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Original Article

Assessment of Serum Vitamin D and Calcium Levels among Patients with Hypothyroidism: A Comparative Study in Albayda, Libya

Nusieba A. Mohammed Ibrahim* and Yahya Saber E. Mansour

Department of Pharmacology and Toxicology, Faculty of Pharmacy, Omar Al-Mukhtar University, Albayda, Libya

Corresponding Author Nusieba A. Mohammed Ibrahim. Email: nusieba.ibrahim@omu.edu.ly

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ABSTRACT

Purpose: Vitamin D is essential for the proper functioning of numerous organs, including the thyroid gland. Therefore, a deficiency in vitamin D is considered a potential risk factor for developing various thyroid disorders, particularly hypothyroidism. The present study aimed to evaluate the serum concentrations of vitamin D and calcium in individuals who have been diagnosed with hypothyroidism. **Materials and Methods** The research was conducted on a cohort of 150 patients with hypothyroidism at the Department of Internal Medicine, Albayda Medical Center, in Albayda, Libya. Serum levels of vitamin D, calcium, thyroid-stimulating hormone (TSH), and thyroid hormones (T_3 and T_4) were measured in all participants. A control group consisting of 100 healthy individuals was used for comparison. Vitamin D deficiency was defined as serum vitamin D concentrations below 20 ng/mL. **Results:** Our findings indicated that patients with hypothyroidism exhibited significantly reduced serum levels of both vitamin D and calcium compared to the control group ($P<0.05$). **Conclusion:** Based on these results, it is strongly advised that individuals with hypothyroidism be screened for vitamin D and calcium deficiencies and, if necessary, receive appropriate supplementation.

Keywords: Vitamin D; Calcium; Hypothyroidism; Hypovitaminosis D; Albayda.

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INTRODUCTION:

Vitamin D is a fat-soluble vitamin that is crucial for regulating several minerals, especially calcium. It is synthesized in the skin upon exposure to sunlight, especially ultraviolet B rays [1]. Vitamin D is also present in a variety of dietary sources, including liver, fortified dairy products, fatty fish, and nutritional supplements [2]. There are two main types of vitamin D: i) D2 (ergocalciferol), which is present in certain plants and fortified food products, and ii) D3 (cholecalciferol), which is synthesized in the skin and found in animal-derived foods [2]. Once in the body, vitamin D is converted to 25-hydroxyvitamin D in the liver, its primary circulating form. It is then further converted into its active form, 1,25-dihydroxyvitamin D (calcitriol), in the kidneys [3]. The thyroid gland, a butterfly-shaped gland located anteriorly in the lower part of the neck, is essential for regulating the body's metabolism through the production of thyroid hormones, mainly triiodothyronine (T_3) and thyroxine (T_4) [4]. Additionally, the parafollicular cells (C cells) of the thyroid gland produce and secrete calcitonin, a hormone involved in maintaining calcium homeostasis in the bloodstream [5]. Vitamin D plays an important role in maintaining bone health and proper bone mineralization. Recent studies have indicated a correlation between low vitamin D levels and various health issues, including cardiovascular disease, diabetes, cancer, obesity, and osteoporosis [6]. A growing body of evidence also supports a significant association between vitamin D deficiency and hypothyroidism. For example, previous studies have shown that the prevalence of vitamin D insufficiency in individuals with Hashimoto's thyroiditis is markedly higher (92%) compared to healthy controls (63%) [7,8]. Additionally, studies have reported that patients with Graves' disease also often present with low levels of Vitamin D [9,10].

Furthermore, studies have identified a negative correlation between serum vitamin D levels and both calcium and thyroid-stimulating hormone (TSH) levels [11]. Consequently, the current study was undertaken to evaluate serum vitamin D and calcium levels in individuals with hypothyroidism.

MATERIALS AND METHOD:

This study was done at the Department of Internal Medicine at Albayda Medical Center, Albayda, Libya, from April to December 2024, involving 150 patients diagnosed with hypothyroidism (70 males and 80 females) with a mean age of 44.60 ± 8.90 years. A control group of 100 healthy individuals (45 males and 55 females) with a mean age of 43.37 ± 8.47 years was also established. These individuals had not been diagnosed with hypothyroidism and were not taking vitamin D supplements at the time of the study. The Medical Ethics Board of Albayda Medical Center granted approval for the study protocol. All participants in this research provided written informed consent. Blood samples were collected from all participants after an 8-hour fasting period. The levels of T_3, T_4, and TSH were measured using the Cobas c111 ECLIA analyzer (Roche Diagnostics GmbH, Mannheim, Germany). The normal reference ranges for serum thyroid hormones are (1.4-4.4 pg/dL for T_3, 0.7-2.1 ng/dL for T_4, and 0.3-4.0 mU/L for TSH) [12]. The serum levels of vitamin D and calcium were measured using the Cobas e411 ECLIA analyzer (Roche Diagnostics GmbH, Mannheim, Germany). Serum vitamin D levels below 20ng/mL were classified as deficient, while levels above 30 ng/mL were considered normal [13]. The normal reference range for serum calcium level is 8.5-10.5 mg/dL [12]. Data were presented as mean ± standard deviation (Mean ±SD) and analyzed by SPSS Version 20. One-way ANOVA was performed, followed by the LSD post hoc test. *P*-values below 0.05 were considered statistically significant ($P<0.05$), whereas values above 0.05 were regarded as non-significant ($P>0.05$).

