|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online atwww.ijmbs.info
PubMed (National Library of Medicine ID: 101738825)
Index Copernicus Value 2018: 75.71
Original Research ArticleVolume 3, Issue 7; July: 2019; Page No. 93-99

STUDY OF THE SERUM LEVELS OF VITAMIN D AND CALCIUM IONIZED IN THYROID DISORDERS

Dr. Abdulrahman H. Amer[1*], Dr. Kaushik Chaudhari[2], Dr. Riyaben Trivedi[2] and Dr. Riddhi Patel[3]

[1]PhD. Research Scholar, Medical Lab. Technology, Pramukhswami Medical College, Karamsad. Sardar Patel University, Gujarat, India. Pin Code- 388325.
Thamar University –Yemen

[2]Assistant Professor, MD in Medical Biochemistry, Pramukhswami Medical College, Karamsad. Sardar Patel University, Gujarat, India. Pin Code- 388325.

[3]Tutor, MD in Medical Biochemistry, Pramukhswami Medical College, Karamsad. Sardar Patel University, Gujarat, India. Pin Code- 388325.

Article Info: Received 21 June2019; Accepted 14 July. 2019
DOI: https://doi.org/10.32553/ijmbs.v3i7.373
Address for Correspondence: Dr. Kaushik Chaudhari, Assistant Professor, MD in Medical Biochemistry, Pramukhswami Medical College, Karamsad. Sardar Patel University, Gujarat, India. Pin Code- 388325.
Conflict of interest: Nil

Abstract

Background: Vitamin D deficiency is a global health problem, and its role as an immune modulator has been recently tightened. The main role of vitamin D is to maintain calcium and phosphorus homeostasis, thus maintaining bone health. Recent evidence has shown that vitamin D may play a role in a variety disorders such as endocrine diseases, adrenal diseases, polycystic ovary syndrome and particular type 1 diabetes, type 2 diabetes. We evaluated the association between thyroid disorders (subclinical or overt hypothyroidism and subclinical or overt hyperthyroidism) and serum vitamin D3 level in the Indian population and its association with ionized calcium.

Methods: The cross-sectional study, included patients who visited Shree Krishna Hospital, Karamsad for thyroid evaluation or follow-up. We conducted this study involving a total of 84 individuals with normal thyroid function, were recorded as control. The cases group included 75 patients with hypothyroidism (overt or subclinical) and 10 patients with hyperthyroidism (overt or subclinical). Serum levels of vitamin D3, thyroid function and calcium ionized were measured in all adult subjects. Deficiency of vitamin D is defined as the level of vitamin D3 in the serum less than 50 nmol/L. Vitamin D insufficiency is defined as serum vitamin D3 level between 50 - 75 nmol/L. Vitamin D sufficiency is defined as serum Vit D3 level >75 nmol/L.

Result: The prevalence of vitamin D deficiency in subclinical and clinical hypothyroidism cases (36 of 40, 90%) was significantly higher than that observed in healthy individuals (0 of 40, 0%). The prevalence of vitamin D deficiency in subclinical and clinical hyperthyroidism cases (4 of 40, 10%). The prevalence of vitamin D insufficiency in subclinical and clinical hypothyroidism cases (24 of 62, 38.7%) was significantly lower than that observed in healthy individuals (controls) (35 of 62, 56.5%).The prevalence of vitamin D insufficiency in subclinical and clinical hyperthyroidism cases (3 of 62, 4.8%). The prevalence of vitamin D sufficiency in subclinical and clinical hypothyroidism cases (15 of 67, 22.4%) was significantly lower than that observed in healthy individuals (controls) (49 of 67, 73.1 %). The prevalence of vitamin D sufficiency in subclinical and clinical hyperthyroidism cases (3 of 67, 4.5%).

Conclusion: Vitamin D deficiency was associated with hypothyroidism especially clinical hypothyroidism. Low serum levels of vitamin D3 were associated with high serum TSH levels.

