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SEASONAL VARIATION OF VIT D AND PTH LEVELS IN LATE ADOLESCENTS

Walulkar M. S.[1], Walulkar S. M.*[2] and Paikrao V. M. [2]

[1]Dept. of Physiology, NKP Salve Institute of Medical Sciences & Research Centre, Nagpur.
[2]Dept. of Anatomy, NKP Salve Institute of Medical Sciences & Research Centre, Nagpur.

***Corresponding Author: Dr. Sanjay M. Walulkar**
Associate Professor, Dept. of Anatomy, NKP Salve Institute of Medical Sciences & Research Centre, Nagpur.

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ABSTRACT

Introduction: Vit D is essential for the skeletal metabolism, muscle function, calcium homeostasis & immune system. Vitamin D deficiency is epidemic in India despite of plenty of sunlight. Most of the Indian studies point to low levels of vitamin D in the population. **Aims**: Here we aimed to study and determine the seasonal variation of vit D and PTH status in late adolescents aged between 17 to 19yrs. **Methodology**: The study was conducted in 42 apparently healthy medical college students of Nagpur region aged between17 to19 yrs. They were studied in the winter season (Nov- 2017) and six months later in summer (April 2018). At each time point their height and weight were measured. Blood was collected to analysis vit D & PTH levels by Immunoenzymetric assay ELISA. **Result**: Shows that Mean±Standard deviation of Vit D concentration which was 44.90 ± 12.7 ng/ml in summer & 44.25±4.74 in winter which is not statistically significant ($p>0.05$). PTH was slightly increased by mean of 29.69±9.30 in winter as compared to summer (27.17 ± 8.89). But this difference between two seasons was not statistically significant ($p>0.05$). No difference in BMI of both the seasons. Weak correlation was seen between vit D & PTH in winter. As vit D was increased, there was decrease in PTH level in summer. There was no correlation found between vit D & PTH in summer.83.33% and 97.62% of subjects had sufficient levels of vit D in winter and summer season respectively.16.67% and 2.38% of subjects had insufficient levels of vit D in winter and summer respectively. Insufficient level of Vit D was more in winter. No deficiency was found in both the seasons. **Conclusion**: From above study we concluded that no significant change in vitamin D levels in different seasons but there was slight change in PTH levels in both the seasons. That means effect of season is slightly more on PTH level as compared to vit D levels. Key words: Vit D, PTH, Seasonal variation.

KEYWORDS: Immunoenzymetric, vitamin D.

INTRODUCTION

Vit D is essential for the skeletal metabolism, muscle function, calcium homeostasis & immune system. Vit D 3 is a prohormone that undergoes successive hydroxylation in the liver (25(OH) D) & kidney (1,25(OH)2 D). 25(OH)D is the principle form of circulating vit D & metabolite which reflects the vit D status.[1]

Vit D is endogenously produced in skin through the proteolysis of 7-dehydrocholesterol to precholecalciferol (previtamin D3) by ultraviolet radiation, or orally ingested through vit D rich nutrients(10%).

Based on integration of bone health outcomes, a serum 25(OH) levels below 50nmol/L is considered inadequate.[2] Adequate Vit D status can also be defined as the levels where serum parathyroid hormone is stable and does not decrease further with vitamin D supplementation, which corresponds to a serum level of 25(OH)D of around 75 nmol/l(15,16,17). Vit D is typically known for its classical role in bone building & maintaining healthy muscle function. It is also required for the absorption of calcium & phosphorus. Low levels are associated with rickets (in children), Osteomalacia (in adults) & osteoporosis. However, it is now known that vitamin D regulates a large number of genes including some linked with auto-immune disease such as multiple sclerosis, Crohn's disease, lupus and rheumatoid arthritis, certain cancers and infections.[3]

It was found that, levels of vit D are related to physical agents that block the exposure to solar radiation (cutaneous pigmentation, sun filters etc.) or to the variables like altitude and latitude of geographical regions and sunlight exposure, atmospheric pollution & seasons of the year.[4-7] The combined intervention of vitamin D and parathyroid hormone, regarding the homeostasis of calcium and phosphorus metabolism, may lead to considering that the changes in vitamin D

concentrations through the year could be followed by seasonal changes in parathyroid hormone levels.

