Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/2435
DOI URL: http://dx.doi.org/10.21474/IJAR01/2435
ISSN NO. 2320-5407

RESEARCH ARTICLE

SCREENING FOR LOW BONE MINERAL DENSITY AMONG ATTENDANTS OF A HEALTH CAMPAIGN USING CALCANEAL QUALITATIVE ULTRASONOGRAPHY, MADINAH , 2014.

Tasneem Saleh AlRuhili[1], Feras Fuad AlMosailhy[2], Rawan Abdullah AlFouzan[1], Omar Abdullah Abduldaem[2] , Khadijah Ahmad AlAmeen AlShangiti[1], Abrar Mohammed Hasan[3] and Abdullah Ali Surrati[1].

1. Intern, Faculty of Medicine , Taibah University , AlMadinah , Saudi Arabia.
2. Medical Student , Faculty of Medicine , Taibah University , AlMadinah , Saudi Arabia.
3. Nurse Intern , AlGhad Collage, AlMadinah , Saudi Arabia.

Manuscript Info

Manuscript History

Received: 20 October 2016
Final Accepted: 22 November 2016
Published: December 2016

Key words:-
Osteopenia, Osteoporosis, Bone mineral Density, Calcaneus, Quantitative ultrasound.

Abstract

Background/aim:- Osteoporosis is a major public health concern with increased morbidity and mortality. The present study was carried out to screen the bone mineral density (BMD) in different age groups of adults attending a health campaign.

Methods:- during the "Your Heath Is Your Life "campaign that was lunched in Madinh, SA, from 24th of April 2014 to 2nd of May 2014 , a community based cross sectional study of bone mineral density in adults was carried out in 336 adults using WHO T-scores utilizing calcaneal qualitative ultrasound (QUS) as a diagnostic tool. A detailed self-reported questionnaire was obtained including demographic, socioeconomic, lifestyle and medical condition data. For females, additional data were obtained including obstetric and gynecological histories, and sun exposure and protection behavioral data. Body mass index was calculated.

Results:- screening retrieved 63 (18.8%) adults with low T-Scores (14.9% osteopenia and 3.9% osteoporosis). Variables including known risk factors were equally distributed in both low and normal T-Score groups, except for male gender (57.1% vs. 20.1%); employment status (58.7% vs 39.7%), and exercise frequency (once (51.6%) vs. > 3 times (36.8%) weekly) and duration (16.1% vs. 25% exercised for 45 - 60 min.) which were significantly higher in the low T-Score group.

Conclusion:- in a Saudi community, 18.8% prevalence of low BMD was detected among adults. Low BMD was associated with male gender, employment, and exercise frequency and duration. Therefore, adults especially employed men, should be encouraged to exercise. Future studies in young Saudi adults using more reliable methods are needed to confirm these findings and to identify secondary causes or unidentified risk factors

Introduction:-

Osteoporosis is a worldwide disease characterized by reduction in the bone mass and disruption of bone architecture leading to increased risk of fractures with increased mortality, morbidity and financial costs (1). Screening for osteoporosis aims at identifying individuals at increased risk of sustaining a fragility fracture and who would benefit

Corresponding Author:- Tasneem Saleh AlRuhili.
Address:- Intern, Faculty of Medicine , Taibah University , AlMadinah , Saudi Arabia.