Keyword: Vitamin D3, calcium ionized, hypothyroidism and hyperthyroidism.

Introduction

Vitamin D is a steroid molecule that is produced in the skin as a result of exposure to the sunlight, as well as from a diet(1). The low levels of vitamin D have been attributed to reduced sun exposure and physical activity as well as obesity. The main role of vitamin D is manifested in the control bone metabolism and regulation of calcium-phosphorus metabolism(2).

Until recently, vitamin D was considered rare in India due to abundant sunshine. However, a systematic study conducted in 2000 in Delhi showed a decrease in vitamin D 25 hydroxy (25 (OH) D) in most subjects including newborns, their mothers, physicians,

nurses, soldiers and those with vitiligo and albinism.(3)Vitamin D deficiency was also associated with an increased incidence of autoimmune diseases, including type 1 diabetes (T1DM), rheumatoid arthritis and systemic lupus erythematous.(4-6)

In a previous study, vitamin D levels were found to be lower in patients with AITDs than healthy volunteers.(7) Another study from India found a a weak correlation between low vitamin D levels and AITDs.(8)

Shaye Kivity, et.al. In 2011, reported that the prevalence of vitamin D deficiency was significantly higher in patients with autoimmune thyroid diseases compared with healthy individuals (72% versus 30.6%; P<0.001). The study also showed that patients with Hashimoto's thyroiditis were significantly higher compared with patients with non-AITDs (79% versus 52%; P<0.05).(9)

Few studies have studied the effect of vitamin D deficiency on thyroid disease and those that did yielded conflicting results. In light of these conflicting results and the dearth of published studies, we study the levels of vitamin D and calcium among thyroid patients, and the correlation between vitamin D, calcium levels and thyroid function.

Methods

Study population

Serum samples were collected from 85 patients with thyroid disorder and 84 from healthy individuals attending the outpatient clinics at Shree Krishna Hospital, Karamsad over a period between April 2018 to April 2019. This study was approved by institutional ethics committee. Thyroid function tests, vitamin D3 and calcium ionized were determined for each patients on the day the blood was collected.

Vitamin D deficiency in our study was defined, in accordance with the manufacturer, as serum levels of vitamin D3 less than 50 nmol/L in adult. Vitamin D Insufficiency was defined as serum levels of vitamin D3 are between 50 -75 nmol/L in adult. Vitamin D sufficiency was defined as serum levels of vitamin D3 more than 75 nmol/L in adult(10).

Thyroid disorder cases were classified into four subgroups according to their thyroid function status. Clinical and subclinical thyroid disease is defined biochemically as the following:

Subclinical hypothyroidism describe a situation in which no overt clinical feature of hypothyroidism in present, with serum levels of T4 and T3 are still in the normal range, but with higher levels of TSH.

Clinical hypothyroidism describes the condition in which overt clinical feature of hypothyroidism is present, with lower levels of T4 and T3 and higher levels of TSH.

Subclinical hyperthyroidism occurs when serum thyroid stimulating hormone (TSH) concentrations are low but thyroxine (T4) and tri-iodothyronine (T3) concentrations are normal.

Clinical hyperthyroid describes the condition in which overt clinical feature of hyperthyroidism is present, with higher levels of T4 and T3 and lower levels of TSH. Healthy individuals were those who have normal levels of T3, T4 and TSH.(11, 12)

Laboratory tests

Vitamin D3 and thyroid function test were measured by ADVIA Centaur XP immunoassay analyzer (Germany). Calcium ionized was measured with GEM® Premier 3000 (Arterial Blood Gas machine).

Vitamin-D measurement

Serum concentrations of vitamin D3 in patients and controls were measured by Immunometric Assay method (Competitive principle). The quantitative determination of 25-OH vitamin D was carried out by a direct, competitive chemiluminescence immunoassay (Direct chemiluminescent reactions).

