Original Article

Investigation of Osteoporosis and Its Relative Factors in Cadet and AJA Students

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Abstract

Introduction: Osteoporosis is a metabolic bone disease. This complication will reduce bone mineral density (BMD) and reduce bone strength. The purpose of present research was to study osteoporosis and its relative factors among student of Iranian Army. **Methods:** This is a cohort research conducted on two groups including 100 students of the cadet school and students of AJA medical school. The status of all participants was tracked for 5 variables including vitamin D, calcium, Femoral neck BMD, Total lumbar spine BMD, and Total hip BMD for a period of six months. **Results:** This was a cohort research conducted on 200 participants in 2 groups consisting of the cadet school students and students of AJA medical school. The participants aged from 18 to 24 years old with an average age of 20.08 ± 1.06 years. The results obtained through studying the five variables indicated that after a six month follow up period, only vitamin D and calcium levels among the cadet students had increased significantly compared to the first assessment (P-value<0.05). Other variables failed to exhibit a significant change within this period (P-value>0.05). Regardless of statistical significance, the general trend of change among cadet students indicated increase, but a decreasing trend was observed among AJA medical school students. **Conclusion:** Exposure to sunshine and physical activities play a major and significant role in increasing vitamin D and calcium levels. Otherwise, vitamin D deficiency and unfavorable consequences such as osteoporosis are inevitable.

Keywords: Osteoporosis; Metabolic diseases; Fracture; Bone mass

Introduction

Osteoporosis and Rickets are important bone metabolic diseases. Rickets is caused by the lack of vitamin D and mineral materials. According to WHO (world health organization), osteoporosis is a skeletal disorder whose most important property is reduced bone strength. As a result, the patient with this complication will be more prone to bone fractures. WHO considers osteoporosis as the third most important global issue following heart diseases and cancers and it is titled silent epidemics. [1] This complication is one of the most common metabolic diseases during the old age ranging from mild cases with no fracture to acute cases and various fractures. As the researchers believe, this disease is one of the risk factors contributing to death toll and disease. This disease plays a major role in the life quality of the elderly due to its high costs. [2-4] Higher rates of osteoporosis and fractures associated with it are observed among women than men. [1] In other words, 1 out of every 4 women suffers from this complication, while this ration among men is 1 to 8. [5] A frequency rate of 30% has been reported for this disease in Europe. A study conducted in Austria showed that as many as 470000 Austrian women older than 50 are suffering from osteoporosis. [6] The results of many studies show that one woman out of every five older than 50 years old suffers from osteoporosis. The same research claims that most women older than 50 have experienced wrist, pelvic, and lumbar fractures. [7] As for Iranian women, a frequency rate of 32.4% has been reported for lumbar osteoporosis while this frequency of femoral osteoporosis has been reported to be 5.9%. [5] The results of the same research show that as many as 75% of all fractures are caused by osteoporosis. [8,9] Neonatals, the elderly, those exposed to insufficient sunshine, those who have problems absorbing fat, the black people, the obese and those who have undergone stomach bypass operation are in the danger of lack of Vitamin D. [10] Fracture is one of the most important complications of osteoporosis. Reduced physical performance, pain, less mobility, depression and social seclusion are the most important consequences of fractures caused by osteoporosis. Medical and non-medical interventions are used to treat and prevent this complication. The most obvious feature of osteoporosis is the reduced level of minerals and bone matrix. [11] The results of various researches points to the fact that exercising, taking sufficient levels of calcium and vitamin D and exposure to sunshine help slow down reduction of bone mass. [12] Proper and regular physical activities play a major role in preventing this disease. [13] Further to improving bone health, proper physical activities help create balance and coordination in the body, improve muscle power and general body health. [14] Most researches on osteoporosis have been focused on the elderly particularly on ladies in Postmenopausal period. Few researches have studied the prevalence of its relative factors

How to Cite this Article: Boustani MR, et al. Investigation of Osteoporosis and Its Relative Factors in Cadet and AJA Students. Ann Med Health Sci Res. 2018;8:47-50

among university students. What's more, the present research has also studied the role of the daily schedule of various colleges in bone health. The present research seeks to study the relative factors of osteoporosis among various ranks of AJA students. As a matter of fact, the present research seeks to study and compare the effect of various schedules in the cadet and medical schools of AJA (in terms of morning exercise, physical activity and exposure to sunshine) on osteoporosis (assessed by measuring bone density) and its relative factors such as vitamin D and calcium levels.

