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The impact of vitamin D3 and B12 in patients with thyroid disorders in Kirkuk –Iraq

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***Abstract*---**Background: Thyroid disorders are common among Iraqis, and hypothyroidism has grown after the 2003 and 2014 events. Anemia and osteoporosis are caused by a lack of ferritin, iron, vitamins B12 and folic acid, as well as vitamin D3. Objectives: to determine thyroid status in people in Kirkuk province and to detect its relation to vitamin D3, B12 as well as its impact on main blood components. Setting: A preliminary cross-sectional study was conducted involving 105 patients attending Ibn-Nafees private medical lab. from both gender, suffering from thyroid dysfunction. their average ages were 38.12± 1.4 years. Methods: Thyroid hormones (T3), thyroid hormones (T4), and thyroid-stimulating hormone (TSH) were measured using the Mini-Vidas machine, and vitamin B12 was evaluated using an ELISA. The Sysmex XN-350 auto-analyzer was used to determine the complete blood count (CBC). Results: The total abnormality rate for thyroid function was 14.28 percent. This rate accounts for 9.52 percent of cases of hyperthyroidism and 4.76 percent of cases of hypothyroidism. Thyroid dysfunction is more prevalent in urban areas than in rural areas. Vitamin B12 insufficiency was often seen in hypothyroid individuals. There was a substantial correlation between hypothyroidism and patient gender. According to age, the sera of elderly patients exhibit a significant prevalence of hypothyroidism. The signs and symptoms that are more prevalent include hair loss, tachycardia, insomnia, skin disorder, and weight loss. The association between the onset of signs and symptoms and thyroid problems was considerable, notably for elevated T4 and TSH levels, as well as for D3 and B12 deficiency. Only leukocytosis was seen in individuals with hypothyroidism on the CBC; all other blood compartments were within normal norms. Conclusions: Kirkukian people have a high prevalence of thyroid problems. In individuals with hypothyroidism, monitoring of vitamins such as vitamin D3 and B12, as well as the white blood cell count, was required to rule out any abnormalities. More research with a larger number of patients is required to know much more about the effects of thyroid disease on the human body.

***Keywords*---**CBC, hyperthyroidism, hypothyroidism, vitamin B12, vitamin D3.

Introduction

Hypothyroidism and hyperthyroidism, two thyroid function disorders, have become increasingly common in Iraqi populations in recent years, especially in Kirkuk Province. Vitamins D3 and B12, as well as minerals like zinc, copper, and magnesium, are necessary for healthy body growth. Some disorders, such as thyroid dysfunctions, have been linked to changes in their levels (Tayeb, Salman, & Ameen, 2019).Vitamin D is a steroid molecule produced in the skin via the expression of a large number of genes involved in bone metabolism, calcium, and phosphorus homeostasis (Michaëlsson et al., 2010). Vit-D3 insufficiency has recently been linked to non-skeletal effects such as cancer, cardiovascular, metabolic, and autoimmune illnesses such as Hashimoto's thyroiditis (HT) and Graves' disease (GD). It has been found that impaired vitamin D signaling promotes thyroid tumorigenesis (Baeke, Takiishi, Korf, Gysemans, & Mathieu, 2010). Vitamin D deficiency in thyroid disease patients may be attributed to inadequate vitamin D consumption, malabsorption, lack of sun exposure, or decreased outdoor activity (Lagishetty, Liu, & Hewison, 2011). The effect of hyperthyroidism on vitamin D3 was investigated using animal models; after inducing hyperthyroidism in BALB mice via Adenovirus immunization, hyperthyroid BALB mice fed a vitamin D-deficient diet demonstrated decreased interferon-mediated responses to mitogen and a lack of memory T-cell responses to A-subunit protein. Additionally, a reduced number of splenic B cells (Misharin et al., 2009).