Statistical analysis

The statistical program SPSS 20.0 (SPSS) was used for all analyses. The mean and the standard deviation (SD) for all the variables were calculated. Comparison of categorical variables between groups was performed. The differences between mean values for each tested variable have been tested by Chi-square test and Anova table. The correlations between serum Vit D, calcium and TSH were presented by correlation coefficient. P values <0.05 were considered statistically significant for all tests.

Results:

The mean and S.D values for all studied parameters, age, vit .D, CA++, T3, T4, TSH and gender distribution are shown in Table (1). There was statistical difference (P< 0.05) between groups (males and females) with regarding to age, T3, T4 and gender. But statistical difference (P > 0.05) between groups (males and females) with regarding to Vit .D, Ca++, TSH and gender.

Table 1: The clinical characteristics based on the gender

GENDER		Age	Vit .D nmol/l	Ca++ mmol/l	T3. nmol/l	T4. nmol/l	TSH mu/l
Male	Mean	48.87	73.31	1.26	1.85	102.30	8.09
	N	89	89	89	89	89	89
	Std. Deviation	10.91	28.77	0.05	0.37	24.96	17.64
Female	Mean	54.11	65.89	1.26	1.72	112.63	12.56
	N	80	80	80	80	80	80
	Std. Deviation	9.96	31.86	0.04	0.38	33.26	26.72
Total	Mean	51.35	69.80	1.26	1.79	107.19	10.21
	N	169	169	169	169	169	169
	Std. Deviation	10.77	30.41	0.04	0.38	29.55	22.44
P-Value		0.001	0.11	0.90.	0.023	0.023	0.1

Table 2: Characteristics based on vitamin D levels

Vitamin D nmol/l		Age	Ca++ mmol/l	T3. nmol/l	T4. nmol/l	TSH mu/l
Deficiency < 50 nmol/l	Mean	54.55	1.26	1.64	105.02	19.83
	N	40	40	40	40	40
	Std. D.	10.05	0.05	0.36	35.91	35.04
	Min.	26.00	1.15	0.26	10.00	0.02
	Max.	70.00	1.44	2.42	165.20	197.70
Insufficiency 50-75 nmol/l	Mean	49.83	1.26	1.83	109.14	7.94
	N	62	62	62	62	62
	Std. D.	11.58	.05	.39	32.05	12.50
	Min.	25.00	1.17	0.94	45.90	0.11
	Max.	81.00	1.37	2.86	265.30	68.54
Sufficiency 75-250 nmol/l	Mean	50.85	1.27	1.84	106.68	6.56
	N	67	67	67	67	67
	Std. D.	10.14	.03	0.36	22.47	18.36
	Min.	29.00	1.15	0.90	38.80	0.13
	Max.	75.00	1.36	2.67	175.90	146.86
Total	Mean	51.35	1.26	1.79	107.19	10.21
	N	169	169	169	169	169
	Std. D.	10.77	.04	0.38	29.55	22.44
	Min.	25.00	1.15	0.26	10.00	0.02
	Max.	81.00	1.44	2.86	265.30	197.70
P. Value		0.08	0.26	0.02	0.7	0.007

The mean and S.D values of the age, Ca, T3, T4 and TSH according to Vit D status are shown in this Table. There was significant with TSH and T3, P Value = (0.007, 0.02) respectively.

