The relation between vitamin D insufficiency and thyroid hormones in Iraqi women living in Al-Khalidiya, Anbar Province

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Abstract

Background: Vitamin D insufficiency is a worldwide issue in all age groups. It was discovered that vitamin D insufficiency is linked to autoimmune disorders such as Irritable bowel illness, rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, and rheumatoid arthritis. Vitamin D is also connected to the development of thyroid autoimmune disease and plays an important role in endocrinopathies including type 1 and type 2 diabetes, adrenal diseases, and polycystic ovarian syndrome.

Materials and methods: 100 samples were collected for women from Al-Khalidiya city in Anbar province (50 samples likely to have thyroid problems, 50 healthy samples). The levels of vitamin D and thyroid hormones were measured using A Minividus system (which combines a two-step enzyme sands assay with an ELFA, or End Fluorescent Detection Method).

Results: The current findings revealed that there are significant variations in vitamin D and T4 levels between patients and healthy controls (P-value 0.05). There is also a positive association between vitamin D levels and T4 (r = 0.378, P-value = 0.007), as well as a negative correlation between vitamin D levels and TSH (r = -0.373, P-value = 0.008).

Conclusion: According to our result, Individuals with hypothyroidism in Alkhaldia have a vitamin D3 deficiency. In addition, blood vitamin D levels show a positive correlation with T4 and a negative correlation with TSH levels. To avoid developing osteoporosis if hypothyroidism persists, all hypothyroid Iraqi patients should be checked for Vitamin D deficiency.

Keywords: Vitamin D, Thyroid hormones, Hypothyroidism.

Introduction

Vitamin D insufficiency is a worldwide issue in all age individuals. Vitamin D deficiency or inadequacy affects over a billion individuals on the planet. Vitamin D insufficiency has been linked to Vitamin D treatment has been found to slow the progression of autoimmune illnesses such rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, and inflammatory bowel disease (1, 2).

The function of vitamin D in autoimmune thyroid disorders (AITD) has aroused the interest of experts. In endocrinopathies such as type 1 and type 2 diabetes, adrenal diseases, and polycystic ovarian syndrome. Vitamin D has been found as an exogenous and endogenous player, in addition to its function in skeletal metabolism (3, 4). Low vitamin D levels may be implicated in the pathogenesis of autoimmune thyroid disease. According to several case-control studies that patients with AITDs have lower blood vitamin D levels or a higher prevalence of vitamin D deficiency than healthy controls (3, 5). Another research showed no difference between vitamin D levels in the blood and thyroid autoimmunity (4).

On the other hand, Low vitamin D levels, have been linked to thyroid disorders including Hashimoto's thyroiditis and new-onset Graves' disease, according to subsequent research. Thyroid cancers have been linked to a lack of vitamin D signaling (6).

Primary hypothyroidism is a common condition, with a frequency of 0.5–2.0 percent in women and 0.2 percent in males. According to various experts, the number of hypothyroidism patients with autoimmune disorders has grown by 2.1 percent recently (7).

Thyroid hormone production is impaired owing to thyroid abnormalities or iodine shortage, but it can also be related to pituitary or hypothalamic problems. Weight gain, cold sensitivity, and constipation are all symptoms of hypothyroidism. Thyroid hormones regulate bodily hemodynamics, thermoregulation, and numerous metabolic processes, among other things. It affects nearly all metabolic processes in the body, including glucose, protein, lipid, and water and electrolyte balance (8).

It is known as the fat-soluble vitamin of the sun. The major source of vitamin D is Ultraviolet B-light (290–320 nm) exposure (9). Vitamin D is absorbed into the bloodstream via a D-binding protein, hydroxylated to 25(OH) D in the liver, and then converted in the kidney to the active metabolite 1, 25 di hydroxyvitamin D (1, 25-(OH)2 D) or calcitriol(10). The most commonly acknowledged measure of vitamin D status is serum 25(OH) D, the most abundant circulating precursor of active vitamin D, which represents combined contributions from cutaneous synthesis. Both vitamin D and thyroid hormone bind to steroid hormone receptors, which is important. A specific gene in the Vitamin D receptor has been found to predispose people to autoimmune thyroid disorders such as Graves' disease and Hashimoto's thyroiditis. As a result, people with thyroid problems should understand how the vitamin D system works (11).