Additionally, another study (Yasuda et al., 2012) found no correlation between thyroid function and vitamin D levels in persons with GD. Furthermore, it was revealed that elevated 25(OH) D levels were independently associated with lower circulating TSH levels. Vitamin B12 (Vit B12), also known as cobalamin, is a water-soluble vitamin that functions as a coenzyme and is necessary for the development of a healthy neurological system and erythrocytes (Allen, 2009). Vitamin B12 shortage has been documented often in autoimmune thyroid patients; this link is most likely owing to autoimmune thyroid illnesses impairing vitamin B12 absorption. Graves disease (GD) is an autoimmune condition in which antibodies to thyrotropin receptors drive hyperthyroidism in rats resulting in hypothyroidism (Agarwal, Chhillar, Kushwaha, Singh, & Tripathi, 2010). Vitamin B12 deficiency is most often caused by atrophic gastritis, which increases the chance of developing stomach cancer, enterochromaffin-like cell hyperplasia, and gastric carcinoid. There is substantial evidence that vitamin B12 insufficiency is more prevalent in people with thyroid illness than in the general population (Sworczak & Wiśniewski, 2011). Centanni et al. studied 62 individuals with thyroid autoimmunity (AITD). Endoscopic, pathological, and immunologic tests were performed on patients with elevated serum gastrin levels 22 instances (35 percent) of atrophic gastritis were verified (Centanni et al., 1999). Ness-Abramoff et al. discovered lower vitamin B12 concentrations in 32 out of 115 individuals with AITD (28 percent) in their research (Ness-Abramof et al., 2006). Thyroid gland also has a crucial effect on erythropoiesis by induction of erythropoietin secretion and also proliferation of erythroid progenitors (Jp & Srikrishna, 2012a) Because there is no information accessible in our destination on the link between thyroid functions and levels of Vitamin D3 and B12, the present research was designed to evaluate this relationship among patients in Kirkuk Province, according to the available data.

Materials and Methods

The current study was carried on from 1st October 2021 to 1st of March 2022 in Ibn-Nafees private medical lab. With different type of study a cross-sectional work was performed. Patients and sample collections: A total of 105 patients were chosen contributes both males and females, their mean age was 38.14± 1.4 years, all patients complained of thyroid dysfunctions, seven patients were thyroidectomy and 31 patients on 50 mg of thyroxin daily. Complete information was arranged in a special questionnaire for each patient. Five ml of venous blood was drawn from each patient using a sterile technique. The first tube contains Ethylene diamine tetra-acetic acid (EDTA) used for complete blood count (CBC) by adding about one ml of the blood. The rest blood sample was discharged gently into the second tube, which contains a jell-activator that facilitates blood clotting and obtaining clear sera (Tayeb et al., 2019). The second tube was centrifuged for 5 minutes at a speed of 3000 RPM after 10 minutes of incubation. The serum was then transferred to a new sterile plan tube and stored at 20°C until use, not for more than 72 hours (Al-Jumaily, 2018). Vitamin D3, T3, T4, and TSH levels are measured using an ELISA-fluorescent approach in a Mini-Vidas equipment, which is used in the laboratory. In contrast, the ELISA kit was used to measure Vitamin B12. According to the instructions on the back of each kit, all of the tests have been completed.

Vitamin B12 Biotech

This is a competitive ELISA kit that was imported from China. It is based on the use of pre-coated antigen on solid phase in a microtiter ELISA plate.

Vitamin D determination

An automated Mini-Vidas machine decides several laboratory tests, including hormonal and immunological assays utilizing ELISA and fluorescence. An immunological competitive assay is used in the VIDAS® 25-OH Vitamin D total test. The kit was acquired in France from Biomerurix. The kit employee evaluated the technical and clinical performance of the VIDAS® 25-OH Vitamin D total test and compared the results to LC-MS/MS AND a commercially available vitamin D immune-assay. The process consisted of two basic steps: Step 1: Separate serum 25(OH)D from its protein carrier (DBP) and add to ALP conjugated vitamin D-specific antibody. ALP antibody subjected to vitamin D analog coated solid-phase receptor. Initiate the fluorescence reaction by adding substrate reagent. The quantity of 25(OH)D in the sample and the number of relative fluorescence units found in the serum are inversely related. The outcome of each serum after 45 minutes, which includes deficiency below 20 ng/ml, insufficiency 20-30 ng/ml, sufficiency 30-60 ng/ml, and toxicity beyond 70 ng/100ml (Noori, Hussien, Tayeeb, & Salman).

Thyroid hormones

The Mini-Vidas equipment was used to measure T3, T4, and TSH hormone levels, as well as particular kits for each hormone. Except for variations in substrate, coated antigen, and conjugate, each kit's basic concept was the same as that described for Vit D determination. In accordance with the Biomerurix company-France-manufactured kit procedures, each thyroid hormone was evaluated. For the measurement of T3, a volume of 100µl of serum was utilized; however, for the estimation of T4, 200µ l of serum was used.

