http:// ijp.mums.ac.ir
Original Article (Pages: 693-699)

Serum 25-hydroxyvitamin D Levels in Patients Referred to Clinical Laboratories in Various Parts of Mashhad- Northeastern Iran

Ali Akbar Shamsian[1], Seyyad A. Rezaee[2], Majid Rajabiian[3], *Habibolah Taghizade Moghaddam[4]

[1]Department of Medical Parasitology and Mycology, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.
[2] Department of Immunology, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.
[3] Director of Biology Department, Payame Noor University of Mashhad, Mashhad, Iran.
[4] Department of Biochemistry, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

Abstract

Introduction

Vitamin D has an important role in maintaining human health. The main source of vitamin D production is skin exposure to sunlight. Accordingly with the spread of apartment life culture, growth of industrial cities and the increase of air pollution; vitamin D deficiency and its implications is an important factor in the appearance of debilitating diseases in different age categories (especially for children, adults and elderly people).

Materials and Methods

A retrospective cross-sectional study based on an objective was conducted on 1,110 patients who were selected randomly. These patients have been referred to Center of Education Culture and Research Laboratories (2 laboratories) and 8 specialized laboratories for vitamin D test in the city of Mashhad. The collected data was analyzed using SPSS 13 software.

Results

The prevalence of vitamin D deficiency in the population under study was 68.8%. Vitamin D levels were significantly lower in males in comparison with females ($P < 0.05$). And the statistical correlation between age and vitamin D deficiency was also significant ($P < 0.05$). The results showed a significantly positive correlation between age and vitamin D deficiency ($r = 0.187$ and $P = 0.000$), consequently vitamin D deficiency in 40-59 age group was more prevalent.

Conclusion

The prevalence of vitamin D deficiency in the residents of the city of Mashhad is higher in men in comparison with women. And vitamin D deficiency has increased considerably in this city in comparison with the past years.

Key Words: 25-hydroxyvitamin D, Laboratory, Mashhad, Prevalence, Vitamin D deficiency.

****Corresponding Author***:

Habibolah Taghizade Moghaddam, Department of Biochemistry, Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.
Email: TaghizadeMH1@mums.ac.ir

Received date: May 2, 2015 ; Accepted date: May 20, 2015

Introduction

Vitamin D is necessary for normal bone metabolism and bone nutrients. Aside from this, non-related metabolic processes of bone also require vitamin D. Besides foods, vitamin D is also obtained through skin synthesis by exposure to sunlight. Exposure to sunlight has a key role in supplying body's vitamin D and if it is adequately supplied through exposure to sunlight, the need for obtaining vitamin D through diet is also resolved. A lot of factors play part in the skin synthesis of vitamin D by exposure to sunlight. Sun's distance from the Earth in different seasons, sun angle, air pollution, climate, exposure to sunlight and type of clothing are among the factors that influence the skin synthesis of vitamin D (1-7).

Vitamin D also increases the absorption of phosphorus and calcium from intestines and reduces their disposal in the kidneys. It also strengthens the process of bone formation. Therefore vitamin D deficiency is an important factor in experiencing bone metabolism disorders (8). Unfortunately, in most cases the amount of vitamin D in the body, which is obtained through food sources, is not enough. On the other hand the enriched resources are also limited and cannot supply the required amount of vitamin D for children and adults. This is considered as the most important reason for the prevalence and epidemic of vitamin D deficiency in Europe and the US. In fact, vitamin D production by the sun's ultraviolet radiation in human skin is the most important source of supplying body's required vitamin D (9).

Serum 25-hydroxyvitamin D level is considered as the best indicator of vitamin D status, and it has the half-life of 2 to 3 weeks in the body (11, 10). Estimates indicate that about one billion people have moderate or severe vitamin D deficiency in the world (9). Vitamin D deficiency impairs bone mineralization. It also can lead to Rickets in children and cause rickets, osteoporosis and pathological fractures in adults. Measurement of 25-hydroxyvitamin D can be helpful in diagnosis of vitamin D deficiency (12-17). Based on extensive studies of vitamin D deficiency in sunny countries such as the Persian Gulf states, Saudi Arabia, Kuwait and Turkey, it can be concluded that given the current lifestyle skin synthesis of vitamin D cannot provide sufficient vitamin D for the daily needs. Season, latitude, inadequate exposure to the sun, using sunscreen lotions, type of clothing and fear of skin cancer are among the factors that can prevent sufficient vitamin D production in human body)(18).

