ORIGINAL ARTICLE

Comparison of Vitamin D levels between urban and rural college students

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ABSTRACT

Background: The D vitamins are a group of sterols that have a hormone like function. It acts like a secosteroid hormone that target more than 1000 genes in the human body. Vitamin D (Vit D) is vitally important for development, growth and maintenance of health at all times during the life cycle, from birth till old age. International Osteoporosis Foundation (IOF) and DSM Nutritional Products jointly defined Vit D >75 nmol/L as optimal, 50-74 as suboptimal, 25-49 as insufficient, and <25nmol/L as deficient, respectively. The reported prevalence of low levels of Vit D (30ng/dL) in our region ranges from 85–98%.

Aim: To evaluate the Vit D status of college students in urban as well as rural population.

Methods: Subjects of this study were divided into two groups. Group 1 (120 college student) recruited from Narowal. Group 2 (120 college students) registered from Lahore. 5ml blood was collected aseptically from each individual. Serum Magnesium, Calcium and Phosphate were measured by photometric method on Mindray BS-400. Intact PTH was performed by Vitros ECiQ and Vitamin D was performed by Cobas E-411analyzers.

Results: Mean age of subjects in group 1 and group 2 were 19.23±1.24 years and 20.95±1.17 years respectively. The difference between our study population's mean and universally recommended value (>75nmol/L) was statistically highly significant (*p*-value <0.001). Mean Vit D level of Group 1 was 16.80±8.21 nmol/L and in group 2 was 21.43±10.13 nmol/L. The difference between the means of Group 1 and Group 2 was statistically highly significant.(*p*-value <0.001.)

Conclusion: An enormous difference exists between universally recommended reference intervals of vitamin D levels and the values observed in our asymptomatic population. We recommend the establishment of local vitamin D reference intervals by employing larger study population.

Key words: Vitamin D deficiency, College students, intact PTH, urban vs. rural.

INTRODUCTION

The D vitamins are a group of sterols that have a hormone like function. Precisely categorizing, Vitamin D (Vit D) is not a vitamin but a hormone because of its renal metabolic product calcitriol, which act like a secosteroid hormone that targets more than 1000 genes in the human body. Vit D is vitally important for development, growth and maintenance of health at all times during the life cycle from birth till old age. It is now recommended for even healthy people (those without the diseases of Vit D deficiency) have Vit D level measured and seek advice if deficient[1]. Institute of Medicine (IOM) USA published a report in 2010 and suggest Vit D concentrations of ≥50 nmol/L (or ≥20 ng/mL) contribute to the requirementsof at least 97.5% of the population.[2] International Osteoporosis Foundation (IOF) and DSM Nutritional Products jointly developed the global map recently to illustrate the Vit D status and they defined Vit D >75 nmol/L as optimal,50-74 as suboptimal, 25-49 as insufficient and <25nmol/L as deficient, respectively[3]. In addition, the US Endocrine Society Clinical Practice Guideline determined Vit D deficiency as 25(OH)D below 50 nmol/L (20ng/mL), and insufficiency as 52.5-72.5 nmol/L (21-29ng/mL)[4]. However, Vit D concentration >75 nmol/L (>30 ng/mL) are not consistently associated with increased benefits[2]. Overall, most researchers define Vit D insufficiency as 25(OH)D concentrations below 50nmol/L.

Exposure to sunlight is the natural source of Vit D. Other sources of Vit D include some natural foods (e.g. fatty fish), fortified foods (e.g. margarine), and supplements. The amount of Vit D produced through exposure to UV radiation depends on skin type: the darker the skin, the more sunlight is required to produce a given amount of Vit D[5].

Recently Vit D deficiency has received significant attention as a contributor to health status. It has been estimated that over one billion people globally have low serum Vit Dlevels[6]. People having darker skin usually have a higher risk of lower serum 25-hydroxyvitamin D (25(OH)D) concentrations when living at the same latitude. Serum 25-hydroxyvitamin

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D is not only a predictor of bone health but is also an independent predictor of risk for cancer and other chronic diseases[7]. Vit D insufficiency increases the risk of bone loss and osteoporotic fractures in older people. Recent evidence has shown that Vit D has a role as an immune modulator and tumor suppressor.[8] Low levels of Vit D (30ng/dL) is a common finding world over[9,10] and varies depending on the population studied, adherence to food fortification policies, demographic features, geographic location and season[6]. It was previously thought that Vit D deficiency is limited to older persons but recent evidence shows that young adults have an equal or greater risk of Vit D insufficiency.

It is reported that exposure to sunshine for 6 to 8 minutes, 2 to 3 times per week to the face, arms, handsand legs is more than sufficient to meet Vit D requirements[11]. Given the hot climate all year round in subtropical and tropical countries such as Pakistan, the population of these countries should have adequate concentrations of Vit D. Several researchers have shown however, that there is a high prevalence of Vit D insufficiency in these countries such as Thailand, Vietnam, India, Hawaii, Saudi Arabia and Bangladesh[12].