Materials and Methods

This is a prospective, cohort research conducted on the students of medical and cadet schools of AJA resorting to Khanevadeh and Imam Reza Hospital in 2015-2017. Those who had no previous history of taking Vitamin D or pathological fractures took part in the research. If the participants took medicines without doctor's prescription, they would be eliminated due to low levels of vitamin D. Based on previous studies and with due consideration of the inclusion and exclusion criteria, the participants were divided into two groups each consisting of 100 students. The participants took part in the research voluntarily and with due consideration of medical ethics principles after obtaining the written consent. 10% of the first three-year students in the medical and cadet schools were evaluated prospectively. The participants were studied in terms of vitamin D and calcium levels and bone mineral density in the lumbar, femoral and hip areas. These laboratory assessments were conducted once at the beginning of the research. Without any intervention, these students were once again assessed in terms of vitamin D, calcium, and bone mineral density levels. IBM SPSS Statistics v.23 was used to analyze the data and the normality of data was studied for all variables. Proper statistical tests were utilized based on the normality status. Paired Samples t-test and Wilcoxon Test were used to analyze the data. The level of statistical significance in this research (P-value) was set to less than 0.05.

Results

The participants aged 18 to 24 with an average of 20.08 ± 1.06 years. The weight and height of the participants were also measured. It turned out that the participants weighed from 51 to 90 kg with an average of 70.13 ± 7.90 kg and their average height was 175.85 ± 5.48 cm. A review of age, weight, and height of participants in each group showed that those in the medical school exhibited higher means in all three variables than those in the cadet school. Wilcoxon non-parametric test was used to compare levels of Vitamin D in the first and second assessment for participants. The results showed that in spite of reduced vitamin D levels in the second phase of assessment among students of medical school of AJA, this difference was not significant (P-value>0.05). On the other hand, the results of this statistical test showed that the average level of vitamin D among the cadet school students in the second assessment had increased significantly compared to the first assessment (P-value<0.05) [Table 1].

The vitamin D levels of the participants in the first and second phase of assessment was also studied. A review of data pointed to an unexpected fact indicating that a large number of students in both groups were in the deficient (Vit-D<10) and insufficient (Vit-D<30) levels, but the improving trend of vitamin D levels was more obvious among cadet school students. Next, the calcium levels measured in two phases among cadet school and medical school students were analyzed and compared with one another. The statistical analysis by Wilcoxon non-parametric test confirmed the fact that the calcium levels measured in the two phases exhibit no significant change among medical school students and this level has stayed relatively constant and fixed (P-value>0.05). However, observations point to the fact that the calcium levels measured in the second phase were significantly more than what was observed in the first phase (P-value<0.05) [Table 2].

An analysis of the difference between the measured values of Total lumbar spine BMD in the both defined stages for both groups was one of the main goals of this research which we will discuss in details here. In this analytical process where the statistical parametric test of Paired Samples T-test was used for both groups, it turned out that after 6 months no statistically

Table 1: Ranking and comparison of vitamin D levels in the first and second assessment among the two groups.

Wilcoxon Test

			Mean	Std. Deviation	N-Mean Rank	P-Mean Rank	Z	P-value
Medical school students	Variables	F-D3	24.041	14.174	49.23	51.88	-0.120	0.904
		S-D3	23.675	7.553				
Cadet school students	Variables	F-D3	14.354	8.620	26.14	52.33	-8.053	0.001
		S-D3	19.595	8.290				

F: First stage measurement
S: Second stage measurement

Table 2: Ranking and comparison of calcium levels in the first and second phases of assessment among the two groups.

Wilcoxon Test

			Mean	Std. Deviation	N-Mean Rank	P-Mean Rank	Z	P-Value
Medical school students	Variables	F-Calcium	9.58600	0.482841	47.55	47.42	-1.447	0.148
		S-Calcium	9.51600	0.605817				
Cadet school students	Variables	F-Calcium	9.43700	0.446910	15.63	49.42	-8.242	0.001
		S-Calcium	9.93800	0.421584				

F: First stage measurement
S: Second stage measurement

significant difference was observed between the two groups in terms of lumbar spine BMD levels (P-value>0.05) [Table 3].

Femoral neck BMD is another parameter measured in this research analyzed following two stages of measurement in each group. The results of parametric statistical test of Paired Samples t-test among medical school students failed to show a statistically significant difference between the values recorded in both stages (P-value>0.05). As a consequence of Wilcoxon non-parametric statistical test failed to show a statistically significant difference between the first measurement data and the first stage among cadet school students (P-value>0.05) [Table 4].

Another goal of the research was to study, investigate and compare Total hip BMD changes within the period of research (6 months) for each group. The results of the statistical analysis of non-parametric Wilcoxon test showed that in spite of rising changes in the second stage of measurement, no statistically significant difference was observed between the two stages of Total hip BMD measurement among the two groups (P-value>0.05) [Table 5].