d risk
inical
bausal

women younger than 65 years if clinical risk factors for fracture are present. Routine BMD screening of young women is not currently recommended, however, screening should be performed for those with history of a fragility fracture or known secondary causes of osteoporosis. For young men, measurement of BMD is recommended in those with risk factors for fracture or clinical manifestations of low bone mass. Many non-modifiable factors are identified as female gender, old age, small habitus, ethnicity and family history of fractures (especially maternal). Other modifiable risk factors include decreased vitamin D and calcium intake, smoking, alcohol and caffeine intake and sedentary lifestyle (3). The World Health Organization considers dual-X-ray absorptiometry (DXA) as the gold standard test for diagnosing osteopenia/osteoporosis, based on the T-score calculated from bone mineral density (BMD) measurements. However, Quantitative ultrasound (QUS) can be used as a convenient alternative to BMD in the assessment of bone for screening but not for allocation or monitoring of treatment (4-6). Since its introduction in 1984, QUS gains public acceptability for screening, probably because its portability, cost effectiveness, safety without exposure to radiation (7) and usefulness in screening certain bone areas (calcanean, phalangeal and others), children (8) and even infants (9). The present study was carried out to screen the BMD in adults attending a health campaign using calcaneal QUS as a screening tool.

Materials & methods:-

A cross sectional community based study was performed to study prevalence of low T-scores (osteopenia and osteoporosis) and its asscoaition with known risk factors amongst adults of both genders above the age of 19 years. The study was carried out during the health campaign "Your Health Is Your Life" run in Madinah, SA, during 24th of April 2014 to 2nd of May 2014 for estimation of BMD, been sponsored by Taibah Medical Club and approved by the deanship of the "College of Medicine, Taibah University, Madinah". Inclusion criteria included any individual above the age of 18 years who gained access to perform QUS during the campaign days. Verbal informed consent was taken from all participants.

The questionnaire and anthropometric measurements:-

The interview based questionnaire included information on age, gender, employment status, marital status, education levels, and medical history. Lifestyle habits were assessed through detailed questions of smoking, exercise, dietary habits (fast food and dairy products), in addition to calculating body mass index from height and weight measurements. For female participants, an additional questions included detailed menstrual, and obstetrics history, dressing (face cover, body cover), and the extent of both sun exposure and protection.

T-Scores:-

The BMD was measured at calcaneus by standardized QUS utilizing T-scores based on WHO criteria (10),which were obtained from the automated equipment. T-score refers to the ratio between patient's BMD and that of young adult population of same sex and ethnicity. T-score of >−1 was taken as normal, between −1 and −2.5 osteopenic and <−2.35 as osteoporotic. Adults with low scores were referred to the main governmental hospital in Madinah for further management.

Statistical analysis:-

Data analysis was conducted on Statistical Package for Social Sciences (SPSS), version 17.0. Categorical variables were presented in the form of number and percentage. Continuous variables were with abnormal distribution and were presented as median. Non-parametric test (Man Whitney Test) was used for comparing the low and the normal T-Score groups concerning all variables. The level of significance considered is 5%.

Results:-

We included 336 out of screened adults, mainly females (244 (72.6%)) with the most frequent (28%) age group was from 35 to <45 years, followed by the younger group from 25 to < 35 years (25.6%). Adults above the age of 55 years represented only 8.6% of the studied sample (Table 1 & Figure 1). Screening detected 63 (18.8%) adults with

low T-Scores (below -1.0), 13 (3.9%) of them had osteoporosis and the remaining 50 (14.9%) had osteopenia (Table 1).

There was significant difference in gender as 42.9% females and 57.1% males were present in the low group compared to 79.9% females and 20.1% males were present in the normal group (p=0.000). A significantly higher percentage of employed persons were seen in the low group (58.7%) compared to the normal group (39.9%) (p=0.007) (Table 2). There was no significant difference between both groups concerning their lifestyle including overweight/obesity, smoking, exercise and dietary habits (Table 3). While the frequency of persons who exercise regularly did not different in both groups (47.6% vs. 45.8%) (p=0.886), both the exercise frequency, and duration differed significantly. In the low group, almost half of the persons used to exercise once weekly (51.6%), while in the normal group, the most common frequency (36.8%) was more than three times weekly (p=0.014). Compared to the low group (16.1%), about a quarter of the persons with normal scores used to exercise for significantly more prolonged duration (from 45 to 60 minutes) (p=0.030) (Table 3). Results also showed that there was no significant difference in any medical condition including chronic illness, medications, fracture, back pain or kyphosis of adults with low compared to normal T-Scores (Table 4). For participating females, there was no significant difference in the obstetric or gynecological history except for the amount of menstruating bleeding that was significantly lower in the low group compare to the normal T-score group (19.2% vs. 6.9%) (p=0.041) (Table 5). Also both groups did not differ in their behavior attitude towards sun exposure (38.5% vs. 38.5%, p=0.880), sun protection (26.9% vs. 25.2%, p=0.924), or wearing face cover (88.5% vs. 78.9%, p=0.574), gloves (7.7% vs. 8.3%, p=0.880) or duration of head and body cover (p=0.887), while outdoors (Table 6).