In a comprehensive study in the 5 provinces of Tehran, Tabriz, Mashhad, Shiraz and Bushehr in 2001, vitamin D deficiency in the urban population was estimated 47.2, 45.7, and 44.2% for men and 54.2, 41.2 and 37.5% for women in under 50 years, 50-60 years and 60 years age groups respectively. According to the results, the highest prevalence of moderate to severe vitamin D deficiency was observed in men of Tehran and the lowest prevalence of moderate to severe vitamin D deficiency was also observed in the women and men of Mashhad and Bushehr (19).

Vitamin D deficiency is posed as a major health problem in the world nowadays. On the other hand, we could prevent and remedy the current situation by adopting appropriate measures, especially in high-risk groups. And this important measure in itself needs accurate depiction of the current situation, identification of risk factors and determinants of data based on specific population of each region. Thus this study was conducted with the aim to determine vitamin D serum levels and its causes in the individuals who have been referred to clinical laboratories in the city of Mashhad-Iran.

Materials and Methods

A retrospective cross-sectional study based on an objective was conducted on 1,110 patients who were selected randomly. These patients have been referred to Center of Education Culture and Research laboratories (2 laboratories) and 8 specialized laboratories for vitamin D test in the city of Mashhad, Northeast of Iran. And then the sample population filled out the demographic variables questionnaires and checklists that included lipid profile and vitamin D tests. It is worth mentioning that these laboratories were located in various parts of the city of Mashhad, and in Mashhad's 10 Municipal areas. In short they were generally scattered in different geographical regions of the city of Mashhad.

In this study information were extracted generally and recording name and last name of subjects was not required. Also the necessary coordination was done with Healthcare Department of Mashhad University of Medical Sciences and the head of "Center of Education Culture and Research" for data collection.

In this study, serum levels of vitamin D were divided into four groups:

1. Less than 20 ng/ml vitamin D level: as Vitamin D deficiency;
2. Between 20-30 ng/ml vitamin D level: as insufficient amount of vitamin D;
3. Between 30 to 100 ng/ml vitamin D level: as sufficient amount of vitamin D;
4. More than 100 ng/ml vitamin D level: as toxic amount of vitamin D.

All of the collected data were entered into SPSS 13 software and then were analyzed using descriptive and analytical tests. And the significant <0.05 was considered statistically significant.

Results

In total 1,110 patients who have been refered to clinical laboratories in Mashhad were studied. 262 of patiens (23.6%) were male and 848 of them (76.4%) were female. Also 45.5% of the subjects under study were in the 40-59 years age group and less than 20 years age group was the smallest age groups in our classification. Table.1 shows the distribution of age groups in this study. The prevalence of vitamin D deficiency in the patients under study was 68.8% (764 patients). According to the findings, of 1,110 patients 68.8% had vitamin D deficiency, 14.6% had low levels of vitamin D, and 0.5% had toxic levels of vitamin D. And 16.1% of subjects also had sufficient vitamin D levels (Figure.1).

Table 1: Distribution of age groups of patients

Statistics Age groups	Frequency	Percent
<20 years old	66	5.9
20-39 years old	320	28.8
40-59 years old	505	45.5
60≥ years old	219	19.7
Total	1110	100

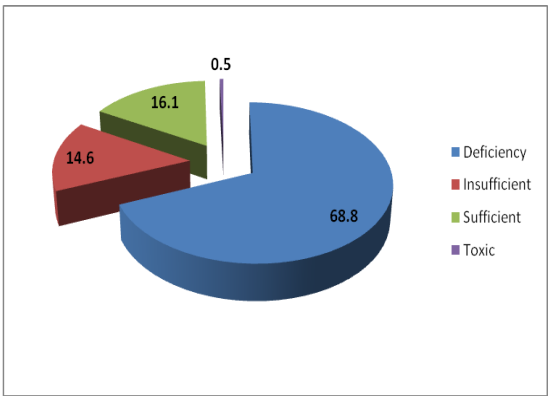

Fig.1: The levels of vitamin D in patients, according percent

The findings also showed that vitamin D deficiency in men was 81.3%, and vitamin D deficiency in women was 65%. In addition, 0.4% of men and 0.5% of women had toxic levels of vitamin D in their body. Table.2 and Figure.2 show the distribution

of vitamin D levels in the subjects under study. The Results also showed that the average of vitamin D was 13.384±13.333 with median of 9.550 in men and 18.475±19.009 with a median of 11.850 in women.

