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Thyroid Diseases with Vitamin D Deficiency in Erbil city

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Keywords

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TSH

Abstract

Vitamin D is essential for the proper growth and development of a child and is associated with numerous public health issues. Our study aimed to examine the relationship between vitamin D deficiency and thyroid diseases. Vitamin D sufficiency is defined in terms of the serum level of the prohormone 25(OH)D which is 30 ng/mL. Vitamin D level less than of it is considered as vitamin D deficiency. A total of 100 subjects (30 (30%) were male and 70 (70%) were female) aged 18-62 years were included in the present study who visited the Central Laboratory in Erbil for health examination between the beginning of September to the beginning of December 2020. The findings of the present study show a high prevalence of vitamin D deficiency (79%) among Erbil population. There was a negative correlation between Vitamin D serum levels and TSH levels (r = - 0.154) with a positive correlation between vitamin D serum levels and FT3 levels (r = 0.168) and FT4 levels (r = 0.122). The results showed that patients with vitamin D deficiency suffered from hypothyroidism. Additionally, the positive significant correlation between thyroid hormones with vitamin D and negative significant correlation with TSH levels, suggested that low vitamin D levels are significantly associated with the severity of hypothyroidism which encourages the advisability of vitamin D supplementation.

1 Introduction

Vitamin D deficiency is a global health problem. Almost 1 billion people worldwide may have deficient or inadequate vitamin D levels [1]. Yet no international health organization or government body has declared a health emergency to warn the public of the urgent need to achieve sufficient levels of vitamin D in the blood [2]. Since its discovery in the early 20th century, understanding of the role of vitamin D has developed from being a simple vitamin to a steroid prohormone. It has been recognized that it is involved in various immune functions as well as bone and muscle growth [3]. The Endocrine Society Clinical Practice Guidelines on vitamin D defines sufficiency as >30 ng/mL of serum 25-OH-D, insufficiency as 21–29 ng/mL and deficiency as <20 ng/mL [4].

Vitamin D is a fat-soluble vitamin, popularly known as the sunshine vitamin. UVB light (wavelengths 290–315 nm) is the key inducer of vitamin D by photoisomerization of 7-dehydrocholesterol in epidermal keratinocytes into previtamin D3, which is then rapidly converted to vitamin D3 (cholecalciferol) in the basal and stratum spinosum stratum of the epidermis [5]. The main biological functions of vitamin D is to regulate calcium and phosphate homeostasis and, consequently, in the processes of bone growth and mineralization [6]. Vitamin D is also important for the proper functioning of many other systems, including immune, cardiovascular, and reproductive systems. Inadequate supply of vitamin D may have potential health impacts such as osteoporosis, osteoarthritis, tuberculosis, diabetes mellitus, multiple sclerosis, preeclampsia, periodontal disease, and several cancers [7]. Autoimmune diseases were found to be associated with vitamin D deficiency, including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), inflammatory bowel disease (IBD) and multiple sclerosis (MS) and that supplementation of vitamin D prevent the onset and/or development of these autoimmune diseases [8].

The thyroid gland is an important endocrine gland located in the neck. It is a butterfly-shaped organ composed of bulbous right and left lobes connected in the midline by a thin structure called the isthmus [9]. It synthesizes and releases two main hormones

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triiodothyronine (T3) and thyroxine (T4), which represents the only iodine-containing hormones in vertebrates. Thyroid hormones are key regulators of metabolism and development and are known to have pleiotropic effects on many different organs. The production of thyroid hormones is controlled by thyroid-stimulating hormone (TSH), also known as thyrotropin, synthesized by the anterior lobe of pituitary gland called thyrotrophs, in response to thyrotropin-releasing hormone (TRH), which is secreted by the hypothalamus. Unbound or free triiodothyronine and thyroxine (fT3 and fT4 respectively) exert negative feedback on the synthesis and release of thyroid-stimulating hormone and thyrotropin-releasing hormone to maintain circulating thyroid hormone levels within the required range [10].

Numerous studies have demonstrated that low levels of vitamin D may play a role in thyroid disorders. Low vitamin D levels have been associated with autoimmune thyroid diseases (AITD) such as Hashimoto's thyroiditis (HT) and Graves' disease (GD). Impaired vitamin D signaling has been reported to encourage thyroid tumorigenesis [11]. This study aimed to examine the relationship between vitamin D deficiency and thyroid disease in Erbil City.