Figure 1:- Age distribution among the 336 screened adults.

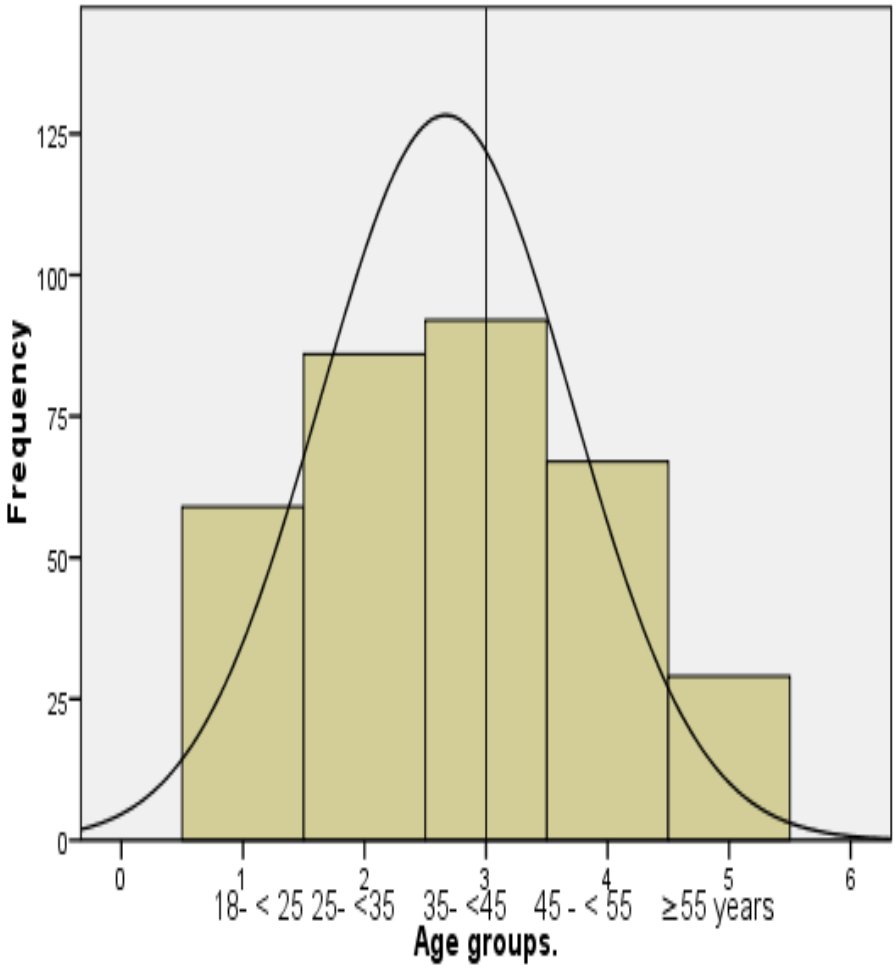

Table 1:- Characteristic data of the 336 screened adults.