Several studies have documented the effect of latitude, season time of the day and altitude on the cutaneous production of vitamin D3.[8] It has been assumed that those residing in tropics can produce enough vitamin D3 in the skin throughout the year.[9] Recent studies from India have shown high prevalence of vitamin D deficiency both in rural and urban population, in north and south India.[10]

In developing countries like India, data on clinical & subclinical vit D deficiency status among adolescents are scarce. In that context the present study was carried out with objective to know the seasonal variations of vit D & PTH during a natural year in a apparently healthy Late adolescents of Nagpur region with a normal nutrition status.

AIMS AND OBJECTIVE

The aims and objective of this study is to determine the seasonal variation of vit D and PTH in late adolescents of Nagpur region.

METHODOLOGY

Participant selection

The study was conducted in 42 apparently healthy 1st year MBBS students of Medical college of Nagpur region aged between 17 to 19 yrs. They were studied in summer (March-April 2018) and six months later in seasons winter (Oct-Nov 2017). The participants who were under Vit D Medication and thyroid disorder were excluded from study.

Anthropometric Analysis

The common anthropometric parameters like height and weight were measured at each time point. The Body Mass Index (BMI) was calculated from the collected anthropometric data.

Sample collection

The 2 ml sample of blood was collected in the vacationer from 42 participant in study.

Immunoenzymetric assay

Vit D and intact parathyroid hormone was measured. Vit D (25(OH) Vit D) was measured by Immunoenzymetric assay a quantative measurement of 25(OH)-D2&D3 in serum & plasma. The DIA source 25(OH) vit D Total ELISA 90 is a solid phase Enzyme Linked immune-sorbent Assay performed on microtiter plates. hPTH was also measured by ELISA, a quantative measurement of human intact parathyroid hormone (PTH) in serum & plasma. The DIA source hPTH–ELISA is a solid phase enzyme Amplified sensitivity immunoassay performed on microtiterplates.

Annual Climate study

The annual climate data is retrieved from world whether database. The temperature and UV Index data were studied from summer (March-April 2018) and winter (Oct-Nov 2017).

Statistical analysis

Statistical analysis was done by using Epi-info software version 6. The mean S.D & correlation coefficient was done by using unpaired‘t’ test. Level of significance was 0.05.

RESULT

Shows that Mean±Standard deviation of Vit D concentration which was 44.25±4.74 ng/ml in winter & 44.90±12.71 in summer. Vitamin D levels was slightly higher in summer but not statistically significant ($p>0.05$). PTH was slightly increased by mean of 29.69±9.30 in winter as compared to summer (27.17±8.89). There was inverse relation between vit D and PTH levels. Levels of Vit D in two seasons were not statistically significant ($p>0.05$). No difference in BMI was to be found in both the seasons. No correlation was found between Vit D & PTH levels in summer.

Table 1: Shows Comparison Between Vit D, PTH & BMI in winter and summer seasons.

		Mean	S.D	Std Error Mean	T value	P value
Vitamin D (ng/ml)	**Oct-Nov**	44.251	4.7448	1.962	0.323	0.748
	March-April	44.90	12.712	0.7321		
PTH (Pg/ml)	**Oct-Nov**	29.698	9.3069	1.4361	1.204	0.2
	March-April	27.174	8.8937	1.3723		
BMI	**Oct-Nov**	21.7156	3.89612	0.60119	-0.541	0.592
	March-April	21.8727	3.93911	0.60782		

Table 2: Shows Correlation Between Vit. D and PTH in winter and summer seasons.

		PTH(pg/ml) winter	PTH(Pg/ml) summer
Vit D(ng/ml) Sept-Oct	Pearson Correleation (r)	-0.304	
	P value	0.050	
	N	42	
Vit D(ng/ml) March-April	Pearson Correleation (r)		-0.071
	P value		0.654
	N		42

Table 3: Percentage distribution of Vit D levels in winter.

