results, the mean serum vitamin D level in the studied subjects was insufficient and a small percentage of students had enough vitamin D levels. In line with the current study, a study entitled "The High Prevalence of Vitamin D Deficiency and Its Relationship with Obesity and Metabolic Syndrome Among Malay Adults in Kuala Lumpur" showed that most participants had insufficient vitamin D levels [22]. Sivakumar et al. in a study entitled "Vitamin D and BMI in Medical Students" claimed that most subjects had vitamin deficiencies and the results of only 24% were in normal range [23].

Vitamin D deficiency varies among different region, since many factors such as season, latitude, inadequate sun exposure, using sun protection, fear of skin cancer, coverage, mean population age, daily consumption of foods rich in vitamin D (seafood, fish oil, and egg yolk) and taking vitamin D supplements can be effective in the production of vitamin D. Regarding the comparison of quantitative individual and social variables of preventive lifestyle in terms of vitamin D, the current study showed a significant relationship between the age and the academic term with the status of vitamin D, so that vitamin D level increases with increasing age and academic term. This finding was consistent with some of the results of other studies [22, 24] and different from some others [25]. According to the authors, the reason for the differences in the findings of the studies can be due to lifestyle and individual differences. On the other hand, there was no conclusive judgment in the current study because the age of the majority of the subjects ranged from 19 to 22 years.

Regarding the dietary diversity dimension of osteoporosis preventive lifestyle with respect to serum vitamin D level, the results indicated no significant correlation between dietary diversity score and vitamin D levels. This finding was consistent with the results of some other studies [26, 27]. According to the researchers, our food is not a sufficient source of vitamin D because vitamin D can only be found in some particular foods (marine fatty fish and fish oils) and the share of the mentioned foodstuff in daily diet is limited, also most other foodstuffs are short of vitamin D and finally vitamin D food fortification plans do not execute in Iran. Regarding physical activity dimension of the preventive lifestyle of osteoporosis with respect to serum vitamin D status level, the results indicated that subjects with high physical activity had higher levels of vitamin D, but this higher level was not statistically significant. In this regard, Ishaghi et al. study stated that in females with more physical activity, the level of vitamin D was higher. However, there was no significant correlation between vitamin D levels and physical activity [24].

The results of a study entitled "Vitamin D and BMI in Medical Students" showed that physical inactivity was observed

in more than one-third of the subjects with vitamin D deficiency. Their study results showed that normal body mass index, regular physical activity, and more than 15 minutes exposure to sunlight increased vitamin D levels. This is due to increased exposure to sunlight and enhancement of metabolism of vitamin D, following a physical activity [23]. The results of these studies were consistent with those of the current study. According to researchers' explanations, the higher the physical activity, the higher would be the metabolism. Since vitamin D is soluble in fat, when an individual is fit due to physical activity, his or her body has less fat, resulting in less vitamin D solution. Therefore, they gain sufficient vitamin D with regular physical activity, maintaining fitness, and more exposure to sunlight.

Regarding the osteoporosis preventive lifestyle in dietary diversity in terms of the serum vitamin D status level, the results indicated a significant relationship between the variables of smoking hookah and using dietary supplementation and vitamin D status. The current study results were similar to those of the Ishaghi study results [24]. The community health policymakers should consider this result.

One of the limitations of the current study was the recall bias regarding nutritional status. Also, in terms of questions about habits such as smoking cigarettes and hookah, some students may refuse to answer correctly, which can be considered another limitation for the current study. Meanwhile, the participants with insufficient vitamin D levels were informed about the amount of their vitamin D deficiency to take necessary actions.

Concerning the role of nutrition, physical activity, habits, and dietary supplements as strategies to prevent osteoporosis, these measures should be considered in community health care, too. Since deficiency of vitamin D is very common in a sunny country like Iran, it is necessary to launch the first-level prevention, by consuming foods and supplements containing vitamin D and performing food enrichment projects. Therefore, public health planners should hold sports programs and provide facilities for physical exercises at universities, parks, and public places, and remove the barriers to perform physical activity. These are among strategies that can be used to maximize bone mass density during this period.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Guilan University of Medical Sciences (Ethical code: IR.GUMS.REC.1393.13).

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Authors contributions

Study concept design: Azadeh Zebhi, Nasrin Mokhtari, Arezo Monfared, Marjan Mahdavi Roshan; Manuscript drafting/revision for intellectual content: All authors; Analysis literature review and data acquisition: Azadeh Zebhi; Guarantor of integrity of entire study and study concept design: Sedigheh Pakseresht; Statistics, analysis, study concept design: Ehsan Kazemnejad leili; and Analysis: Marjan Mahdavi Roshan.

Conflict of interest

The authors declared no conflict of interest.

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