Discussion

Various researches have pointed to factors such as calcium shortage, lack of vitamin D, lack of mobility and proper physical activities, insufficient exposure to sunshine, genetic and inherited factors, Menopause and previous history of certain diseases are the factors that intensify osteoporosis. Vitamin D deficiency (VDD) creates imbalance and unnatural conditions in levels of calcium, phosphor, and bone metabolism. VDD contributes to reduced absorption of calcium and phosphor from your diet and this will increase levels of parathyroid hormone (PTH). Higher osteoclastic activities will create weak local bone centers as a result of parathyroid hormone which will culminate in reduced bone mineral density (BMD) and osteoporosis. [15] Measuring bone mineral density (BMD) is one of the most important methods to diagnose osteoporosis. Considering the great importance of this issue in the health and life quality of people, the researchers in the present study have studied osteoporosis and its relative factors among various ranks of the students of AJA. Various groups are working on osteoporosis and the factors that affect it and they keep publishing their results. A review of the related literature and an analysis of the results achieved by those researchers and comparing them with the present research points to a general alignment and rational agreement between data. In a 20-year cohort research ending in 2014, Lindqvist et al. studied the effects of receiving sunshine on the death toll regardless of the disease (all-cause mortality). They arrived at the conclusion that failing to expose to sunshine is a risk factor for all-cause mortality. Although the first glance at this research fails to show a correlation between this research and its goals with our research, the general view and conclusion of our research can justify its correlation with the above-said study. [16] Based upon the reports released in a review research by Holick in 2007 [17] and according to the epidemiologic research by Eobinson et al. [18] the global rate of Vitamin D insufficiency is 50%. A glance at the present research shows that the rate of insufficient vitamin D in both groups at the beginning and at the end of the research was more than 50% which shows the

Table 3: Total lumbar spine BMD comparison in the double stages of measurement in both groups.

Paired Samples Statistics

			Mean	Std. Deviation	t	d	P-Value
Medical school students	Variables	F-Total lumbar spine BMD	0.98625	0.082785	1.727	99	0.087
		S-Total lumbar spine BMD	0.97602	0.079998			
cadet school students	Variables	F-Total lumbar spine BMD	0.98694	0.091588	-1.366	99	0.175
		S-Total lumbar spine BMD	0.99493	0.083123			

F: First stage measurement
S: Second stage measurement

Table 4: Femoral neck BMD comparison in the double stages of measurement in both groups.

Paired Samples Statistics

			Mean	Std. Deviation	t	d	P-value
Medical school students	Variables	F-Femoral neck BMD	0.96553	0.127235	1.438	99	0.154
		S-Femoral neck BMD	0.96164	0.129567			
Cadet school students	Variables	F- Femoral neck BMD	1.01585	0.132028	47.66	41.26	-1.948
		S- Femoral neck BMD	1.01055	0.130832			

F: First stage measurement
S: Second stage measurement

Table 5: Total hip BMD comparison in the double stages of measurement in the two groups.

Wilcoxon Test

			Mean	Std. Deviation	N-Mean Rank	P-Mean Rank	Z	P-value
Medical school students	Variables	F- Total hip BMD	1.00620	0.114051	47.66	41.26	-1.783	0.075
		S- Total hip BMD	1.01317	0.099195				
Cadet school students	Variables	F- Total hip BMD	1.08741	0.123115	53.42	39.53	-1.860	0.063
		S- Total hip BMD	1.08256	0.144709				

F: First stage measurement
S: Second stage measurement

insufficient rate of vitamin D has a great prevalence. At the end of the research, the rate of vitamin D insufficiency was 15% less than the global level which indicates the positive effect of physical activity and exposure to sunshine on vitamin D and calcium levels. Many authors such as Fu et al. [19] Langsetmo et al. [20] Moayyeri, [21] Zernicke et al. [22] have reported the positive effect of physical activity on BMD through mechanical loading mechanism. A clear example of these researches is athletes who have a higher BMD as a result of greater mechanical loading mechanism. [23] In a research by Alghadir et al. in order to assess the role of physical activities in bone mineral density (BMD) and bone metabolism indicators among 350 young volunteers, it was shown that body mass index (BMI), physical activity; low calcium consumption and lifestyle play a major role in bone minerals density and pre-awareness of osteoporosis among adults. [24] Taking into consideration the intangible and insignificant change of BMD in our research, we may conclude that changes in this variable were not significant possibly due to the limited time of the research and absence of any intervention.

Conclusion

Physical activity and exposure to sunshine plays a major and central role in the increasing trend of vitamin D and calcium level in the group of cadet school students and absence of these factors among medical school students is responsible for reduced levels of vitamin D and calcium. We may also predict that reduced levels of vitamin D and calcium caused by lack of physical activity, unhealthy diet, insufficient exposure to sunshine, etc. will reduce BMD level over a long period and may culminate in Osteopenia and Osteoporosis.

Conflict of Interest

All authors disclose that there was no conflict of interest.

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