The T-test showed a significant correlation between gender and the serum level of vitamin D in the subjects under study (P = 0.000).

Table 2: Distribution of vitamin D levels in patients (ng/ml)

Statistics	Men	Females
Vitamin D	Frequency(%)	Frequency(%)
<20 years	213 (81.3)	551 (65)
20-39 years	30 (11.5)	132 (15.6)
40-59 years	18 (6.9)	161 (19)
60≥ years	1 (0.4)	4 (0.5)
Total	262 (100)	848 (100)

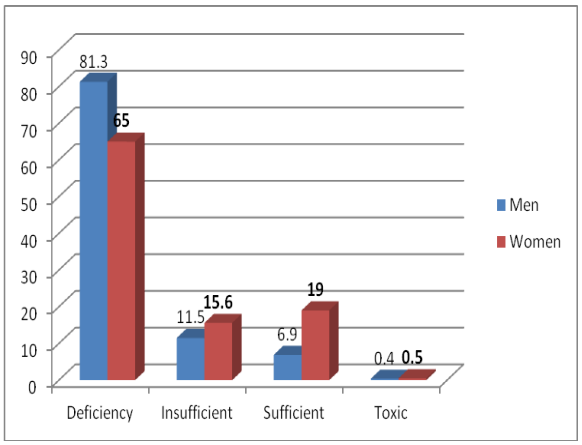

Fig.2: Percentage of vitamin D in patients by gender

Results also showed that the age range of subjects under study was 2 to 90 years for males, and 4 to 85 years for females. Tables 3 and 4, showed the vitamin D levels separately for different age groups and genders. Due to the fact that biochemical indicators in the subjects under study were not normally distributed, Spearman nonparametric test was used to evaluate the correlation between age and vitamin D in this study. And the results showed a significant positive correlation between these two variables in the age group of 40-59 years (Table.3).

Table 3: Distribution of vitamin D levels in patients according to age

Statistics Variables		Frequency (percent)	Spearman coefficient	P-value
1-19 years	Deficiency	60(90.9)	-0.181	0.145
	Insufficient	5(7.6)		
	Sufficient	-		
	Toxic	1(1.5)		
	Total	60(100)		
20-39 years	Deficiency	279	0.08	0.153
	Insufficient	26		
	Sufficient	15		
	Toxic	-		
	Total	320		
40-59 years	Deficiency	324	0.187	0.000*
	Insufficient	80		
	Sufficient	100		
	Toxic	1		
	Total	505		
>60 years	Deficiency	101	-0.023	0.738
	Insufficient	51		
	Sufficient	64		
	Toxic	3		
	Total	219		

Table 4: Mean ± SD of vitamin D in patients by age

Variables	Statistics	Number	Mean± SD	Min	Max
Men	1-19 years	29	15.645 (26.754)	4	150
	20-39 years	73	8.295 (3.907)	4	21.8
	40-59 years	91	13.113 (11.086)	4	73.8
	>60 years	69	18.174 (12.464)	4	65.5
	Total	262	13.384 (13.333)	4	150
Women	1-19 years	37	8.384 (5.719)	4	28.6
	20-39 years	247	10.649 (9.500)	4	44.9
	40-59 years	414	19.719 (17.911)	4	101
	>60 years	150	30.420 (27.079)	4	215
	Total	847	18.475 (19.009)	4	215

ANOVA test also showed that the levels of vitamin D in subjects under study is dependent on their age (P = 0.000) (Figure.3). And Tukey's range test showed that the correlation between vitamin D levels and age group of people in the over twenty years groups had been significant (P<0.05).