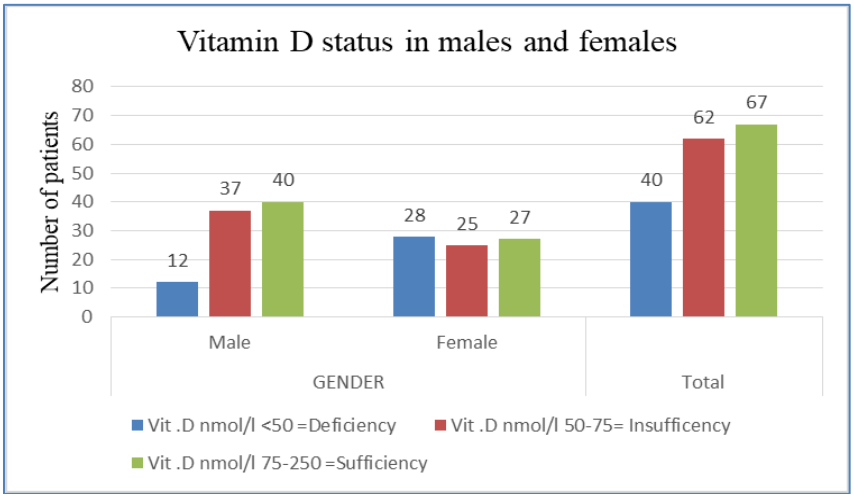

Figure:1 Vitamin D status in males and females

This figure shows that the number of patients with vitamin D deficiency increased in females more than males.

Table No 3: Correlation coefficients of vitamin D and Ca++ with thyroid function tests

		Vit. D nmol/l	Ca++ mmol/l	T3. nmol/l	T4. nmol/l	TSH mu/l
Vit .D nmol/l	Pearson Correlation	1	.071	.160*	-.001	-.184*
	Sig. (2-tailed)		.361	.038	.991	.017
	N	169	169	169	169	169
Ca++ mmol/l	Pearson Correlation	.071	1	.107	.126	-.189*
	Sig. (2-tailed)	.361		.166	.103	.014
	N	169	169	169	169	169
*. Correlation is significant at the 0.05 level (2-tailed).						
**. Correlation is significant at the 0.01 level (2-tailed).						

Table No 3: The levels of serum vitamin D and calcium were negative correlation when compared to TSH levels. It was significant with P-value (0.017, 0.014) respectively. These findings suggest that there is a significant correlation between vitamin D deficiency and hypothyroidism.

Table 4: The characteristics based on the thyroid status

Thyroid status		Age	Vit. D nmol/l	Ca++ mmol/l
HYPOTHYROIDISM	Mean	57.33	54.15	1.22
	N	3	3	3
	Std. D.	11.93	24.717	.01528
SUB CLINICAL HYPOTHYROIDISM	Mean	54.33	57.04	1.2679
	N	72	72	72
	Std. D.	11.46	29.297	.05157
HYPER THYROIDISM	Mean	62.33	70.16	1.3167
	N	3	3	3
	Std. D.	14.18	24.841	.03215
SUB CLINICAL HYPER THYROIDISM	Mean	56.14	58.38	1.2857
	N	7	7	7
	Std. D.	10.99	39.924	.05912

Normal	Mean	47.79	82.23	1.2694
	N	84	84	84
	Std. D	8.79	25.995	.04470
Total	Mean	51.35	69.80	1.2695
	N	169	169	169
	Std. D	10.77	30.413	.04838
P-Value		< 0.0001	< 0.0001	0.16

This table shows the decreased vitamin D levels in subclinical and clinical hypothyroidism patients and the significant association between vitamin D status and thyroid function.

Table 5: Relationship between vitamin D serum levels and thyroid status

Vit. D nmol/l and thyroid status							
		Thyroid status					Total
		HYPOTHYROIDISM	SUB CLINICAL HYPOTHYROIDISM	HYPER THYROIDISM	SUB CLINICAL HYPER THYROIDISM	Normal	
Vit .D nmol/l	Deficiency < 50	2	34	0	4	0	40
	Insufficiency 50-75	0	24	2	1	35	62
	Sufficiency >75	1	14	1	2	49	67
Total		3	72	3	7	84	169

Table No 5: The prevalence of vitamin D deficiency in subclinical and clinical hypothyroidism cases (36 of 40, 90%) was significantly higher than that observed in healthy individuals (0 of 40, 0%). The prevalence of vitamin D deficiency in subclinical and clinical hyperthyroidism cases (4 of 40, 10%). But in Insufficiency and sufficiency of Vitamin D, we found most cases with normal thyroid status.