This study was conducted to assess the pathology and the relationship between the deficiency or insufficiency of the vitamin D levels and thyroid hormone levels hormones in a sample of Iraqi patients in the city of Al-Khalidiya, Anbar providence.

Methodology

100 sample blood tests were taken in Al-Khalidiya area in Anbar providence. Fifty tests of cases have been obtained as a healthy person and fifty samples were taken as a state with thyroids. The average of the age for the selected persons and the relationship to the vitamin D levels were determined. The study participants and were determined and their relationship to the measured levels was determined.

The concentration of (Vitamin D, T3, T4, and TSH) was determined using a Minividus system Through the interplay of two elements: the SPR coated receptor and the Strip, which consists of a succession of reagent wells, the Minividus system (which combines a 2-step enzyme sands assay with an End Fluorescent Detection Method -ELFA) is possible (12). To complete all essential processing steps, the small VIDA SPR serves as the foundation for the sample phase, mixing, and cleaning (13). Both responses occur during the SPR's two primary phases: immune response and enzyme response.

Statistical analysis

The data of the present study were analyzed using the Chi-square (X2) test to compare percentages. Diagnostic test sensitivity and specificity were measured (detection of the best test for diagnosis). (Mean SD) was used to describe numeric dates. The T-test was used to compare two numeric variables, while Pearson correlation (R) was utilized to describe the kind and strength of the association. The test was run using a significance level of 0.05. Current data were analyzed using (SPSS v.22 and Graph pad prism v.6) applications.

Results

To elucidate the relationship of age and the level of vitamin D depending on age periods, 40-49 years, this age periods recorded the highest percentage (28.0%) of vitamin D, while (10-19 and 50-59 year) age periods recorded the lowest percentage (2.0% and 12.0%) respectively. The differences among age periods were high significant ($p<0.05$).

Table (1) Frequency and percentage of the age of patients has been compared by using chi-square test.

		Count	%
Age periods	<20	1	2.0%
	20-29	7	14.0%
	30-39	10	20.0%
	40-49	14	28.0%
	50-59	6	12.0%
	≥60	12	24.0%
P value	0.021*		

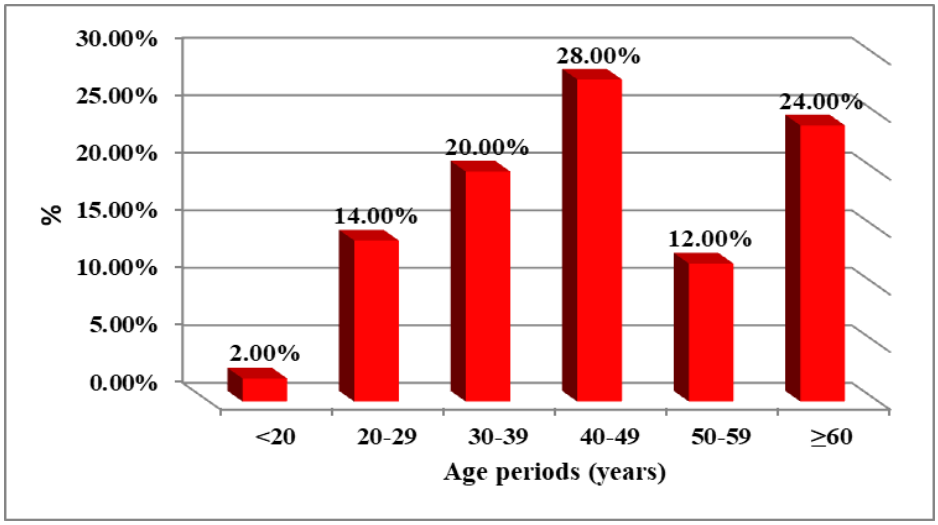
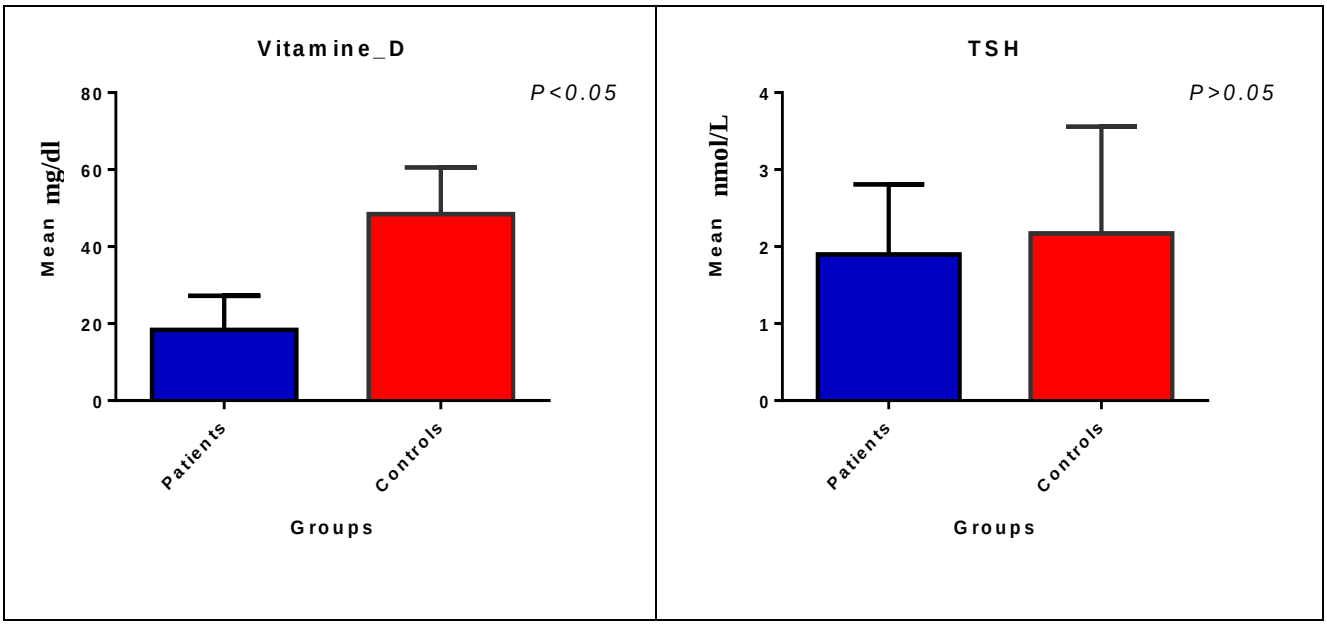