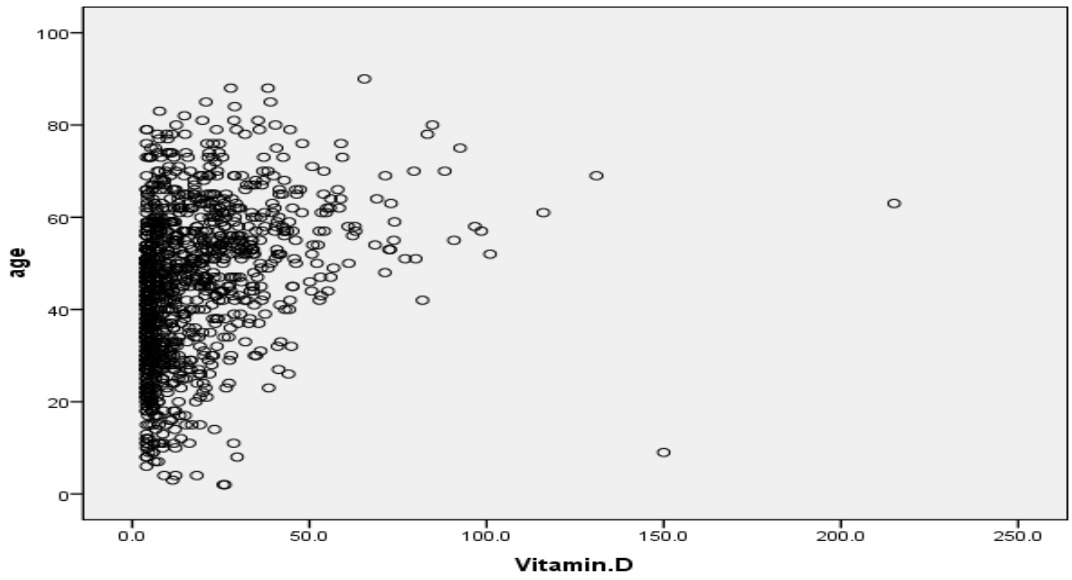

Fig. 3: Correlation of vitamin D in patients with age

Discussion

In recent studies, vitamin D has been reported as a necessary factor for bone formation, prevention of osteoporosis and external skeletal applications such as regulating the immune system, preventing cancer and hypertension. Therefore the study of distribution and determinants of vitamin D deficiency in all populations, especially in developing countries is essential. The results show that the prevalence of vitamin D deficiency is higher in the Middle East in comparison to Europe and America. It seems that clothing habits, especially among women, was an important factor in the prevalence of vitamin D deficiency in the Middle East

and Islamic countries. Accordingly the prevalence of vitamin D deficiency in countries such as Saudi Arabia, UAE, Jordan, Turkey and Lebanon is higher than other countries. Because in these countries women's clothing covers most of the body parts that are usually exposed to sunlight in other countries (9, 10, 18).

The results of this study indicate a high prevalence of vitamin D deficiency in the subjects under study, which is consistent with the study of Saeedi Nia and Shakiba (9, 18). Since the prevalence of vitamin D deficiency is higher in men than in women, the results of this study does not confirm that the type of clothing affects vitamin D deficiency, therefore vitamin D deficiency in both genders can be attributed to individual lifestyles. In the meta-analysis that was conducted in 2008 in Tehran, Shiraz, Tabriz, Mashhad and Bushehr; high prevalence of vitamin D deficiency have been reported on the beachside and lower longitudes. In these studies, this deficiency was attributed as part due to lack of exposure to sunlight despite sufficient radiation in these areas (due to the lifestyle of people), increased pigmentation of the skin and absorption of less vitamin D and calcium (20).

The results of various studies on diverse age groups showed different results of vitamin D deficiency, especially in older people (21, 22).

Conclusion

The prevalence of vitamin D deficiency is high in the city of Mashhad. Also it should be noted that vitamin D deficiency is higher in men than in women in this city. It seems that vitamin D deficiency is a common public health problem in Mashhad and requires substantial planning, especially for food enrichment with vitamin D and awareness of people about this vitamin and how it is absorbed.

Conflict of interest: None.

Acknowledgment

This article is part of the results of the thesis, Mr. Habibolah Taghizade Moghaddam. We sincerely thank of the efforts of Ms. Sanaz Ahmadi, head of the laboratory of molecular SID Mashhad.