The reported prevalence of low levels of Vit D (30ng/dL) in our region ranges from 85–98%, as observed by numerous authors. A cross sectional study done in Karachi Pakistan, on employees in a tertiary care center revealed 90% of the employees having low Vit D levels.[6] A 92% prevalence of Vit D deficiency is reported by Zuberiet al. in retrospectively studied asymptomatic ambulatory patients presenting to the endocrinology outpatient service in a tertiary care center in Karachi. In India, Vit D deficiency has been reported from all over the country (both rural and urban), in all age groups including toddlers, school children, adolescent girls, pregnant women, and postmenopausal women[13]. A study reported from Saudi Arabia in medical college students found 100% Vit D insufficiency.[14] A study suggests that Vit D deficiency is prevalent even in a young physically active population in the southern United States[15]. Another study among female college students at Qatar University has demonstrated a high prevalence of Vit D insufficiency/deficiency[16].

Two studies, one in the United States and one in India, showed high rates of Vit D deficiency in rural populations, but these studies only looked at women and provided no comparison with urban residents[17,18] Iranian study found that women living in urban areas had higher rates of Vit D deficiency than rural residents[19].

This study was planned to evaluate the Vit D status of college students in urban as well as rural population. Vit D levels were compared to find out the effect of different environmental factors and dietary habits on the levels of Vit D.

MATERIAL AND METHODS

Subjects of this study were divided into two groups. Group 1 (from rural area) comprised of 120 college student (80 females, 40 males) collected from Narowal. Group 2 (from urban area) consisted of 120 college students (80 females, 40 males) collected from Lahore. Written consent was taken from all the subjects for inclusion in the study. Inclusion criteria of this study were asymptomatic healthy college students. Student with renal impairment and any other terminal illnesses were excluded from the study. 5ml blood was collected aseptically from each individual. Serum Mg, Ca and Po_4 were measured by photometric method on Mindray BS-400 by using kits manufactured by Merck. Serum intact Parathyroid Hormone (iPTH) was measured by chemiluminescence technique on VITROS ECiQ Immuno-diagnostic Systems, using kit (Lot 0330) from ortho clinic diagnostic UK. Vit D total was performed on Cobas E-411 employing the principle of Electro chemiluminescence immunometric assay (ECLIA) by using kits (Lot 167435) from Roche Diagnostics GmbH. The study was conducted in the Pathology department of Shalamar Hospital from Jan 2013 to June 2013. During the analytical run of analytes, two concentrations of controls were run together with the samples for quality control. Hemoglobin, Calcium, Phosphorus, intact PTH were assessed to rule out nutritional deficiency and TLC was performed to exclude infections. SPSS 20.0 was used to analyze the results.

RESULTS

Mean Vitamin D level of the study population (group1 and group 2) was 19.11±9.49 nmol/L, which is very low as compared to the recommended reference interval of vitamin D. The difference between our study population's mean and universally recommended value (>75nmol/L) was statistically highly significant (*p*-value <0.001). Mean age of subjects in group 1 and group 2 were 19.23±1.24 and 20.95±1.17 years respectively. Mean Vit D level of Group 1 was 16.80±8.21 nmol/L and in group 2 was 21.43±10.13 nmol/L. The difference between the means of these two groups was statistically highly significant with a *p*-value of <0.001. The difference in mean Vit D levels between female students of group 1 and group 2 was statistically significant (*p*-value <0.001), while no statistically significant difference was observed between male students (*p*-value 0.102) of both groups.

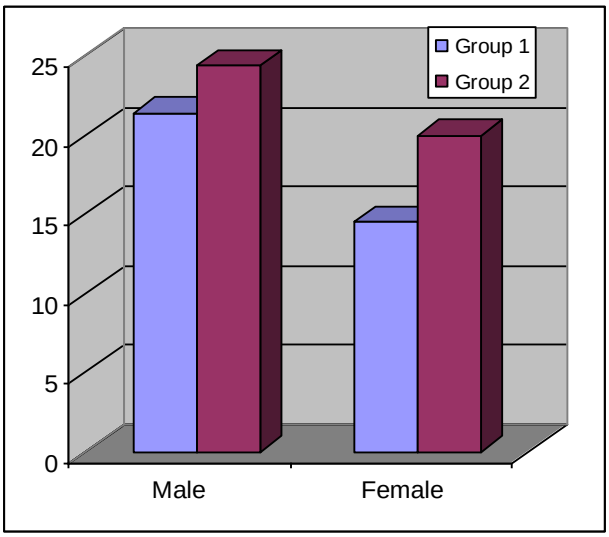
Mean levels of calcium in groups 1 and 2 were 9.18±0.49 mg/dL and 9.29±0.48 mg/dL respectively. The difference in the both means was non-significant with a *p*-value of 0.09. Mean magnesium levels in groups 1 and 2 were 1.84±0.14 mg/dL and 1.92±0.11 mg/dL respectively. The difference in the both means was significant with a *p*-value of <0.001. Mean iPTH levels in groups 1 and 2 were 63.56±10.45 pg/mL and 59.87±6.85 pg/mL respectively. The difference in the both means was statistically significant with a *p*-value of 0.001. Mean phosphorus levels in groups 1 and 2 were 4.03±0.55 mg/dL and 3.99±0.04 mg/dL respectively. The difference in the both means was non-significant with a *p*-value of 0.45. (Table. 1)