Statistical analysis

A Microsoft Excel file was used to consolidate and organize all of the collected data. Chi-square and t-student tests were used to examine the differences in parameters between the study and control groups at the P 0.05 and P 0.01 levels of significance, respectively.

Results

The overall rate of abnormal thyroid test disorder was 14.28 % distributed in sera of 15 patients versus 85.72 % in 90 sera. The levels of the T3 hormone were within the normal range in both groups, while T4 hormone abnormalities were seen in the sera of 12 patients, the rate was 9.56%. This rate was distributed in high number among urban area patients compared to 3 patients in seral of rural area patients; most of the T4 cases showed hypothyroidism, particularly the sera of urban area patients. Concerning TSH hormone, hyperthyroidism was highly recorded versus hypothyroidism, the rates were 9.52 % and 4.76 % respectively, $P<0.05$. The general relationship between thyroid dysfunction and patient residencies was significant; Table 1. Table 2. Summarizing thyroid dysfunctions as hyperthyroidism and hypothyroidism compared to normal levels of thyroid function tests and mean levels of Vitamins D3 and B12; via which the mean levels of T3, T4, and TSH hormones are 1.34nmol/L, 162.97 nmol/Land 0.13µIU/ml respectively obtained in hyperthyroidism. On the other hand, the following mean levels 1.14, 74.64, and 21.30 were recorded for T3, T4, and TSH respectively for hypothyroidism. Vitamin D3 and B12 were within normal, the means are 39.67 and 206.69 ng /ml respectively for hyperthyroidism cases versus 61.64 and 159.23 ng/ml for Vit D3 and B12 respectively among hypothyroidism cases, $P<0.05$. Also, the same table shows the following mean levels 1.19, 100.98, 1.73, 34.85, and 228.84 for T3, T4, TSH, Vit D3, and B12 respectively in the sera of normal patients.

Table 1
Thyroid dysfunction distribution regarding patient Residencies

Residency	No. Exam %	Normal No. %	Abnormal No. %	T3	T4			TSH		
					No	Hyper	Hypo	No	Hyper	Hypo
Rural	24	21	3	24	3	2	1			
	22.85	87.5	12.5			8.33	4.16	3	2	1
Urban	81	69	12	81	9	1	8	12.5	8.33	4.16
	77.15	85.18	14.81			1.23	9.87	12	8	4
Total	105	90	15	105	12	3	9	14.81	9.87	4.93
	100	85.72	14.28			9.56	14.03	15	10	5

Table 2
A Thyroid dysfunctions concerning vitamin D3 and Vitamin B12 levels

Thyroid Status	T3 Mean ± s.e	T4 Mean ±s.e	TSH Mean ±s.e	Vit-D3 Mean ±s.e	Vit-B12 Mean ±s.e
Hyperthyroidism	1.34±0.015	162.97±16.97	0.13±0.005	39.67±2.53	209.69±8.06
Hypothyroidism	1.14±0.19	74.64±0.45	21.30±2.11	61.64±4.51	159.23±17.33*
Normal	1.19±0.08	100.98±3.67	1.73±1.73	34.85±5.76	228.84±6.03

*$P<0.05$, normal ranges:T3 = 0.9 to 2.3 nMol/L , T4=60 to 120 nMol/L ; TSH 0.25 to 5.0 µIU/ml

The correlation of thyroid dysfunction, Vitamins D3 and B12 regarding patients ages and genders were shown in table 3. In general, the mean levels of T3 and Vit D3 were within normal ranges in both genders and different age groups. While TSH levels showed a significant difference; the mean level in males was 8.53 µIU/ml versus 3.51 µIU/ml in the sera of females, $P<0.05$. The same relationship was reported concerning Vitamin B12 in males 185.53 ng/ml compared to normal mean level 212.93 ng /ml females, $P<0.05$. Conclusively the relationship between Vitamin B12, hypothyroidism, and patient genders was significant, $p <0.05$. Regarding patient ages also T3, T4, and Vitamin D 3mean levels were within normal ranges in all ages.