Discussion

Vitamin D is known to play a fundamental role in bones and in the balance of minerals. Recently, vitamin D deficiency has emerged to be associated with various diseases such as cardiovascular disease, cancer, infection, obesity and osteoporosis (13).

Interestingly, it has newly been shown that vitamin D has potent immunomodulatory effects and plays important roles in the pathogenesis of autoimmune diseases. In addition, many recent studies have shown the relationship of vitamin D and various autoimmune diseases. Vitamin D receptor (VDR) gene polymorphisms and vitamin D status are associated with various autoimmune diseases such as T1DM, IBD, and MS (14, 15).

To our knowledge, there are some researchers examined the prevalence of vit D deficiency in India populations but our study was one from few studies aimed to examine the association between Vit D, calcium levels with thyroid status (Clinical and subclinical hypothyroidism, Clinical and subclinical hyperthyroidism) in Gujarat mainly Anand region.

We therefore undertook this study to evaluate the levels of vitamin D and calcium among patients with thyroid disorder compared to healthy controls who had normal results of thyroid function test.

An increase in the prevalence of thyroid disorder and vitamin D deficiency in the Indian population has

provided us with a unique opportunity to assess the correlation between these two variables.

Few studies have been conducted in order to find any significant correlation between vitamin D levels and hypothyroidism and determine whether vitamin D deficiency involves causing hypothyroidism.

This study showing the decreased vitamin D levels in subclinical and clinical hypothyroidism patients and the significant association between vitamin D status and thyroid function. The vitamin D had a significantly higher with TSH level (P-Value < 0.0001).

Furthermore, the current study showed that vitamin D serum level was significantly lower in hypothyroid patients (mean= 54.15 nmol/l) compared to the participant who had normal levels of thyroid function tests (mean= 82.23 nmol/l) with P-Value < 0.0001. Also, serum calcium level was lower in patients with hypothyroidism (mean= 1.22 mmol/l) compared to the participant who had normal levels of thyroid function tests (mean= 1.26mmol/l), but non-significant with P-Value =0.16.

The levels of serum vitamin D and calcium were negative correlation when compared to TSH levels. These findings suggest that there is a significant correlation between vitamin D deficiency and hypothyroidism. There was a negative significant with P-value (0.017, 0.014) respectively.

Our results were consistent with previous studies which showed that the prevalence of vitamin D insufficiency in Hashimoto's cases (92%) was significantly higher than that observed in health controls (63%, P <0.0001)(9, 16).

Another study, conducted in the Netherlands, showed that vitamin D deficiency was not associated with early stages of thyroid autoimmunity(17).

There is a study on the prevalence of vitamin D deficiency and its relationship to thyroid gland in Asian Indians. Which reported that there was no significant difference in the frequency of vitamin D deficiency between males and females (85·2 and 88·2 %, respectively, P¼0·169)(8).

Our results revealed low levels of serum vit D3 in females (mean = 65.89 nmol/l) than those of male (mean = 73.31 nmol/l). It was non-significant (P-Value = 0.11). However, we can refer this non-significant decrease to the small sample size of our study. In line with our findings, previous studies have observed that serum vit D3 levels did not differ significantly between males and females (18-20).

Conclusion

Our findings indicate that patients with hypothyroidism suffered from vitamin D deficiency which is strongly associated with the degree and severity of hypothyroidism. This encourages the desire of adding vitamin D and recommends the detection of vitamin D deficiency levels in the blood of all patients with hypothyroidism.

