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ASSOCIATION OF VITAMIN D DEFICIENCY WITH HYPOTHYROIDISM AMONG POPULATION ATTENDING NORTH BENGAL MEDICAL COLLEGE AND HOSPITAL

Physiology

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ABSTRACT

Background: Vitamin D deficiency is health problem which is prevalent globally. People require sufficient levels of Vitamin D in their blood for regulation of calcium metabolism in body for normal physiological actions. Very few governments and national or international organization have given much importance on the vitamin D deficiency or declared it a public health problem.

Objectives: There is a high prevalence of hypothyroidism and calcium deficiency in Indian population .Vitamin D deficiency is one of the major causes of calcium deficiency in our body. With this fact we found an opportunity to study the association between hypothyroidism and Vitamin D deficiency if any, among population of sub-Himalayan region of West Bengal attending North Bengal Medical College and Hospital.

Material and Methods: 120 young and adult individuals between the age group 15 to 45 years comprising 60 number as control (n=60; 26 male and 34 female) and 60 as case (n=60; 24 male and 36 female) were taken in the study. Serum fT3, fT4, TSH and 25(OH) vitamin D levels were estimated using ELISA method. Patients having serum TSH>10 mIU/ml or serum TSH levels between 6 to 10 mIU/ml along with decreased serum fT3 &/or fT4 levels were diagnosed as hypothyroid cases. Statistical analysis was done by SPSS.

Results: Serum 25(OH) Vitamin D was significantly lower in hypothyroid patients (13.30 ± 3.84 ng/ml) compared to controls (32.36± 5.88 ng/ml), $p < 0.001$. There was insignificantly decreased levels of Serum 25(OH) Vitamin D in females than male patients ($t=.138$, $p>0.05$).

Conclusion: The study indicates that patients with hypothyroidism are frequently associated with vitamin D deficiency which suggests that they need routine screening and vitamin D supplementation along with thyroid hormone replacement therapy.

KEYWORDS

Vitamin D Deficiency, TSH, Hypothyroidism.

Introduction:

Deficiency of Vitamin D is recognized throughout the world as one of the major problem of public health [1]. Almost one billion persons around the world have deficiency or insufficiency of vitamin D [1]. Over a period of last 20 years many articles published; indicate that low levels of vitamin D exist among patients of hypothyroidism. Prevalence of vitamin D deficiency is widespread in India which is around 50-90% [3]. Vitamin D deficiency is still widely prevalent among the elderly according to recent report and it also exists as an unrecognized serious problem in many populations globally [1]. It is an established fact that vitamin D maintains normal blood levels of calcium and phosphate required for bone and teeth formation and plays important role in the different physiological functions of the body.[13],as well as different immunoregulatory and anti-inflammatory properties [19,20,21]. Deficiency of vitamin D is associated with the skeletal disorders, cardiovascular diseases [4,5], diabetes mellitus[6,7], multiple sclerosis[8,9], hypertension[10], atherosclerosis[11], infectious diseases[12]. Vitamin D maintains normal blood levels of calcium and phosphate which in turn plays an important role in the different physiological functions of the body.[13].

Vitamin D binds to its receptors (VDR) and mediates its effect through activation of VDR responsive genes [14], which is also a common site action of thyroid hormone and thus affects the action of one another [3]. As a result Vitamin D deficiency is likely to increase similar problems which are associated with hypothyroidism[15,16].

According to our knowledge, no recent studies have evaluated vitamin D levels among healthy and hypothyroid young or middle-aged population in the Sub Himalayan region of West Bengal. We took the opportunity to assess the association between vitamin D deficiency and hypothyroidism among population who attended North Bengal Medical College and Hospital for one year period.

Subjects and Methods:

A total number of 120 subjects with age group between 15-45 years were included in our cross-sectional study. A control group (will be called Group I) with 60 healthy euthyroid subjects including 34 women and 26 men was formed. Similarly a case group (will be called Group II) included 60 subjects including 36 women and 24 men of recently diagnosed hypothyroidism having serum TSH level higher than 5.0 mIU/ ml with normal or lower serum levels of fT_3 and/or fT_4 was taken. There was no history of treatment for hypothyroidism in the past.

Statistical Analysis:

Statistical analysis was carried out using Statistical package for social sciences (SPSS) software.

- The mean, Standard Deviation (SD), differences between mean values tested by using independent simple student's t-test.
- The association between study variables was assessed using Pearson's correlation analysis presented by correlation coefficient "r".
- Results considered significant or non-significant when $P < 0.05$ or > 0.05, respectively.