The significant difference was clear regarding TSH mean level which is high inpatient aging over than 50 years, the following levels 7.24 versus 6.25 µIU/ml were recorded in sera of females and males respectively, $P <0.05$. Moreover, Vit B12 mean level was dropped in the same age of male 156.5 ng/ml compared to the normal mean level of 268.95 ng/ml in the same age in females, The impact of hypothyroidism was obvious in decreasing the mean level of Vit B12 in elderly patients and patients ages from 31 to 40 years, $P<0.05$.The following signs and symptoms were noticed: Hair drop 73(69.52%) followed by tachycardia 63(60%), Insomnia 58(55.70%), skin disorder 51(48.57), weight loss 41(39.04), weight gain 35(33.33).meanwhile the lowest rates16(15.23 %), 14(13.33 %) and 7 (6.66 %) were recorded with diabetes Mellitus, hyperlipidemia and the symptoms of thyroidectomy respectively, as shown in table 4.

Table 3
Mean and standard errors of Thyroid function tests, Vitamins D3, B12 concerning patient gender

Female (Age years)	T3	T4	TSH	Vit-D3	Vit-B12
10-20	1.3 ± 0.05	86.16± 3.01	2.24± 0.029	38.79 ± 2.71	202.36 ± 2.79
21-30	1.41± 0.1	100.06± 7.30	3.07± 0.18	34.66 ± 6.39	198.13 ± 1.85
31-40	1.16± 0.04	103.1± 5.36	1.77± 0.09	33.77 ± 6.19	194.07 ± 4.44
41-50	1.52± 0.07	95.25± 1.24	3.26± 0.047	40.215 ± 2.13	201.18 ± 3.35
50 above	1.30± 0.09	106.3± 4.58	7.24± 0.489	45.39 ± 3.95	268.95 ± 5.92
Total mean± s.e	1.33± 0.07	98.18± 4.28	3.51± 0.167	38.56 ± 4.27	212.93 ± 3.67
Male (Age years)	T3	T4	TSH	Vit-D3	Vit-B12
10-20	1.43± 0.03	123 ± 11.02	1.50± 0.043	65.45 ± 8.36	198.6 ± 2.24
21-30	1.58± 0.09	98.17 ± 1.10	1.24± 0.15	42.34 ± 3.06	201.33 ± 3.24
31-40	1.76± 0.18	94.66 ± 1.93	31.23 ± 0.96	47.47 ± 2.33	177.75 ± 5.44
41-50	1.47± 0.03	104.36± 0.68	2.46± 0.24	54.81 ± 1.23	193.5 ± 2.13
50 above	1.81± 0.14	99.61 ± 3.86	6.25± 0.89	59.15 ± 2.99	156.5 ± 8.95
Total mean ± s.e	1.61±0.09	103.96± 3.71	8.53± 1.57 *	44.38 ± 3.11	185.53 ± 4.32

Table 4
Common signs and symptoms among patients in the current study

Signs and symptoms	No. +ve	%
Thyroidectomy	7	6.66
Diabetes Mellitus DM	16	15.23
Hyperlipidemia	14	13.33
Weight loss	41	39.04
Weight gain	35	33.33
Hair drop	73	69.52
Skin disorder	51	48.57
Insomnia	58	55.70
Tachycardia	63	60.00
Total No. Exam	105	

Table 5 was shown the frequency of thyroid dysfunction according to signs of symptoms were seen as follows: hair drop 6 cases with high T4 levels and 7, 9 cases with Low TSH and High TSH, followed by 4 and 7 by tachycardia, insomnia 2 and 6, 3 and 5 for both skin disorder and weight loss in low and high TSH respectively. Hyperlipidemia was seen in sera of 2 patients with elevated TSH levels only. No abnormal levels of 3 thyroid functions were seen in sera of DM patients. Relationship between symptoms, thyroid function disorders with vitamins showed decreasing of Vitamin D3 and B12 was significant, the incidences of elevated Vitamin D3 according to symptoms was lower compared low vitamin D3, $P<0.05$. Despite fluctuated numbers of lower Vitamin B12 according to symptoms, the relationship was significant between thyroid disorders and lowered levels of vitamin B12, $P<0.05$.

