



وقائع المؤتمر العلمي الدوري الثاني للمديرية العامة للتربية في بغداد الرصافة الثانية الموسوم:
(البحث العلمي وسيلة حضارية لتطوير العملية الاشرافية والنهوض بالواقع التربوي)
وتحت شعار
(البحث العلمي والاشراف التربوي رؤى مشتركة لبناء عملية تربوية ناجحة)
يومي الاربعاء و الخميس 22-23/10/2025

Effect of age and gender on the expression level of IL-6 and thyroid hormones TSH, T3, T4 in thyroid patients.

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Abstract

The thyroid gland is an endocrine gland responsible for the synthesis and secretion of thyroxine (T4) and triiodothyronine (T3) (thyroid hormones), which play a key role in regulating metabolism as well as development and growth, Thyroid disorders a disease affecting the thyroid gland, resulting from an abnormality resulting from excessive or insufficient activity. **This study aimed To** evaluate the level of immune factor Interleukin-6 (IL-6) and thyroid hormones; Thyroid Stimulating Hormone (TSH), Triiodothyronine (T3), Thyroxin (T4) in thyroid patients. **Material and method** This study was conducted by collecting (50) blood samples from thyroid patients and (50) individuals as a control group, aged between (30-65) years. Interleukin 6 (IL-6) levels were measured using ELISA, and thyroid hormones (TSH, T3, and T4) were measured. Samples were collected from April 2024 to September 2024, Patient data (age, gender, smoking, family history) were collected, **Results** The results showed that the highest infection rate was in the age group (≤ 50) as it reached (50%), and the highest infection rate was in males as it reached (60%), and the highest expression rate of ((IL-6) was in the age group (≥ 60) as it reached (21.2198 ± 7.4022 , 33.4202 ± 7.43473) respectively, and the results showed a significant difference in the expression of (IL-6) in females as it reached (16.2766 ± 6.87162) in patients compared to control (3.4363 ± 1.20474) ($p \leq 0.001$), The results also showed a significant difference in the expression of (TSH), which reached (5.3053 ± 7.84264) in patients compared to healthy people (2.3450 ± 1.98495) ($p \leq 0.01$). The results also showed a significant difference in the expression of (TSH) in patients, which reached (7.3205 ± 9.63679) in females. The results also showed a significant difference in the expression of (T3) in patients in all age groups ($p \leq 0.05$), The results also showed a significant difference in T3 expression across different age groups ($p \leq 0.05$). Regarding T4 expression, the results showed a significant difference in T4 expression among patients (6.7440 ± 1.42115) compared to healthy controls (7.9500 ± 3.08097) ($p \leq 0.01$), The results also showed a significant difference in (T4) expression across different age groups



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($p \leq 0.001$). **Statistical Analysis** Statistical analysis was performed using using spss version 25.

Conclusion

The current study showed that the highest incidence rate was in the age group (≤ 50) and the highest expression rate of (IL-6) was in the age group (≥ 60) and there was a significant difference in the expression of (IL-6) in females compared to the control group. The study showed a significant difference.

The study also showed a significant difference in TSH expression in patients compared to the control group. There was also a significant difference in TSH expression in female patients. The age groups of patients also showed a significant difference in T3 expression in patients across all age groups.

Keywords: Thyroid disease, IL-6, thyroid hormones, Thyroid-stimulating hormone, T3, T4.

Introduction

The thyroid gland is an endocrine gland responsible for the synthesis and secretion of thyroxine (T4) and triiodothyronine (T3) (thyroid hormones), which play a key role in regulating metabolism as well as development and growth (Sadra, F., 2023), Autoimmune thyroid diseases (AITDs) are the most common endocrine disorders worldwide (Deraz et al. 2019) (Casto et al. 2021), Thyroid disorders are disorders affecting the thyroid gland. These disorders are divided into two types: hyperthyroidism and hypothyroidism, depending on the high or low levels of thyroid hormones (thyroxine and triiodothyronine), respectively (Caturegli, De Remigis, and Rose 2014) (Hasan, Ibrahim, and Rasheed 2022). The genetic onset of this disease requires an environmental trigger (Ragusa et al. 2019).