2 Methodology

2.1 Study area

This descriptive-analytical study was conducted in Erbil city, Kurdistan Region, Iraq to evaluate the relationship between Vitamin D deficiency and thyroid disease. For this purpose, samples are collected randomly and included those individuals who had visited the Central Laboratory in Erbil city.

2.2 Sample and diagnostic procedures

This cross-sectional study enrolled a total of 100 subjects (30 (30%) were male and 70 (70%) were female) aged 18-62 years, all patients were followed up at the Central Laboratory in Erbil City during the period from the beginning of September to the beginning of December 2020. The data collected included gender, vitamin D value, thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4). Serum levels of TSH, fT4 and fT3 were determined with electrochemiluminescence method using Cobas e 411 analyzer (Roche Diagnostics, Germany). The inclusion and the exclusion criteria used in the study were as follows:

Inclusion Criteria

- Willingness to go through with the procedure after receiving informed consent.
- Patients who are newly diagnosed with thyroid disease.

Exclusion Criteria

- Patients who are on hypo or hyperthyroidism treatment
- Patients who are on medication, such as vitamin D supplementation or any drug that affects vitamin D level.
- Patients who are under investigation for any immunological disorder

2.3 Statistical analysis

The data were tested for normality using the D'Agostino-Pearson omnibus normality test. Normally distributed variables were presented as mean ± standard error of the mean (SEM), whereas skewed distributed variables were presented as median (interquartile range [IQR]). Statistical analysis was performed using GraphPad Prism 6 software (GraphPad Software, Inc., CA, US). The correlations between Vitamin D and TSH, FT3 and FT4 were presented by correlation coefficient (r^2). Results considered significant or non-significant when *P*-value > or < 0.05, respectively.

3 Results

The present study included data from 100 subjects (30 (30%) were male and 70 (70%) were female) aged 18-62 years. The results showed that the highest number of the cases (79%) had vitamin D deficiency and (21%) had normal levels of vitamin D as shown in (Fig. 1).

A nonlinear regression analysis was performed to study the correlation between Vitamin D and TSH, FT3 and FT4 (Table 1).

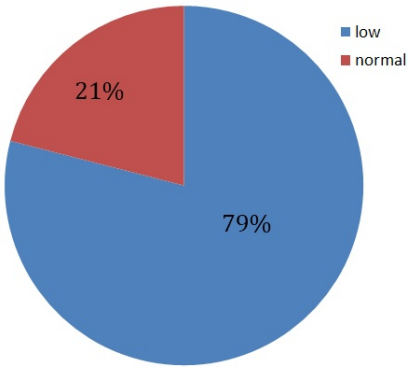

Fig. 1: Percentage of vitamin D status among people in Erbil city.

Table 1: Correlation between Vitamin D and each of TSH, FT3 and FT4.

X variable	Y variable	Correlation coefficient (r)	(P-value)
Vitamin D	TSH	-0.154	0.212
Vitamin D	FT3	0.1681	0.1706
Vitamin D	FT4	0.1223	0.3203

There were significant negative correlations were recorded between vitamin D and TSH (r = - 0.154, P > 0.05) (Fig. 2). Significant positive correlation between vitamin D and FT3 (r = 0.168, P > 0.05) (Fig. 3), with

significant positive correlation between vitamin D and FT4 (r = 0.122, P > 0.05) (Fig. 4).

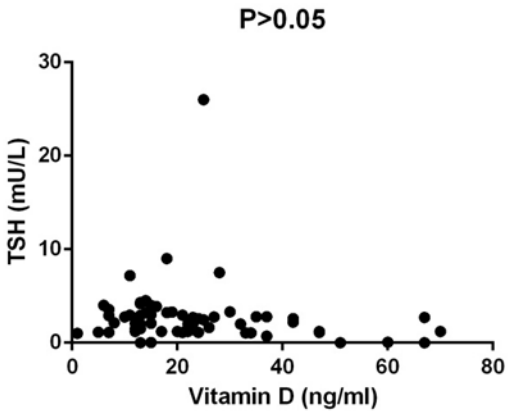

Fig. 2: Correlation between Vitamin D and TSH.