Table 5
Distribution of abnormalities thyroid dysfunctions, vitamin D3 and B12 according to Associated signs and symptoms

Signs and symptoms	Thyroid levels T4		TSH		Vitamin D3 levels		Vitamin B12 levels	
	low	High	Low	High	Low	High	Low	High
Diabetes Mellitus DM	0.0	0.0	0.0	0.0	4.0	0.0	12	0.0
Hyperlipidemia	0.0	0.0	0.0	2.0	7.0	0.0	6.0	0.0
Thyroidectomy	0.0	0.0	3.0	1.0	2.0	0.0	7.0	0.0
Weight loss	0.0	0.0	3.0	5.0	16.0	0.0	18.0	0.0
Weight gain	0.0	0.0	5.0	3.0	15.0	2.0	16.0	0.0
Hair drop	0.0	6.0	7.0	9.0	23.0	3.0	42.0	0.0
Skin disorder	1.0	3.0	3.0	5.0	24.0	4.0	21.0	0.0
Insomnia	3.0	6.0	2.0	6.0	21.0	5.0	24.0	0.0
Tachycardia	1.0	5.0	4.0	7.0	21.0	5.0	29.0	0.0
Total No. Exam	105							

The current study has studied the probability of main blood components changes and the following results were obtained: Red blood corpuscles count(RBCs), hemoglobin level(Hb) mean levels were within normal ranges among normal patients and patients with hypo/hyperthyroidisms. Although platelets count variations in mean counts particularly 277.7 in blood samples of patients with hypothyroidism which is higher normal than 220.58, during hyperthyroidism, statistically was not significant. A good relationship was exerted in the white blood cells count (WBCs) via which leukocytosis(12.24 cells/mm^3) was seen during hypothyroidism compared to normal WBCs among normal [patients and during hyperthyroidism, the following means were recorded: 8.197 and 9.53 cells/mm^3 respectively P<0.05.

Table 6
Main blood components regarding thyroid dysfunction

Thyroid Status	RBCs X 106	Hb gm/dl	PCV %	Platelets cells/mm^3	WBCs X 103 cells/mm^3
	Mean ± s.e	Mean ±s.e	Mean ±s.e	Mean ±s.e	Mean ±s.e
Hyperthyroidism	4.76 ± 0.31	13.12 ± 0.68	39.3 ± 2.14	220.58 ± 15.36	9.53 ± 0.57
Hypothyroidism	4.73 ± 0.22	13.04 ± 0.26	37.0 ± 2.00	277.7 ± 18.94	12.24 ± 0.71*
Normal ±	4.83 ± 0.11	12.09 ± 0.64	38.06 ± 0.64	279.9 ± 9.08	8.197 ± 0.9

* P<0.05, For normal range detailes, see material method.

For detecting anemia among patients with thyroid disorders, table 7 below was showing the obtained results of blood indices: mean corpuscle volume(MCV), Mean corpuscle hemoglobin(MCH), and mean corpuscle hemoglobin concentration(MCHC), all the results in this regard were within normal ranges, except, MCH mean level 26.97 pg was slightly lower than the normal range(27 to 31pg). However, the impact of thyroid hormones dysfunction on blood indices was not significant p>0.05. For detecting anemia among patients with thyroid disorders, table-7 below was showing the obtained results of blood indices: mean corpuscle volume(MCV), Mean corpuscle hemoglobin(MCH), and mean corpuscle hemoglobin concentration(MCHC), all the results in this regard were within normal ranges, except, MCH mean level 26.97 pg was slightly lower than the normal range(27 to 31pg). However, the impact of thyroid hormones dysfunction on blood indices was not significant p>0.05.

Table 7
Hemoglobin level, Red blood cell indices concerning thyroid dysfunction

Thyroid Status	RBCs X 106 Mean ± s.e	Hb gm/dl Mean ±s.e	MCV Mean ±s.e	MCH Mean ±s.e	MCHC Mean ±s.e
Hyperthyroidism	4.68 ± 0.31	13.12 ± 0.68	83.41 ± 3.41	28.15 ± 1.03	33.7 ± 1.14
Hypothyroidism	4.45 ± 0.22	13.04 ± 0.26	81.45 ± 1.28	28.26 ± 0.6	34.36 ± 0.65
Normal	4.64 ± 0.11	12.09 ± 0.64	78.79 ± 2.16	26.97 ± 1.33	34.14 ± 1.12

Normal ranges, MCv=77 to 100 pg/cells, MCH=27 to 31 ft/cells and MCHC=32 to 26 gm/dl.