References

1. Brown AJ, Dusso A, Slatopolsky E. Vitamin D. Am J Physiol 1999; 277(2 Pt 2):F157-75.
2. Rao LS, Ray R, Holick MF, Horst RL, Uskokovic MR, Reddy GS. Metabolism of [3alpha-3H] 25-hydroxyvitamin D2 in kidneys isolated from normal and vitamin D2-intoxicated rats. J Nutr Sci Vitaminol (Tokyo) 2000;46(5):222-9.
3. Biancuzzo RM, Young A, Bibuld D, Cai MH, Winter MR, Klein EK, et al. Fortification of orange juice with vitamin D(2) or vitamin D(3) is as effective as an oral supplement in maintaining vitamin D status in adults. Am J Clin Nutr 2010; 91(6):1621-6.
4. MacLaughlin JA, Anderson RR, Holick MF. Spectral character of sunlight modulates photosynthesis of previtamin D3 and its photoisomers in human skin. Science1982;216(4549):1001-3.
5. Lagunova Z, Porojnicu AC, Aksnes L, Holick MF, Iani V, Bruland OS, et al. Effect of vitamin D supplementation and ultraviolet B exposure on serum 25-hydroxyvitamin D concentrations in healthy volunteers: a randomized, crossover clinical trial. Br J Dermatol 2013;169(2):434-40.
6. Tangpricha V, Koutkia P, Rieke SM, Chen TC, Perez AA, Holick MF. Fortification of orange juice with vitamin D: a novel approach for enhancing vitamin D nutritional health. See comment in PubMed Commons

below Am J Clin Nutr 2003;77(6):1478-83.
7. Holick MF. Vitamin D and bone health. J Nutr 1996;126(4 Suppl):1159S-64S.
8. Holick MF, Vitamin D: importance in the prevention of cancers, type 1 diabetes, heart disease, and osteoporosis. Am J Clin Nutr 2004; 79(3): 362-71.
9. Saeidinia A, Larijani B, Jalalinia Sh, Farzadfar F, Keshtkar AA, Rezaei E, et al. Iranian Journal of Diabetes and Metabolism 2014;12(6):574-84.
10. Sullivan SS, Rosen CJ, Halteman WA, Chen TC, Holick MF. Adolescent girls in Maine are at risk for vitamin D insufficiency. J Am Diet Assoc 2005; 105(6): 971-4.
11. DeLuca HF. Overview of general physiologic features and functions of vitamin D. Am J Clin Nutr 2004; 80(6 Suppl): 1689S-96S.
12. Schmidt-Gayk H, Bouillon R, Roth HJ. Measurement of vitamin D and its metabolites(calcidiol and calcitriol) and their clinical significance. Scand J Clin Invest 1997; 57 (Supp 227): 35-45.
13. Lips P. Vitamin D status and nutrition in Europe and Asia. J Steroid Biochem Mol Biol 2007;3(3-5): 620-5.
14. Das G, Crocombe S, McGrath M, Berry JL, Mughal MZ. Hypovitaminosis D among healthy adolescent girls attending an inner city school. Arch Dis Child 2006; 91(7): 569-72.
15. Michael F, Holick M. Vitamin D deficiency. N Engl J Med 2007; 357(21):266-81.
16. Lindsay R, Meunier PJ. Osteoporosis: Review of the evidence for prevention, diagnosis and treatment and cost-effectiveness analysis. Osteoporosis International 1998; 8: (Suppl. 4): 3-10.
17. Saeidi M, Vakili R, Khakshour A, Taghizade Moghaddam H, Zarif B, Nateghi S, et al. Iron and Multivitamin Supplements in Children and its Association with Growth rate. Int J Pediatr 2013; 1(1): 13-17.
18. Shakiba M, Rafiei P. Prevalence of Vitamin D Deficiency Among Medical Staff in Shahid Sadoughi Hospital in Yazd, Iran. The journal of Toloo-e-behdasht 2009; 7(3): 22-30.
19. Heshmat R, Mohammad K, Majdzadeh SR, Forouzanfar MH, Bahrami A, Ranjbar GH, et al. Vitamin D Deficiency in Iran:A Multi-center Study among Different Urban Areas. Iranian J Publ Health 2008;37(sup):72-8.
20. Moradzadeh K, Larijani MB, Keshtkar AA, Hosein-nejad A, Rajabian R, Nabipour E, et al. Normal levels of vitamin D and vitamin D deficiency in Iran. Scientific Journal of Kurdistan University of Medical Sciences 2005;10(38):33-43.
21. Chapuy MC, Preziosi P, Maamer M, Arnaud S, Galan P, Hercberg S, et al. Prevalence of vitamin D insufficiency in an adult normal population. Osteoporos Int. 1997; 7(5):439-43.
22. Burnand B, Sloutskis D, Gianoli F, Cornuz J, Rickenbach M, Paccaud F, et al. Serum 25-hydroxyvitamin D: distribution and determinants in the Swiss population. Am J Clin Nutr 1992;56(3):537-42.