Levels of vitamin D	No of subjects	Percentage
>30 ng/ml (sufficient)	35	83.33
20-29 ng/ml (insufficient)	7	16.67
<20 ng/ml (deficient)	0	0

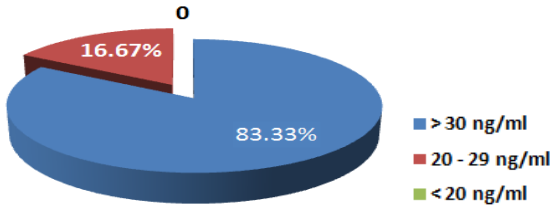
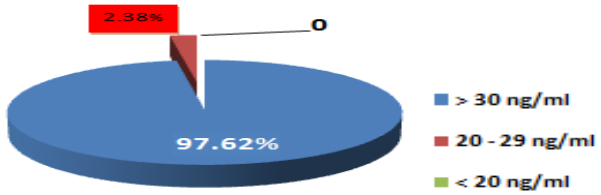


Table 4: Percentage distribution of Vit D levels summer – 2017.

Levels of Vit D	No. of subjects	Percentage
>30 ng/ml (Sufficient)	41	97.62%
20-29 ng/ml (Insufficient)	1	2.38%
< 20 ng/ml (Deficiency)	Nil	0%



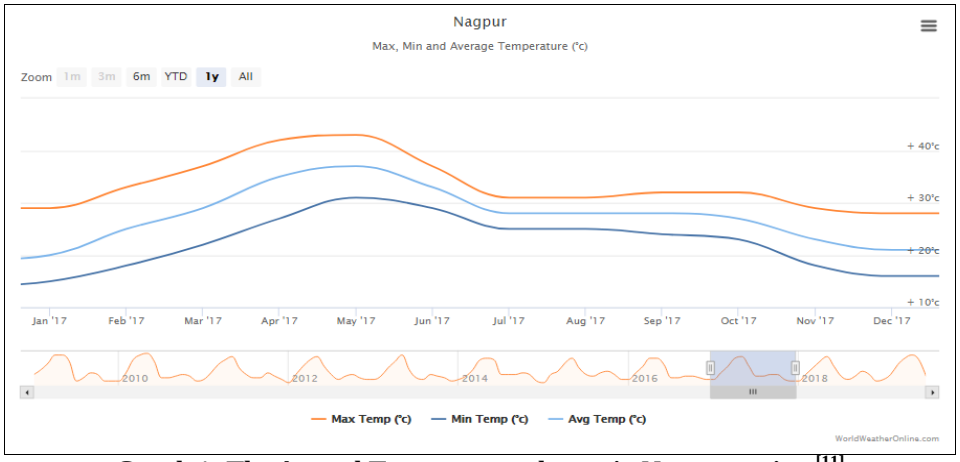
From above Table this shows that 83.33% and 97.62% of subjects had sufficient levels of Vit. D in winter and summer respectively. 16.67% and 2.38% of subjects had insufficient levels Vit D in winter and summer respectively. Insufficient levels of vit D was more in winter season. No subject was found to be deficient of Vit D in both the seasons.

According to annual climate change data retrieved from the world weather online report, the Nagpur has tropical savannah climate dry conditions prevailing for most of the year. (Table 5 Graph 1-2) It receives about 163 mm of rainfall in June. The amount of rainfall is increased in July to 294 mm. Gradual decrease of rainfall has been observed from July to August (278 mm) and September (160 mm).

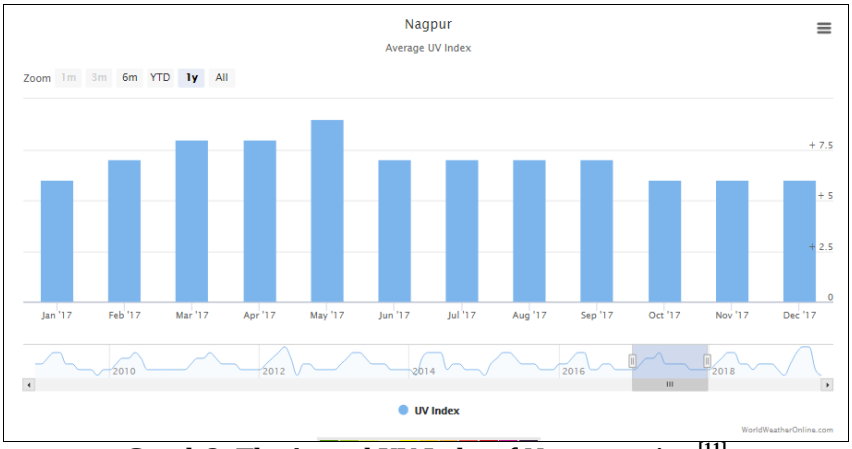
Table 5: Annual climate change in 2017 of Nagpur Region.[11]