		N	%
Gender	Female	244	72.6%
	Males	92	27.4%
Age	19- < 25	59	17.6%
	25- <35	86	25.6%
	35- <45	94	28%
	45 - < 55	67	19.9%
	>=55	29	8.6%
Employment	Not employed	189	56.3%
	Employed	146	43.5%
Married status	not married	94	28.0%
	Married	241	71.7%
Economic status	Average and lower.	216	64.3%
	above average.	119	35.4%
Education	Below secondary school	66	19.6%
	Secondary and above	269	80.1%
Family size	<4 adults	111	33.0%
	>4 adults	223	66.4%
Smoking		35	10.4%
Overweight/obese.		225	73.8
Chronic illness		136	42.2%
Postmenopausal women		10	3.0%
T-Score (median)		0.1	
Z-Score (median)		0.7	
Low bone mineral density **Osteoporosis** **Osteopenia.**		63 (18.8%) 13 (3.9%) 50 (14.9%)	

Table 2:- Demographic and socioeconomic data of adults with low compared to normal T-Scores.

		Low T-Score (n= 63).		Normal T-Score (n= 273)		P
		N	%	N	%	
Gender	Females	27	42.9	218	79.9	0.000
	Males	36	57.1	55	20.1	
Age	<45 **years**	41	65.1	197	72.2	0.247
	>=45 years	22	34.9	75	27.5	
Employment	Not employed	26	41.3	163	59.7	0.007
	Employed	37	58.7	109	39.9	
Married status	not married	18	28.6	76	27.8	0.920
	Married	45	71.4	196	71.8	
Economic status	Average and lower.	46	73.0	170	62.3	0.077
	above average.	16	25.4	103	37.7	
Education	Below secondary school	10	15.9	56	20.5	0.434
	Secondary and above	52	82.5	217	79.5	
Family size	<4 adults	23	36.5	88	32.2	0.413
	>4 adults	38	60.3	185	67.8	

Table 3:- Lifestyle of adults with low compared to normal T-Scores.

	Low T-Score (n= 63).		normal T-Score (n= 273)		P
	N	%	N	%	
Overweight/obese.	47	74.6	178	65.2	0.371
Smoking	8	12.7	27	9.9	0.484
Duration (median): years	7.5		7.0		0.890
Number of cigarette (median)/day:	20		20		0.190
Exercise	30	47.6	125	45.8	0.886
Exercise times/week (median)	Once		3 times		0.014
Once weekly	16	51.6	37	29.6	
twice weekly	5	16.1	21	16.8	
3 times weekly	3	9.7	20	16.0	
> 3 times weekly	6	19.4	46	36.8	
Duration/exercise (median): minutes.	30-40		30-40		0.030
<15 min.	12	38.7	23	18.4	
15-30 min.	12	38.7	48	38.4	
30-45 min.	2	6.5	22	17.6	
45 - 60 min.	5	16.1	32	25.6	
Frequent fast food intake	57	90.5	216	79.1	0.353
Median intake of dairy products/ week:					
Milk	Twice		Once		0.739
Cheese	3 times		3 times		0.162
Yogurt	Once		Twice		0.785
Laban	Once		Once		0.348

Table 4:- Medical conditions of adults with l low compared to normal T-Scores.

	Low T-Score (n= 26).		Normal T-Score (n= 218)		P
	N	%	N	%	
History of Use of steroids	3	4.8	9	3.3	0.474
Chronic illnesses	21	33.3	115	42	0.111
Regular use of medication	19	30.2	111	37	0.237
Vitamin D intake	11	17.5	77	28.2	0.087
Calcium supplementation	10	15.9	67	24.5	0.138
Back pain	42	66.7	168	61.5	0.466
Kyphosis	12	19.0	39	14.3	0.355
History of low trauma fracture	1	1.6	3	1.1	0.748
History of fractures	16	25.4	50	18.3	0.256
Family history of pelvic fracture	3	4.8	12	4.4	0.909

Table 5:- Obstetric and gynecological histories in women with low compared to normal T-Scores.