RESULT:

As illustrated in Table 1 below, there were no significant differences between the two groups in terms of age and sex ($P>0.05$). However, serum vitamin D and calcium levels were significantly lower in patients with hypothyroidism compared to the control group ($P < 0.05$). Additionally, serum TSH levels were significantly higher in patients with

hypothyroidism (*P < 0.05), while serum T3 and T4 levels were significantly lower in these patients compared to the controls (P < 0.05*).

Table 1: Serum levels of vitamin D, calcium, TSH, T_3, and T_4 in the control and hypothyroid groups.

Variables	Control Group (Mean ±SD)		Hypothyroid Group (Mean ±SD)		*P- values*
Sex	**Males**	**Females**	**Males**	**Females**	**0.407**
	45 (45.00%)	55 (55.00%)	70 (46.66%)	80 (53.33%)	
Age (years)	43.37 ± 8.47		44.60 ± 8.90		**0.568**
Serum Vit D (ng/mL)	45.53 ± 10.51		12.21 ± 2.02		**0.008***
Serum Ca^{+2} (mg/dL)	10.88 ± 3.45		6.47 ± 2.34		**0.005***
Serum TSH (mU/L)	3.63 ± 0.91		7.98 ± 0.91		**0.002***
Serum T_3 (pg/dL)	2.94 ± 1.45		1.21 ± 1.09		**0.009***
Serum T_4 (ng/dL)	**1.57 ± 0.70**		**0.59 ± 0.70**		**0.001***

We observed no significant differences in serum levels of vitamin D, calcium, TSH, and thyroid hormones between male and female patients (P > *0.05*; Table 2).

Table 2: Serum levels of vitamin D, calcium, TSH, T_3, and T_4 in the hypothyroid group.

Variables	Hypothyroid Group (Mean ±SD)		
	Males	**Females**	***P- values***
Serum Vit D(ng/mL)	11.63 ± 1.87	12.79 ± 2.17	**0.578**
Serum Ca^{+2} (mg/dL)	6.12 ± 1.54	6.82 ± 3.15	**0.470**
Serum TSH (mU/L)	7.05 ± 0.96	8.92 ± 0.87	**0.362**
Serum T_3 (pg/dL)	1.08 ± 0.72	0.81 ± 1.42	**0.290**
Serum T_4 (ng/dL)	**0.64 ± 0.94**	**0.52 ± 0.46**	**0.201**

DISCUSSION:

Vitamin D deficiency in individuals with hypothyroidism is primarily attributed to either inadequate dietary intake or poor intestinal absorption of vitamin D. To the best of our knowledge, this research is among the few that evaluate the relation between vitamin D and calcium levels in the context of hypothyroidism in Albayda, Libya. Therefore, we conducted this study to assess and compare the serum levels of vitamin D and calcium in patients diagnosed with hypothyroidism versus healthy individuals without any reported symptoms or history of hypothyroidism or other thyroid-related conditions. The current study demonstrated that the serum levels of both vitamin D and calcium were significantly lower in the patient group than in the control group ($P<0.05$). Significant positive correlation was observed between vitamin D and calcium levels and thyroid hormone concentrations in both groups. These findings align with those of Mackawy et al., who investigated the impact of vitamin D deficiency on the thyroid gland and reported that inadequate vitamin D levels may lead to reduced thyroid hormone production [14]. Additionally, vitamin D and calcium serum levels showed a negative correlation with TSH levels, suggesting a potential significant correlation between vitamin D deficiency and hypothyroidism. Consistent with earlier studies, our research found no significant differences in serum vitamin D levels between males and females [15,16]. For instance, Hashemipour et al. reported similar findings in their study on vitamin D status in Tehran, observing no gender-based variation [17]. Similarly, Heshmat et al. concluded that vitamin D levels did not differ significantly between men and women in a large-scale study conducted in Iran [18]. In line with our results, a study conducted by Mackawy et al. also identified hypovitaminosis D and hypocalcemia in individuals with hypothyroidism, reinforcing the link between these deficiencies and thyroid dysfunction [14]. Appunni et al., using a nationally representative sample of 7,943 participants, found that 25.6% of individuals with hypothyroidism had vitamin D deficiency, compared to 20.6% among healthy controls [11]. While it is commonly observed in many Muslim-majority countries that women tend to have lower vitamin D levels compared to men—mainly due to clothing practices (e.g. wearing hijab) and social-religious customs—some studies challenge this assumption. For example, Heshmat et al., in a comprehensive study conducted in Iran, found no significant differences in vitamin D levels between men and women [18]. Our own findings align with this conclusion, revealing a high prevalence of severe vitamin D deficiency in both male and female participants. This is supported by earlier research showing an overall vitamin D insufficiency rate of 83.5%, with no significant correlation to gender [19]. Similarly, our study's findings corroborate those of a study by Faid et al., who also reported a widespread and severe vitamin D deficiency among both sexes [20].

CONCLUSION:

Our research findings revealed that patients diagnosed with hypothyroidism commonly exhibited hypovitaminosis D and hypocalcemia. Thus, we highly recommend routine screening of serum vitamin D and calcium levels for patients with hypothyroidism. Furthermore, appropriate supplementation of vitamin D and calcium should be considered as part of the management strategy for these individuals.

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CONFLICTS OF INTEREST

There were no conflicts of interest related to this research article.

AUTHOR CONTRIBUTIONS: This research was conducted collaboratively by both authors. NAMI developed the study design, wrote the protocol, and gathered the data. YSEM composed the manuscript, performed the statistical analyses, and managed the literature reviews. Both authors reviewed the results and approved the final manuscript.

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