Results: Age and sex distribution in both the studied groups and the mean values ± S.D of all studied parameters are shown in Table (1).

Regarding age and sex, there was no statistical difference ($P > 0.05$) between both the groups.

Table 1: Demographical and clinical characteristics of the participants used in the study.

Parameters : Mean ± SD	Group I (n=60)	Group II (n=60)	t – test/ p - value
Sex	26 M (43%), 34 F (57%)	24 M (40%),36 F(60%)	p>0.05
Age (years)	34.43 ± 9.214	36.27 ± 8.634	t= 1.125, p= 0.263
BMI (kg/m^2)	19.33 ± 1.99	19.59 ± 1.70	t=0.757, p= 0.45
Serum 25(OH)Vit D (ng/ml)	32.357 ± 5.884	13.301 ± 3.846	t= 20.997,p = 0.000
Serum TSH mIU/ml	3.383 ± 1.228	18.948 ± 6.776	t= 17.505, p = 0.000
Serum T3 ng/ml	1.585 ± .283	1.332 ± .238	t= 5.281, p = 0.000
Serum T4 ng/dl	1.126 ± .399	1.874 ± 1.264	t= 4.368, p = 0.000

By using t-test it was revealed that serum 25(OH) D level was significantly lower in hypothyroid subjects than in controls (t=20.997, p=0.000) as illustrated in table 1. According to the sex distribution, serum 25(OH) vitamin D levels were insignificantly decreased in females than those of male in both control and hypothyroid patients (t= .138, p >0.05) respectively, table 2.

Table 2: Mean ±SD of serum T3, T4, 25(OH) vitamin D, and TSH levels in hypothyroid patients according to sex.

Parameters(Mean ±SD)	Male = 24	Female = 36	t-test/p- value
T_3 (ng/ml)	1.314 ± .251	1.345 ± .232	t= .488, p= 0.628
T_4 (ng/dl)	2.135 ± 1.328	1.699 ± 1.207	t= -1.317, p= .193
25(OH)vit D (ng/ml)	13.358 ± 4.069	13.217± 3.567	t= .138, p= 0.891
TSH (mIU/ml)	18.659 ± 6.701	19.140± 6.914	t= .267, p= 0.790

TSH level was significantly higher in hypothyroid subjects than that of controls (t=17.505, p=0.000) table 1.There was a non-significant difference of serum TSH between male and female patients (t=0.267, p=0.790) table 2. When serum T4 levels in hypothyroid patients were compared according to sex, we noticed a non-significant difference between male and female patients (t=-1.317, p=0.193) table 2.

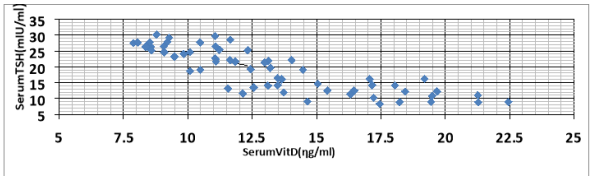

Figure 1: Correlation between serum TSH and 25(OH) vitamin D levels in hypothyroid patients.

Regarding control group, serum 25(OH) vitamin D levels were non-significantly correlated to serum TSH levels (r= -0.142, p=0.281) and serum T4 levels (r=0.178, p=0.173). In hypothyroid patients, serum 25(OH) vitamin D levels had a significant negative correlation with serum TSH levels (r=-0.835, p=0.000) [Fig.1] but a non-significant correlation with serum T4 levels (r=0.202, p=0.121) [Fig.2].

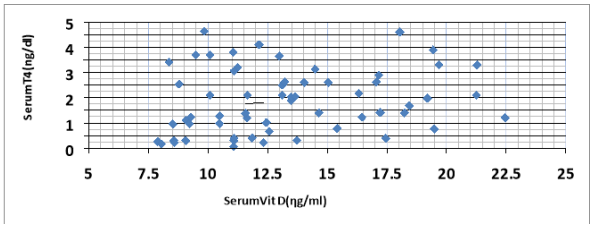

Figure 2: Correlation between serum T4 and 25(OH) vitamin D levels in hypothyroid patients.