Discussions

Thyroid dysfunction was unknown in Iraq before the last three or four decades, but after 1980 and with the lifestyle change, there has been an increase in awareness about most of the prevalent diseases. High-quality diagnostic laboratory methods, such as HIV and hepatitis kits and more advanced clinical biochemistry, in particular, the hormonal assays guide the physician for a good diagnosis of thyroid disorders known as either hyperthyroidism or hypothyroidism, using more advanced tests such as anti-thyroglobulin antibody test TG ab, TG ab, anti-thyroid peroxidase (microsomal) antibody (TPO ab), and other tests (Vanderpump, 2011). Fine-needle aspiration with ELISA and fluorescent cytology to rule out any alterations in the thyroid glands. Furthermore, The rate of abnormal thyroid 14.28 percent in the current study was high, which may be due to several factors, including the ongoing war on Iraq, instability, economic sanctions, poverty, crises after 2003, and the events following 2014, which resulted in the displacement of Iraqi citizens from the west and the north. Most people lost their employment and were forced to live in poverty due to the deterioration of the infrastructure, which led to nutritional deficiencies and even hypovitaminosis in certain cases (Mohammed, Abdulmahdi, & Nabat). such as vitamin D3 and B12, as well as trace elements such as iodine, which is required for thyroid hormone production (Rasheed, Sadek, & Salman, 2019).

The present study's findings contradicted those from Australia and Nepal, which revealed rates of 18.6 percent and 22.42 percent, respectively. (Merno-asso et al., 2020; Sharma, Magar, & Mahesh, 2021) while it was in agreement with 14.45 % and 14.6 % that recorded in Baghdad and Sulaimania in Iraq respectively also

(Faisal, 2010; HASAN, SAEED, RASHID, & ABDULLAH, 2017). Although the prevalence of local thyroid dysfunction was 14.81 percent in urban regions compared to 12.5 percent in rural areas, the rate of hyperthyroidism was 9.87 percent higher in rural areas than in urban areas, where the rate was 4.93 percent. This observation may be explained by the fact that thyroid dysfunction may be caused by the geographic location and pattern of iodine deficit (!!! INVALID CITATION !!!).

In table 2, thyroid dysfunction was classed as hypothyroidism and hyperthyroidism. The mean rate of hyperthyroidism was 0.13± 0.005 TSH and 162.97±16.97for T4 versus 21.30±2.11 and 74.64 ± 0.45 for TSH and T4 during hypothyroidism this finding was in agreement with that recorded in the same Province during 2010 by (Jalal, Al-Samarrai, & Al-Tikriti, 2010). This indicates the poor health of thyroiditis patients in Kirkuk Province for over 4 decades, especially when compared to other frequent illnesses like toxoplasmosis (high mean rate), which may lead to health issues including habitual miscarriage or congenital defects in females (Y. Salman & Mustafa, 2014). Vitamin D3 had an upper normal limit in hypothyroidism compared to sufficiency in hyperthyroidism. (Alameri, Wafa, Moriarty, Lessan, & Barakat, 2018). The mean level of vitamin B12 in hypothyroidism patients was 159.23 ng/ml compared to 209.69 ng/ml in hyperthyroidism patients, indicating that hypothyroidism has a greater influence on vitamin B12 than hyperthyroidism. Inadequate food intake and malabsorption are the most prevalent causes of B-12 insufficiency. Inadequate nutritional intake is especially common in developing nations when animal products are a small part of the diet. Vegetarians and the elderly, particularly those who are underweight, are more prone to deficiencies (Khattak, Shahmim, Alam, Mohsin, & Gul, 2001; Meng et al., 2015).

Furthermore, several parasitic illnesses, such as intestinal giardiasis (Y. J. Salman, Al-Taee, & Abid, 2016) and cyclosporiasis (Y. J. Salman, Kadir, & Abdul-Allah, 2015), have been shown to cause malabsorption, which necessitates a general stool examination to verify the true involvement of B12 deficiency in hypothyroidism patients. Patients of all ages with thyroid dysfunction had normal levels of T3 hormone and vitamin D3 in both groups tested and compared, regardless of their age or gender. These data show that thyroid malfunction has no negative effect on vitamin D3 levels in the body. Male sera from children aged 1 to 10 years had greater levels of T4 than female sera, which may indicate an overactive thyroid in these young children (hyperthyroidism). Anxiety, unexplained weight loss, tremors, and diarrhea are among the symptoms that might help establish a diagnosis of this kind (Muller, Levitt, & Louw, 1997).