References

1. Holick MF. Resurrection of vitamin D deficiency and rickets. The Journal of clinical investigation. 2006;116(8):2062-72.
2. Makariou S, Liberopoulos EN, Elisaf M, Challa A. Novel roles of vitamin D in disease: what is new in 2011? European journal of internal medicine. 2011;22(4):355-62.
3. Goswami R, Gupta N, Goswami D, Marwaha RK, Tandon N, Kochupillai N. Prevalence and significance of low 25-hydroxyvitamin D concentrations in healthy subjects in Delhi. The American journal of clinical nutrition. 2000;72(2):472-5.
4. Hyppönen E, Läärä E, Reunanen A, Järvelin M-R, Virtanen SM. Intake of vitamin D and risk of type 1 diabetes: a birth-cohort study. The Lancet. 2001;358(9292):1500-3.
5. Saag KG, editor. Vitamin D intake is inversely associated with rheumatoid arthritis. Arthritis and Rheumatism; 2004: Citeseer.
6. Ben-Zvi I, Aranow C, Mackay M, Stanevsky A, Kamen DL, Marinescu LM, et al. The impact of vitamin D on dendritic cell function in patients with systemic lupus erythematosus. PloS one. 2010;5(2):e9193.
7. Orbach H, Shoenfeld Y. Vaccination infection and autoimmunity: myth and reality VIAMR 2005-10-26-28, Beau-Rivage Palace Hotel, Lausanne, Switzerland. Autoimmunity reviews. 2007;5(6):261-6.
8. Goswami R, Marwaha RK, Gupta N, Tandon N, Sreenivas V, Tomar N, et al. Prevalence of vitamin D deficiency and its relationship with thyroid autoimmunity in Asian Indians: a community-based survey. British Journal of Nutrition. 2009;102(3):382-6.
9. Kivity S, Agmon-Levin N, Zisappl M, Shapira Y, Nagy EV, Dankó K, et al. Vitamin D and autoimmune thyroid diseases. Cellular & molecular immunology. 2011;8(3):243.
10. Tamer G, Arik S, Tamer I, Coksert D. Relative vitamin D insufficiency in Hashimoto's thyroiditis. Thyroid. 2011;21(8):891-6.
11. Cooper DS. Subclinical hypothyroidism. New England Journal of Medicine. 2001;345(4):260-5.

12. Cooper DS, Biondi B. Subclinical thyroid disease. The Lancet. 2012;379(9821):1142-54.

13. Vilarrasa N, Vendrell J, Maravall J, Elío I, Solano E, San José P, et al. Is plasma 25 (OH) D related to adipokines, inflammatory cytokines and insulin resistance in both a healthy and morbidly obese population? Endocrine. 2010;38(2):235-42.

14. Smolders J, Peelen E, Thewissen M, Menheere P, Tervaert JWC, Hupperts R, et al. The relevance of vitamin D receptor gene polymorphisms for vitamin D research in multiple sclerosis. Autoimmunity reviews. 2009;8(7):621-6.

15. Naderi N, Farnood A, Habibi M, Derakhshan F, Balaii H, Motahari Z, et al. Association of vitamin D receptor gene polymorphisms in Iranian patients with inflammatory bowel disease. Journal of gastroenterology and hepatology. 2008;23(12):1816-22.

16. Holick MF. Vitamin D deficiency. New England Journal of Medicine. 2007;357(3):266-81.

17. Effraimidis G, Badenhoop K, Tijssen JG, Wiersinga WM. Vitamin D deficiency is not associated with early stages of thyroid autoimmunity. European Journal of Endocrinology. 2012;167(1):43-8.

18. Mackawy AMH, Al-Ayed BM, Al-Rashidi BM. Vitamin D deficiency and its association with thyroid disease. International journal of health sciences. 2013;7(3):267.

19. Elsammak M, Al-Wossaibi A, Al-Howeish A, Alsaeed J. High prevalence of vitamin D deficiency in the sunny Eastern region of Saudi Arabia: a hospital-based study. Eastern Mediterranean Health Journal. 2011;17(4).

20. Lippi G, Montagnana M, Meschi T, Borghi L. Vitamin D concentration and deficiency across different ages and genders. Aging clinical and experimental research. 2012;24(5):548-51.