Table 1: Demographic and Biochemical Data of groups.

	units	Group1 (Mean±SD) n=120	Group2 (Mean±SD)n=120	Sig. (2-tailed)
Age	years	19.23±1.24	20.95±1.17	
Vitamin D	nmol/L	16.80± 8.21	21.43±10.13	<.001*
Calcium	mg/dL	9.18±0.49	9.29±0.48	.090
Magnesium	mg/dL	1.84±0.14	1.92±0.11	<.001*
Intact PTH	pg/mL	63.56±10.45	59.87±6.85	.001*
Phosphorus	mg/dL	4.03±0.55	3.99±0.04	.453

*statistically significant

Fig. 1: Mean vitamin D levels in Group 1 (Rural) and group 2 (Urban)



DISCUSSION

Mean Vitamin D level in our study population was 19.11±9.49 nmol/L, which is lower than the reference interval recommended by the IOM, IOF or DSM. This finding is reported from all over the Pakistan[5,20] which is a hint to establish new reference interval for our population by combining latest available technologies. Sheikh A et al.(2012) reported low levels of vitamin D (30 ng/dL) in 84.3% of the general population in Karachi with both genders affected equally. Mithal A et al (2009) evaluated Vit D status of six regions of the world and concluded that serum 25(OH)D levels below 75nmol/L are prevalent in every region studied whilst levels below 25nmol/L are most common in regions such as South Asia and the Middle East.

Hanan A et al.(2014) performed a study in tertiary care hospital, Riyadh. Total population under study was 3475, they reported that over-all prevalence of vitamin D deficiency was 78.1% in females and 72.4% in males. Abdul Mohsen H. et al. (2012) conducted a research in medical college students in Saudi Arabia, including 95 male and 103 female students. The mean age for all students was 19.54 years. In 100% of the students, the Vit D level was low. The prevalence of vitamin D deficiency in all students was 96.0% (92.64% in males and 99.03% in females), while the remaining 4% had Vit D insufficiency. Elham A et al (2011) reported remarkably high prevalence of Vit D deficiency and insufficiency (97.2%) among healthy college female subjects residing in Qatar; 50.7% showed severe Vit D deficiency (25(OH)D <10 ng/ml); and 46.5% showed Vit D insufficiency (25(OH)D(10-30) ng/ml), only 2.8% were found to have an optimal level of Vit D (25(OH)D >30 ng/ml).

In the present study mean Vit D concentration was lower in rural population than in urban population while one might expect more exposure to ultraviolet light in a rural population and so higher levels of Vit D. This was not seen in our study, most likely due to the possibility that the main determinant of Vit D status was dietary intake. Chan SP et al. (2009) reported a significant difference in mean 25(OH) vitamin D concentrations between urban and rural subjects and reported that rural subjects had higher 25(OH) vitamin D concentrations compared to urban subjects [70.7±18.3 vs. 45.7±15.5nmol/L (or 28.3±7.3 vs. 18.3±6.2 ng/mL)]. In our study Vit D levels were lower in rural females than the urban females. This may be explained by the fact that as Pakistan is a predominantly Muslim society, the practice of purdah (a covered-up style of dress for Muslim women) is very common in women of rural areas as compared

to urban areas. In addition, women avoid sunshine exposure as they think it makes their skin color black. These factors predispose to a reduction in endogenous synthesis of Vit D. Moreover, inadequate dietary intake of Vit D may result in low Vit D status.

The present study supports the previous findings whereby urban female in this also had significantly higher median concentration of Vit D compared to rural women. Additional research is needed to validate these findings.

Positive correlation was observed between Mg and Vit D levels and negative correlation between iPTH and Vit D levels. The results are comparable with the previous studies such as a study was conducted by Ho-Pham et al. (2011) and Suriah AR et al. (2004) they found an inverse correlation between serum Vit D and iPTH concentration. Similarly Sheikh A et al. (2012) reported that Vit D was negatively correlated to PTH levels (r=20.176) and the PTH levels were significantly higher in the vitamin D deficiency group when compared with the sufficiency group. In another study by A. J. Sai et al.(2011)reported an inverse correlation between PTH and Vit D ($r=-0.256$, $P < 0.0005$).

CONCLUSION

An enormous difference exists between universally recommended reference intervals of vitamin D levels and the values observed in our asymptomatic population. The possible causes of low levels of serum 25OH vitamin D seem to be multiple and need to be investigated in future studies in order to address this public health concern. We recommend the establishment of local vitamin D reference intervals by employing larger study population.

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