Parameters	Study period	Maximum
Temperature(^{o}C)	Oct	32 ^{o}C
	Nov	29 ^{o}C
	March	36 ^{o}C
	April	40 ^{o}C
UV Index (UVI)	Oct	6 UVI
	Nov	6 UVI
	March	8 UVI
	April	8 UVI

Summers are extremely hot, lasting from March to June, with May being the hottest month. Winter lasts from November to January, during which temperatures drop below 10 °C (50 °F).[11]



Graph 1: The Annual Temperature change in Nagpur region.[11]



Graph 2: The Annual UV Index of Nagpur region.[11]

DISCUSSION

This work constitutes the combined variations of Vit D and parathyroid hormone during a natural year in late adolescents of Nagpur region with a normal nutrition status. The criteria from the American Academy of Endocrinologist have been applied in order to compare the results to the previous published data. These criteria consider calcidiol (25-OH-D) as the best indicator of body vit D content and establish normality when serum levels reach 30 ng/ml and hypovitaminosis D below this point, we refer to Vit D insufficiency(between21 and 29ng/ml) and deficiency (below 20ng/ml).[12-15]

Serum 25(OH)D levels are dependent on vit D intake and cutanous synthesis in the skin upon exposure to solar UV-B radiation (UVB). The vital role of vit D in bone mineralization depends on its critical role in the absorption of calcium and phosphorus in the intestine as well as the differentiation of cells in the osteoblastic lineage.[16] A comparison of serum Vit D data with other studies may not be entirely appropriate, given the fact that different studies were conducted in different seasons and using different assays. Lips et al. in a cross-sectional study described seasonal variation in serum parathyroid hormone concentration[17-23] and an inverse relationship between serum 25 hydroxy Vit D and parathyroid hormone concentration. This seasonal variation and inverse relationship has been reported in other studies.[24,25] Our study showed that vit D levels was 44.25±4.75 ng/ml in the month of Nov and 44.90±12.7ng/ml in the month of April. This study was just reverse to the other study shown by J.Guillemant et.al. which shows that 25(OH)D concentration was 29.96±7.46µg/l in sept had significantly (p=0.0001) fallen by a mean of 23.31±6.6µg/l in March. Significant correlation was found between both the months (r=0.536, p=0.0039). No correlation was found in our study.[18]

PTH levels in our study increased by a mean of 2.52±0.51pg/ml but not increased significantly (29.69±9.30pg/ml) in winter and 27.17±8.89pg/ml in summer. J.Guillemant et al. show significant increase in PTH levels by a mean of 8.59±8.53 ng/ml(22.8±7.44ng/l in sept vs 30.33±8.05ng/l in march).[26] Behzad Heidari et al. show that there was a difference in Vit D levels in seasons. Although, the differences did not reach to a significant level despite the wide fluctuations in serum vitamin D levels. The results of this study are in aggrement with several published studies that show the relation between the seasonal changes and the status of vitamin D.[19] However, some studies have shown lower levels of serum 25-OHD in winter whereas, in a number of studies, the prevalence of vitamin D deficiency did not differ by seasonal changes and remained stable even in sunny climate.[27] These observations indicate that seasonal changes should not consider the exclusive cause of Vit D variations but many other factors are also contributed to the changes in serum vitamin D over the different seasons.[28-29]

The geographical conditions like UV, sunlight and temperature also affect significantly the body vitamin D content and consequently, parathyroid hormone levels, it would be extremely risky to make comparisons among the different results obtained in the published works from different countries and /or weather conditions, since latitude and especially the month of the year when the blood sample was collected, have to be always considered.

Our study shows that 83.33% and 97.62% of subjects had sufficient levels of Vit D in winter and summer respectively. 16.67% and 2.38% of subjects had insufficient levels Vit D in winter and summer respectively. Insufficient level of vit D was more in winter season. No subject was found to be deficient in Vit D in both the seasons. This could be because of geographical location of this region as India is located 8.4 and 37.6^0 N. And in Nagpur region because of abundant sunshine, we are not getting deficiency of vit D.

CONCLUSION

From above study we can conclude that, the Vit D & PTH levels do not vary significantly according to seasonal variations in Vidarbha region. This may be due

to the healthy, balanced diet and prolonged availability of sunlight in the region.

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