Figure (1): age periods of patients suspected of hypothyroidism

The present study's findings reveal that patients' mean Vitamin D levels were lower (18.35±8.88) than controls' (48.40 ±12.18), with a large significant difference (P 0.05) between study groups. As a result, the mean TSH value for patients was lower (1.90±0.91) than for controls (2.17±1.39), with no significant difference (P > 0.05). T4 was substantially higher in patients (98.88±29.40) than in controls (89.20 ±18.88), with a significant difference (P 0.05). T3 was also higher in patients (1.57±0.67) than in controls (1.34± 0.59), with no statistically significant differences (P> 0.05). (table 2 and figure 2).

Table (2): comparative Vitamin D, TSH, T4, and T3 variables between study groups and compared by using t-test

Groups		N	Mean	SD	Std. Error Mean	P-value
Vitamin D	**Patients**	50	18.35	8.88	1.26	0.001***
	Controls	50	48.40	12.18	1.72	
TSH	**Patients**	50	1.90	0.91	0.13	0.25
	Controls	50	2.17	1.39	0.20	
T4	**Patients**	50	98.88	29.40	4.16	0.05*
	Controls	50	89.20	18.88	2.67	
T3	**Patients**	50	1.57	0.67	0.10	0.07



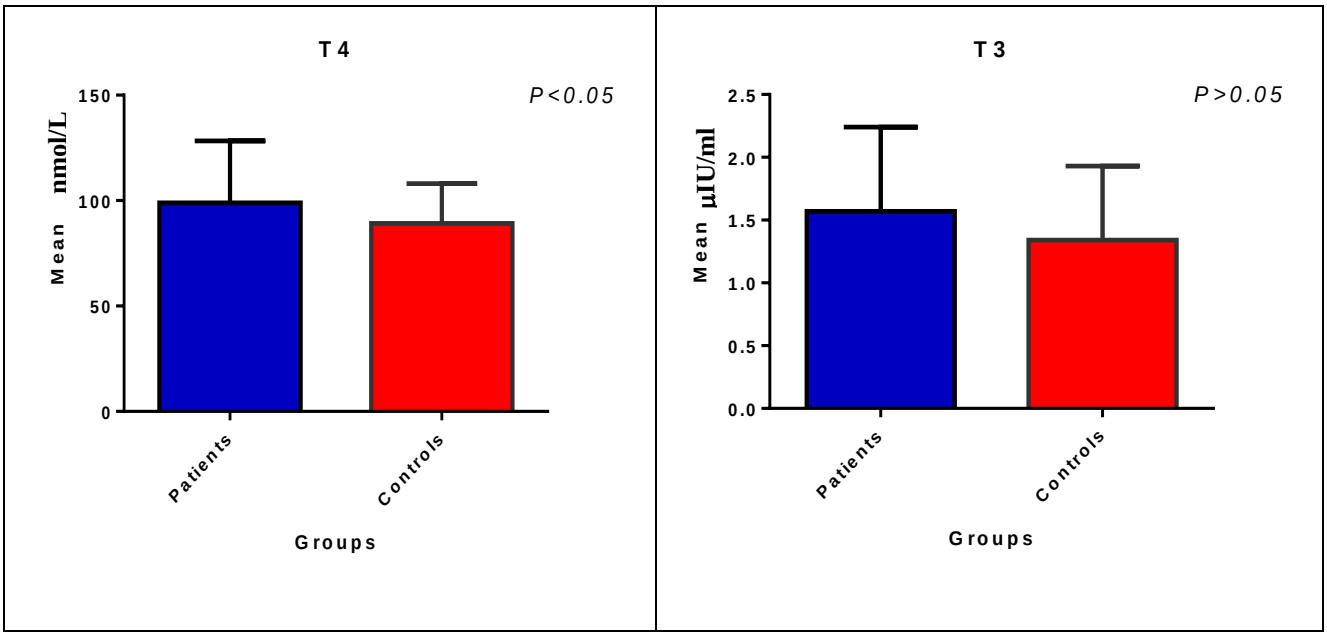


Figure (2): comparative Vitamin D, TSH, T4, and TE variables between study groups

The maximum sensitivity was found for T4 (Sn.= 68%) and T3 (Sn.= 63%), while the lowest sensitivity was found for Vitamin-D (Sn.= 4%). Vitamin D had higher specificity (Sp. = 88%) than T4 (Sp. = 55%), while T3 had the lowest specificity (Sn.=44%). (table 3 and figure 3).

Table (3): ROC curve, sensitivity, and specificity of variables

Variable	AUC	Sensitivity	Specificity
Vitamin-D	0.023	4%	88%
TSH	0.488	46%	52%
T4	0.622	68%	55%
T3	0.630	66%	44%

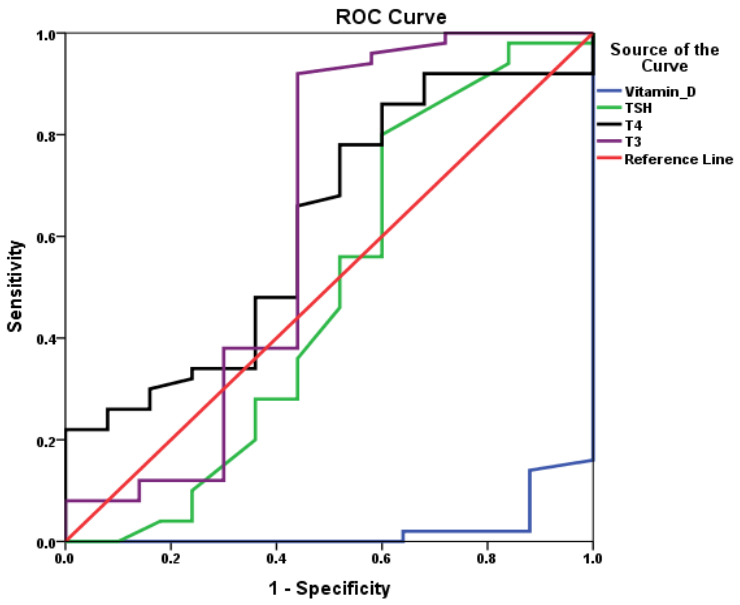


Figure (2): ROC curve of variables

The correlation link between (TSH and T4) is negative, according to the findings of our study. The connection between (Vitamin D and T4) is positive. (table 4).