Discussion:

Summary of findings:

In the present study of one year duration; serum vitamin D level was estimated among 120 subjects in the age group of 35.35 ± 8.93 years of North Bengal Medical College and Hospital consisting of two groups; one Euthyroid and one hypothyroid group. Vitamin D deficiency was considered when serum 25(OH) Vitamin D levels were below 20ng/ml, insufficiency when between 20-30ng/ml and sufficient when levels were above 30ng/ml [17].

If we consider the prevalence of vitamin D deficiency in hypothyroid group, vitamin D levels in male were below 20ng/ml in 23(95.8%) cases. The mean vitamin D level in male among hypothyroid subjects was 13.21 ± 3.57ng/ml and below 20ng/ml in 34(94.4%) female. No male or female in hypothyroid group were found with sufficient vitamin D level (> 30 ng/ml). In control group, we found a non-significant correlations between serum 25(OH) vitamin D and serum T_3 levels.

Comparative other similar studies:

Prevalence of Vitamin D deficiency was noted in 92% autoimmune hypothyroidism cases was the observation of few other workers**,** in a study which is relevant to our finding also[29].

In hashimoto's thyroiditis, a serum 25(OH) vitamin D was significantly lower than the controls and with the duration of Hashimoto's thyroiditis; severity of vitamin D deficiency increases.[30]**.**

Some researchers also observed no deficiency of vitamin D in early stages of autoimmune thyroid diseases[31].

Serum levels that vitamin D are significantly more decreased in females than males was the observation of some workers [28] but in our study this was insignificantly decreased.

Some experimental study reported that the possibility of low thyroid hormones may be contributed by deficiency of Vitamin in female patients with graves' disease of new on set [33]

Vitamin D deficiency in 40% of women and around 20% of men ($p < 0.005$) was found in a study in Japan including 200 euthyroid patients with Graves' disease [32]. The discrepancies between these studies can be explained by differences in the selection of patients, dietary vitamin D intake, and exposure to sunlight, and seasonal variations.

We observed in this study that there was a significant negative correlation between serum TSH levels and serum 25(OH) Vitamin D levels on Pearson's correlation analysis (r= **-** 0.835, p<0.005. In this study, the hypothyroid patients had significantly lower level of serum 25(OH) vitamin D as compared to controls (p<0.005) and the results are in close agreement with that of study conducted by Amal Mohammed Husein Mackawy et al.; suggesting that the deficiency of serum vitamin D levels was significantly associated with degree and severity of hypothyroidism[23].

We observed that 95% hypothyroid patients had serum 25(OH) Vitamin D levels below 20ng/ml(vitamin D deficiency) and 5% had serum 25(OH) Vitamin D levels between 20 to 30ng/ml having Vitamin D insufficiency . But no subject in the hypothyroid group had sufficient levels (>30ng/ml) of Vitamin D. On the other hand, healthy controls had higher levels of vitamin D.

Our results revealed decreased serum 25 (OH) vitamin D levels in females than those of males in both the controls and hypothyroid patients. Similar type of observations were found in other studies where serum vitamin D levels were significantly more decreased in females than male controls and patients [22,24,25,26,27]. One of the probable cause may be; males are engaged in more outdoor activities where as females mostly do indoor activities as well as difference in dietary intake.

Limitation of the study

In our study, the sample size was too small. The study was limited in its ability to conclude that vitamin D status is directly related to the pathogenesis of hypothyroidism. We could not measure the serum PTH levels and clarify its effect on vitamin D and hypothyroidism.

Further studies with a larger number of subjects are needed to determine whether hypothyroidism is caused by vitamin D deficiency or vice versa. Many study including ours also pointing to the involvement of vitamin D in the pathogenesis of hypothyroidism. So, screening vitamin D levels in patients with thyroid diseases **e**ncourage the advisability of vitamin D supplementation.

Conclusion:

There is increased incidence and prevalence of vitamin D deficiency in India and other countries due to rapid economic development, dietary changes, life style modification, like inadequate sunlight exposure [18]. However, data from epidemiologic studies in India are still limited. If we consider the high prevalence of vitamin D deficiency in India, there is a need for further research to identify the major factors responsible for vitamin D deficiency, despite of abundance of sunlight in our country. Vitamin D deficiency affects all age groups. Strategies like mass awareness programme about adequate exposure to sunlight, dietary fortification with vitamin D should be undertaken irrespective of the socio-economic status. This strategy may be adopted and implemented for prevention and control of vitamin D deficiency as well as hypothyroidism as a part of National Disease Prevention and Control programme. It will not be unjustified if vitamin D is combined with thyroid hormones which are given as medication to hypothyroid patients.

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