TSH levels in the sera of elderly individuals, especially those over the age of 50, are greater in females than in males (7.24 vs 6.25 UI/L, respectively). Hypothyroidism is increasingly frequent in older people, particularly women, because of the increased incidence and prevalence of autoimmune thyroiditis (Díez, 2002; Garber et al., 2012). Thyroid hormone activity has also been linked to decreased estrogen levels in prior studies (Chen et al., 2019). While males had a greater total mean TSH than females, this was not the case in China, where the total mean TSH was lower (Serin et al., 2002). Stress associated with nature and lifestyle in recent Iraq owing to instability and poverty, most of the graduating males were unemployed. The current study found that tachycardia, hair loss, insomnia, and skin disorders (cracks, hair scarring roughness, or smoothness of the skin) are common signs and symptoms among patients with thyroiditis (Collins & Pawlak, 2016). Furthermore, autoimmune thyroid illness is linked to pernicious anemia and atrophic gastritis, both of which cause vitamin B-12 malabsorption (Kawa et al., 2010). Vitamin D deficiency and hypovitaminosis have been linked to hypothyroidism symptoms and signs (Kawa et al., 2010). Vitamin D, generated by the skin, controls numerous genes and helps maintain calcium and phosphate balance (Jp & Srikrishna, 2012b). Vitamin D3 estimate was required to prevent bone mineral loss and osteoporosis.

Thyroid problems are usually accompanied by changes in the red blood cell count and composition. Thyroid hormones are often shown to have a significant impact on erythropoiesis. They promote erythropoiesis by promoting the proliferation of immature erythroid progenitors, and they promote the secretion of erythropoietin (EPO) by increasing the expression of the erythropoietin gene (also known as erythropoietin gene expression) (Erikci et al., 2009). Thyroid hormones also promote HIF-1 repletion and so erythroid colony formation (BFU-E, CFU-E). Their effects on erythrocyte 2, 3 DPG compactness improve oxygen transport to tissues. Hyperthyroidism causes neutropenia, thrombocytopenia, and normal to modest declines in total white blood cell count. Hypothyroidism produces hypoplasia in all myeloid cell lines, whereas hyperthyroidism causes hyperplasia. T3 acts as a precursor chemical for proper B cell production in the bone marrow by promoting pro-B cell proliferation. Thyroid problems, therefore, affect multiple blood cell lineages (Dorgalaleh et al., 2013). However, the current study's findings indicated no differences in the mean levels of RBCs, hemoglobin, or platelet count between the circumstances of hyperthyroidism and hypothyroidism.

In contrast, the platelet count, although within acceptable limits, was lower in hyperthyroidism than in hypothyroidism Platelets are less affected by thyroid function status, this finding has been found in many other studies this may be because platelets are non-nucleated and have a short life span with continuous rapid turnover (Fatima, Dotasara, & Gauri, 2020). Patients with hypothyroidism had a significant difference in white blood cell count ($P<0.050$), and they had apparent leukocytosis (high number of white blood cells). This observation might be attributable to hypoplasia as well as the activity of T3 in promoting B cell production, and it could also be related to inflammation in the body, namely thyroiditis. In this situation, active phase protein measurement (CRP) may be useful in confirming the diagnosis. This outcome was not consistent with what was documented in Iran by (Metwalley, Farghaly, & Hassan, 2013). There is no significant difference between thyroid dysfunction and the control group in terms of MCV, MCH, MCHC, or hemoglobin except for a modest drop in the mean level of MCH among the control group. The subject in this research had no severe anemia.

Conclusion

The prevalence of thyroid dysfunction, particularly hypothyroidism, was higher than expected in this research, especially among older patients and those living in urban regions. Tachycardia, hair loss, sleeplessness, and weight loss were all seen. Patients with hypothyroidism had leukocytosis despite a normal blood cell count. As part of the follow-up of thyroid patients and those diagnosed with anemia, a full blood count should be performed before starting iron medication. Thyroid dysfunction should be evaluated in cases of persistent anemia.

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