Table (4): correlation relationship among Vitamin D, T3, T4, and TSH and compared by using Pearson correlation test

		Vitamin D	TSH	T4	T3
Vitamin D	**r**	1	-0.257	0.378**	-.028
	p		0.071	0.007	0.845
TSH	**r**	-0.257	1	-0.373-**	0.157
	p	0.071		0.008	0.276
T4	**r**	0.378**	-0.373-**	1	-0.109
	p	0.007	0.008		0.451
T3	**r**	-0.028	0.157	-0.109	1
	p	0.845	0.276	0.451	

The current findings reveal that the lowest mean Vitamin D parameter value was for a period (20) and the highest mean value was for a period (20-29 and ≥60), with no significant difference (P0.05) across patient age periods. In contrast, the TSH parameter had the lowest mean value (40-49) and the highest mean value (20), with no significant difference (P0.05) among patients' age periods. In contrast, period (40-49) had the lowest mean TSH value, and period (20) had the highest mean TSH value, with no significant difference (P0.05) between patient age periods. T4 parameter had the lowest mean value for the period (20) and the highest mean value for the period (30-39), with no significant difference (P0.05) across patient age periods. Finally, period (20) had the lowest mean value of T3, and

period (20-29 and 50-59) had the highest mean value, with no significant difference (P0.05) amongst patient age periods. (table 5).

Table (5): Comparative Vitamin D levels with TSH, T4, and T3 levels in patients of various ages

		N	Mean	Std. Deviation	Std. Error	P-value
Vitamin D	<20	1	13.10	0.00	0.00	0.43
	20-29	7	21.41	9.77	3.69	
	30-39	10	19.45	8.03	2.54	
	40-49	14	15.34	7.75	2.07	
	50-59	6	15.20	7.28	2.97	
	≥60	12	21.18	10.77	3.11	
TSH	<20	1	2.69	0.00	0.00	0.66
	20-29	7	2.09	0.69	0.26	
	30-39	10	1.93	1.20	0.38	
	40-49	14	1.84	0.74	0.20	
	50-59	6	2.26	1.30	0.53	
	≥60	12	1.60	0.77	0.22	
T4	<20	1	80.10	0.00	0.00	0.26
	20-29	7	93.59	26.76	10.11	
	30-39	10	118.46	24.72	7.82	
	40-49	14	99.09	16.79	4.49	
	50-59	6	87.42	36.22	14.79	
	≥60	12	92.72	38.96	11.25	
T3	<20	1	1.22	0.00	0.00	0.59
	20-29	7	1.78	0.84	0.32	
	30-39	10	1.42	0.42	0.13	
	40-49	14	1.38	0.14	0.04	
	50-59	6	1.74	1.14	0.47	
	≥60	12	1.75	0.84	0.24	

DISCUSSION

The importance of vitamin D in maintaining bone and mineral homeostasis has long been recognized (14). Vitamin D insufficiency has been linked to a variety of diseases, including cardiovascular disease, cancer, infection, obesity, and osteoporosis, based on current studies (15). The function of vitamin D in the start and progression of thyroid diseases has been studied extensively.

Studies have been done to understand whether there is a link between Vitamin D levels and hypothyroidism and to see if Vitamin D insufficiency plays a role in the etiology of hypothyroidism or is simply a symptom of the condition. The hypothyroid group had lower vitamin D levels than the control group, according to the findings of this study. Vitamin D deficiency and insufficiency are more common in hypothyroid individuals than in the control group. With a P-value of 0.007, there is a significant link between vitamin D levels and T4 levels.
In hypothyroid individuals, research demonstrated that the link between hypothyroidism and vitamin D deficiency, thyroid autoimmunity, increased thyroid gland volume, nodularity, and vascularity (16).
On correlating Vitamin D with T4 in a hypothyroid group, a significant correlation was seen. The present findings suggest a possible association of hypovitaminosis D with hypothyroidism, This study is consistent with the results of R Priya, et, al. (17)

Byron Richards (18) studied the effects of Vitamin D shortage on the thyroid gland and found that a deficiency in Vitamin D might lead to low thyroid hormone levels in an experimental study. Low Vitamin D levels in hypothyroidism patients might be explained by two causes. First, low vitamin D levels might be related to inadequate intestinal absorption of the vitamin. Second, Vitamin D may not be properly activated by the body. Both Vitamin D and thyroid hormone bind to steroid hormone receptors, which is important, which are identical. Autoimmune thyroid disorders such as Graves' disease and Hashimoto's thyroiditis have been linked to a distinct gene in the Vitamin D receptor (19).