		Low T-Score (n= 26).		Normal T-Score (n= 218)		P
		N	%	N	%	
Menarche	<13	9	34.6	84	38.5	0.628
	13-16	16	61.5	110	50.5	
	>16	1	3.8	11	5.0	
Menstrual regulation	**Regular**	22	84.6	134	61.5	0.069
	Irregular	4	15.4	55	25.2	
Menopause		1	3.9	9	4.1%	0.266
Menstrual cycle	21-35	18	69.2	127	58.3	0.163

length	<21	4	15.4	39	17.9	
	>35	1	3.8	11	5.0	
	Not defined	3	11.5	17	7.8	
Duration of menstrual cycle	<2 days	3	11.5	4	1.8	0.857
	2-7 days	20	76.9	164	75.2	
	> 7 days	3	11.5	26	11.9	
Amount of menstruating blood	Decreased	5	19.2	15	6.9	0.041
	Average	16	61.5	142	65.1	
	Heavy	2	7.7	35	16.1	
Pregnancy	0	5	19.2	38	17.4	0.857
	1	0	0	9	4.1	
	2	2	7.7	17	7.8	
	>=3	16	61.5	129	59.2	
Abortion	0	12	46.2	101	46.3	0.867
	1	6	23.1	37	17.0	
	2	2	7.7	26	11.9	
	>=3	3	11.5	19	8.7	
Lactation	No	8	30.8	63	28.9	0.456
	<3 m	4	15.4	21	9.6	
	3-6 m	0	0	17	7.8	
	6-12 m	0	0	26	11.9	
	12-18 m	6	23.1	39	17.9	
	18-24 m	6	23.1	39	17.9	
	>24 m	2	7.7	10	4.6	

Table 6:- Sun exposure and protection behavior in women with low compared to normal T-Scores.

		Low T-Score (n= 26).		Normal T-Score (n= 218)		P
		N	%	N	%	
Sun exposure		10	38.5	84	38.5	0.880
Sun protection products		7	26.9	55	25.2	0.924
Face cover outdoors		23	88.5	172	78.9	0.574
Gloves wearing outdoors		2	7.7	18	8.3	0.880
Head and body cover outdoors	<1 h	5	19.2	36	16.5	0.887
	1-2 h	9	34.6	62	28.4	
	2-4 h	4	15.4	67	30.7	
	4-8 h	7	26.9	31	14.2	
	>8h	0	0	6	2.8	

Discussion:-

In this study, using calcaneal QU in 336 adults in a Saudi community, a prevalence of 18.8% of low T-Scores (14.9% osteopenia and 3.9% osteoporosis) was detected irrespective to their age. Variables including known risk factors were equally distributed in both low and normal T-Score groups, except for male gender; employment status, and both exercise frequency and duration which were significantly higher in the low T-Score group. Higher prevalence of both osteopenia and osteoporosis were reported in other studies including Saudis (11) as well as non-Saudis populations (12- 14). This could be explained by the use of QUS in the diagnosis. QUS was found to yield a lower prevalence of osteoporosis if WHO T-Score is applied. Therefore, the main use of QUS as a screening tool using same diagnostic criteria is to confirm or rule out osteoporosis (10,15 - 17).

As the age advances, the imbalance between bone resorption and formation increases, resulting in increases of prevalence of osteopenia/osteoporosis with a parallel increase in the fragility fractures especially in women (1,3). In this study, the age of the participating adults is well representing the general population distribution pyramid with youth bulge. Their median age group ranged from 35 to <45 years and constituted 28% of the sample followed by the younger group from 25 to < 35 years (25.6%). This age groups nearly corresponds to the achievement of the

peak bone mineral density in adults. Postmenopausal women represented only 3% and adults above the age of 55 years represented only 8.6% of the sample. Age did not differ between low and normal T-Score groups. In this study, adults were screened irrespective to their age and this selection nullified or diluted most known major risk factors for osteoporosis and what remained to be risky should be considered the most strong risk factor for low BMD in adults like exercising frequency and duration.