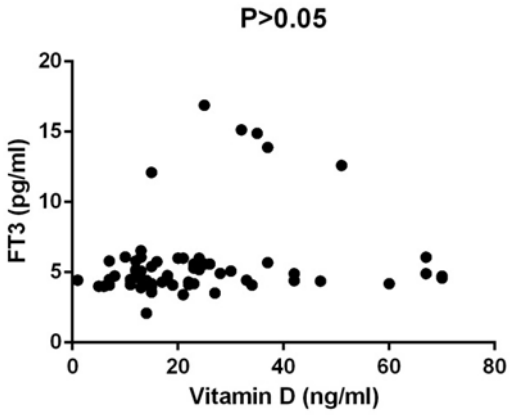

Fig. 3: Correlation between Vitamin D and FT3.

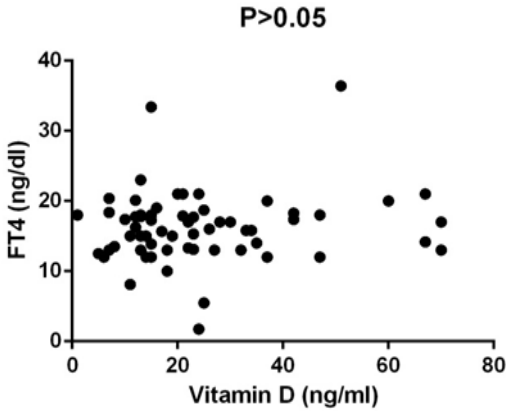

Fig. 4: Correlation between Vitamin D and FT4.

4 Discussion

Previous studies have discussed the role of vitamin D in preventing autoimmune thyroid disease. Vitamin D prevents aberrant immune responses by modulating the immune cells [12]. However, Vitamin D may affect thyroid function in other ways than immunomodulation and preventing autoimmune diseases [13]. The prevalence of vitamin D deficiency among adults has been reported to be 14-59 percent with a higher prevalence in Asian countries [14]. Vitamin D deficiency is common in patients with Graves' disease and is associated with higher thyroid volume. Vitamin D receptor gene polymorphisms were found to be associated with the risk of Graves' disease [15]. According to these findings, in hypothyroid patients the prevalence of vitamin D deficiency was high. Supplementation of vitamin D significantly decreased TSH levels but did not affect T4 or T3 concentrations [16].

The present study showed that vitamin D serum levels in hypothyroid patients were significantly lower. Patients with hypothyroidism were suffering from hypovitaminosis D. Our results indicate that vitamin D deficiency is more prevalent in the females, 55 out of 70 (78.57%) while in males 11 out of 30 (36.66%). Women have often been found to have lower vitamin D levels than men possibly due to lifestyle habits and higher percentage of body fat [17]. There was a negative significant correlation between Vitamin D serum levels and TSH levels (r = - 0.154) with a positive significant correlation between vitamin D serum levels and FT3 levels (r = 0.168) and FT4 levels (r = 0.122). These results indicate that vitamin D deficiency and hypothyroidism may have a significant relationship and low levels of serum 25(OH)D was significantly associated with the degree and severity of hypothyroidism. There are two main reasons for this association. First, low vitamin D levels may be due to inadequate intake of vitamin D from the intestine. Second, vitamin D may not be activated properly by the body [18].

Furthermore, it was recently reported that the prevalence of vitamin D deficiency in patients with Graves' disease was significantly higher compared to control subjects (65.4 vs. 32.4%, $P < 0.05$) [19]. Both Vitamin D and thyroid hormone bind to similar receptors called steroid hormone receptors. A different gene in the Vitamin D receptor was shown to predispose people to autoimmune thyroid disease including Graves' disease and Hashimoto's thyroiditis [20]. Vitamin D mediates its effect through binding to vitamin D receptor (VDR), and activation of VDR-responsive genes. While VDR gene polymorphism was found to associate with AITDs. Variation in the VDR gene is thought due to mediate susceptibility to various endocrinal autoimmune diseases [21]. Moreover, increased bone turnover in hyperthyroid patients may lead to high calcium levels and negative feedback on parathyroid hormone and $1,25(OH)_2D_3$ synthesis, which induces low vitamin D levels [22].

5 Conclusion

Our results indicated that patients with vitamin D deficiency suffered from hypothyroidism. In addition, the

positive significant correlation between thyroid hormones and vitamin D and the negative significant correlation with TSH levels suggested that the lack of vitamin D levels was significantly associated with hypothyroidism, which encourages the advisability of vitamin D supplementation. Screening for Vitamin D deficiency is recommended for all hypothyroid patients.

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