On the other hand, TSH, T4, and T3 secretion can be affected by sex hormones, genetic susceptibility, and even environmental variables, all of which might have a role in the connection between vitamin D status and TSH, T4, and T3 levels (20). Poor intestinal vitamin D absorption and inappropriate vitamin D activation are two proposed reasons for reduced vitamin D levels in hypothyroidism patients. Although hypothyroid patients' vitamin D levels were substantially lower than those in the euthyroid condition were, the mean level of vitamin D in hypothyroid patients was still within the acceptable range (20).

When compared to TSH levels, vitamin D serum levels exhibited a negative connection. These data suggested that vitamin D deficiency and hypothyroidism might be linked. Our findings were in line with the previous study, which revealed that vitamin D insufficiency was far more common in Hashimoto's patients (92 %) than in healthy controls (63 %) (P= 0.00001) (21). The rationale for these findings (low vitamin D levels in hypothyroid individuals) might be related to inadequate vitamin D absorption in the gut or a lack of vitamin D activation by the body. Because thyroid hormone is a steroid hormone and vitamin D3 is a fat-soluble vitamin, they connect to steroid hormone receptors in the same way (21).

Obaid and co-workers (2020) indicated that Iraqi patients with hypothyroidism suffering from a deficiency in vitamin D3. Furthermore, blood vitamin D levels have a favorable association with T4 and a negative significant link with TSH levels. All hypothyroid Iraqi patients should be tested for Vitamin D insufficiency to avoid osteoporosis if the shortage persists (22).

Conclusion

Based on our findings reveal that individuals with hypothyroidism in Alkhaldia have a vitamin D3 deficit. Furthermore, blood vitamin D levels have a favorable association with T4 and a negative significant link with TSH levels. All hypothyroid Iraqi patients should be tested for Vitamin D insufficiency to avoid developing osteoporosis if the deficit persists.

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العلاقة بين نقص فيتامين (د) وهرمونات الغدة الدرقية لدى عينة من النساء العراقيات في مدينة الخالدية بمحافظة الأنبار

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الملخص

المقدمة: نقص فيتامين D مشكلة عالمية في جميع الفئات العمرية. تم اكتشاف أن نقص فيتامين D مرتبط باضطرابات المناعة الذاتية مثل مرض القولون العصبي والتهاب المفاصل الروماتيدي والذئبة الحمامية الجهازية والتصلب المتعدد والتهاب المفاصل الروماتيدي. يرتبط فيتامين (D) أيضًا بتطور أمراض المناعة الذاتية للغدة الدرقية ويلعب دورًا مهمًا في اعتلالات الغدد الصماء بما في ذلك مرض السكري من النوع 1 والنوع 2 ، وأمراض الغدة الكظرية ، ومتلازمة المبيض المتعدد الكيسات.

المواد و طرق العمل : تم جمع 100 عينة لسيدات من مدينة الخالدية بمحافظة الأنبار (50 عينة يحتمل أن تكون مصابة بمشاكل في الغدة الدرقية ، 50 عينة اصحاء). تم قياس مستويات فيتامين (د) وهرمونات الغدة الدرقية باستخدام نظام Minividus (الذي يجمع بين فحص رمال الإنزيم المكون من خطوتين مع ELFA ، أو طريقة End Fluorescent Detection Method).

النتائج: كشفت النتائج الحالية أن هناك اختلافات كبيرة في مستويات فيتامين (D) و هرمون T4 بين المرضى و الاصحاء ($P < 0.05$). هناك أيضًا ارتباط إيجابي بين مستويات فيتامين (د) و T4 ($r = 0.378$ ، $P = 0.007$) ، بالإضافة إلى ارتباط سلبي بين مستويات فيتامين (D) و TSH ($r = - 0.373$ ، $P = 0.008$).

الخلاصة: وفقا لنتائجنا ، فإن الأفراد الذين يعانون من قصور الغدة الدرقية في مدينة الخالدية يعانون من نقص فيتامين D. بالإضافة إلى ذلك ، تظهر مستويات فيتامين (د) في الدم ارتباطًا إيجابيًا مع T4 وارتباطًا سلبيًا بمستويات TSH. لتجنب الإصابة بهشاشة العظام إذا استمر قصور الغدة الدرقية ، يجب فحص جميع مرضى الغدة الدرقية العراقيين بحثًا عن نقص فيتامين د.

الكلمات المفتاحية : فيتامين D ، هرمونات الغدة الدرقية ، قصور الغدة الدرقية.