In this study, low scores in women could not be explained by age, menopause or defective diet or sun exposure as there was no significant difference in all these variables in the low compare to the normal T-Score groups. Also both groups did not differ in their behavior attitude towards sun exposure , sun protection, or wearing face cover, gloves or duration of head and body cover while outdoors. Presence of low BMD in young women may be explained by genetically determined low peak bone mass, or insults to the skeleton during childhood or adolescence or secondary causes (18). One of the most important secondary cause to be excluded is vitamin D deficiency as it is prevalent in the Saudi community (19).

While adult females predominated in our sample, men showed significantly increased prevalence of low T-Scores (%57.1% vs 42.9%). Other risk factors included employment and exercise frequency and duration. However, BMD measurement in men younger than 50 years are not enough for diagnosis and it needs to be combined with history of a fragility fracture and presence of other risk factors for proper diagnosis of osteoporosis. However, this could draw our attention to encourage young men working in Saudi Arabia to improve their modifiable risk factors as having low score is not uncommon. Especial interest should focus on young men working in Saudi Arabia who did not perform regular exercise because of their job engagement or office confinement.

Evidence of the beneficial effects of exercise training on bone mass is strong (20, 21). Effects depend on the exercise techniques as resistive exercises (21, 22) and weight-bearing exercises especially in young adults, and postmenopausal women (20, 23)

Limitations:-

The present study has some limitations. First, the use of QUS as a screening tool using the WHO T-score thresholds of−2.35 for osteoporosis and <−1.0 for osteopenia is still not recommended (24). Second, adults included were those who volunteered for screened during campaign, although efforts were made to ensure maximum participation by the adults in different age groups. Third , inclusion criteria included patient with different medical conditions and medications without any restriction.

Conclusion;-

In a Saudi community, 18.8% prevalence of low BMD was detected among adults of both genders irrespective to their age. Low BMD was associated with male gender, employment, and exercise frequency and duration. In this study, adults were screened irrespective to their age and this selection nullified or diluted most known major risk factors for osteoporosis and what remained to be risky should be considered the most strong risk factor for low BMD in adults like exercising frequency and duration.Therefore, adults especially employed men, should be encouraged to exercise regularly, frequently and for duration that exceeds 45 minutes. Other unidentified risk factors or secondary causes may be present among young adults with low BMD that may differ from the well-studied risk factors in the elderly or in other populations. Individualizing screening of BMD needs identification of different risk factors in different gender and age groups. Therefore, future larger community based trials in young adults using more reliable methods are needed to confirm these findings and to identify unknown risk factors or secondary causes.

Conflicts of interest:-

All authors have none to declare.

Acknowledgments:-

The authors thank taibah university, campaign sponsors and all participants, taibah medical club.

References:-

1. Lane N.E. Epidemiology, etiology and diagnosis of osteoporosis. Am J Obstet Gynecol. 2006;194:S3–11.
2. 2013 ISCD Official Positions - Adult http://www.iscd.org/official-positions/2013-iscd-official-positions-adult/ (Accessed on February 28, 2014).
3. Malhotra N., Mittal A. Osteoporosis in Indians. Indian J Med Res. 2008;127:263–268.
4. Briot K1, Roux C. What is the role of DXA, QUS and bone markers in fracture prediction, treatment allocation and monitoring? Best Pract Res Clin Rheumatol. 2005 Dec;19(6):951-64.
5. Glüer CC, Eastell R, Reid DM, Felsenberg D, Roux C, Barkmann R, Timm W, Blenk T, Armbrecht G, Stewart A, Clowes J, Thomasius FE, Kolta S. Association of five quantitative ultrasound devices and bone densitometry with osteoporotic vertebral fractures in a population-based sample: the OPUS Study. J Bone Miner Res. 2004 May;19(5):782-93. Epub 2004 Mar 1.
6. Kok-Yong Chin and Soelaiman Ima-Nirwana. Calcaneal Quantitative Ultrasound as a Determinant of Bone Health Status: What Properties of Bone Does It Reflect?. Int J Med Sci. 2013; 10(12): 1778–1783. Published online Oct 25, 2013. doi: 10.7150/ijms.6765 PMCID: PMC3837236.
7. Laugier P. An overview of bone sonometry. Int Congr Ser. 2004;1274:23–32.
8. Baroncelli GI. Quantitative Ultrasound Methods to Assess Bone Mineral Status in Children: Technical Characteristics, Performance, and Clinical Application. Pediatr Res. 2008;63:220–8. [PubMed]
9. Mimura K, Yamamoto T, Nakatuka K, Yoh K, Arai T. Infant bone quantity measurement - Hoping for the growth of smooth bone. Clin Calcium. 2008;18:1014–27. [PubMed]
10. Kanis J.A. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: synopsis of a WHO report. WHO Study Group. Osteoporos Int. 1994;4:368–381.
11. Ardawi MS1, Maimany AA, Bahksh TM, Nasrat HA, Milaat WA, Al-Raddadi RM.Bone mineral density of the spine and femur in healthy Saudis. Osteoporos Int. 2005 Jan;16(1):43-55. Epub 2004 May 27.
12. Acharya S., Srivastava A., Sen I. Osteoporosis in Indian women aged 40–60 years. Arch Osteoporos. 2010;20:1121–1126.
13. Sharma S., Tandon V.R., Mahajan A., Kour A., Kumar D. Preliminary screening of osteoporosis and osteopenia in urban women from Jammu using calcaneal QUS. Indian J Med Sci. 2006;60:183–189. [PubMed]
14. Kanis J.A. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: synopsis of a WHO report. WHO Study Group. Osteoporos Int. 1994;4:368–381.
15. Brar K.S. Prevalent & emerging therapies for osteoporosis. Med J Armed Forces India. 2010;66:249–254.
16. Kung A.W., Ho A.Y., Ross P.D., Reginster J.Y. Development of a clinical assessment tool in identifying Asian men with low bone mineral density and comparison of its usefulness to quantitative bone ultrasound. Osteoporos Int. 2005;16:849–855. [PubMed]
17. Mohr A., Barkmann R., Mohr C., Romer F.W., Schmidt C., Heller M. Quantitative ultrasound for the diagnosis of osteoporosis. Rofo. 2004;176:610–617
18. Khan AA, Syed Z. Bone densitometry in premenopausal women: synthesis and review. J Clin Densitom 2004; 7:85.
19. Hussain AN, Alkhenizan AH, El Shaker M, Raef H, Gabr A.Increasing trends and significance of hypovitaminosis D: a population-based study in the Kingdom of Saudi Arabia. Arch Osteoporos. 2014;9(1):190. doi: 10.1007/s11657-014-0190-3. Epub 2014 Sep 12.).
20. Fuchs RK, Bauer JJ, Snow CM. Jumping improves hip and lumbar spine bone mass in prepubescent children: A randomized controlled trial. J Bone Miner Res 2001;16:148-56.
21. Winters KM, Snow CM. Detraining reverses positive effects of exercise on the musculoskeletal system in premenopausal women. J Bone Miner Res 2000;15:2495-503
22. Tolomio S, Lalli A, Travain G, Zaccaria M. Effects of a combined weight-bearing and non-weight-bearing (warm water) exercise program on bone mass and quality in postmenopausal women with low bone-mineral density. Clin Ter 2009;160:105-9
23. Englund U, Littbrand H, Sondell A, Pettersson U, Bucht G. A 1-year combined weight-bearing training program is beneficial for bone mineral density and neuromuscular function in older women. Osteoporos Int 2005;16:1117-2
24. Mohr A., Barkmann R., Mohr C., Romer F.W., Schmidt C., Heller M. Quantitative ultrasound for the diagnosis of osteoporosis. Rofo. 2004;176:610–617.