IL-6 is a soluble cytokine with multiple functions, playing a key role in immunity by regulating inflammatory responses. It is secreted by many cell types, including macrophages, dendritic cells, T and B lymphocytes, fibroblasts, endothelial cells, and cancer cells (Waldner, Foersch, and Neurath 2012) (Zhang, Liu, and Zhou 2016).

IL-6 has multiple functions such as regulating immune and inflammatory responses (Kobawala et al. 2016) interacting with dendritic cell receptors (Machala et al. 2019). (Xu et al. 2022), It activates signal transduction through various pathways. Consequently, it influences the proliferation, migration, and invasion of cancer cells, is associated with poor prognosis in many cancer types, and has biological roles such as stimulating cancer cell growth and inhibiting antibody responses to viruses (GOYAL et al. 2022), Some



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studies have shown that IL-6 not only promotes tumor proliferation but also enhances symptoms of metastasis and wasting (Kobawala et al. 2016).

Thyroid-stimulating hormone (TSH) is a hormone produced by the pituitary gland that plays a role in regulating thyroid function (Hasan, Ibrahim, and Rasheed 2022) , Studies have shown that thyroid hormones affect mitochondrial oxidative activity, protein synthesis, and muscle fiber differentiation. They also play a role in capillary growth (Abdullah et al. 2024).

Material and Methods

This study was conducted by collecting (50) blood samples from thyroid patients and (50) individuals as a control group of both sexes, aged between (30-65) years. The disease was diagnosed by doctors at the Medical City Hospital in Baghdad Governorate. The sample collection period lasted from April 2024 to September 2024.

Serum sample processing

5 ml of serum was collected from both groups and placed in gel tubes, left for 30 minutes at room temperature, and then the tubes were centrifuged for 15 minutes at 3000 rpm. The serum was isolated, and a portion of it was placed in Eppendorf tubes and stored at -20°C for subsequent assay for interleukin 6 (IL-6) by ELISA technique from Koma BIOTICH (Korea), The other portion of serum was used to measure thyroid hormones (TSH, T3 and T4), Patient data (age, gender, smoking, family history) were collected.

Statistical Analysis

Statistical analysis was performed using (Steel and Torrie 1960) using spss version 25.

Results and Discussion

Table (1) shows the division of the patient and control groups according to age. They were divided into three groups (≤ 50 , 51-59, ≥ 60) where their number was (25, 15, 10) (50, 30,20)% respectively for both the patient and healthy groups.

Table (1): Ratios of Patient to Control by Age Group

Characteristic	Patient		Control	
	NO.	%	No.	%
Age				
≤ 50	25	50%	25	50%
51-59	15	30%	15	30%
≥ 60	10	20%	10	20%
Total	50	100%	50	100%

The results of the current study showed that the highest infection rate was among individuals whose ages were (≤ 50) (50%) compared to the rest of the ages (51-59 and ≥ 60) (30%,20%) respectively. This result was agreed with a previous study that showed that the highest infection rate was among patients over 40 years of age (Y. J. Abdullah, Essa, and Jumaa 2022) (Assi, Alhasan, and Salman 2024).

This may be due to the fact that this age group experiences psychological and hormonal changes that contribute to suppressing immunity and reducing the ability to resist disease.

Table (2) shows the division of the patient and control groups according to gender. They were divided into two groups (male, female) where the number of (30,20) (60, 40)% among patients compared to control group (40, 10) (80, 20)% respectively.

Table (2): Ratios of Patient to Control by Sex.

Characteristic	Patient		Control	
	NO.	%	No.	%
Sex				
Male	30	60%	40	80%
Female	20	40%	10	20%
Total	50	100%	50	100%

The results of the current study showed a higher incidence of thyroid disease in males; This may be attributed to the elevated pro-inflammatory cytokine IL-6 in males, as shown in Table 1. It enhances the production of acute-phase proteins, regulates immunity and inflammation, and works with the male hormone testosterone to stimulate the C-reactive protein gene in male mice (Szalai et al. 1998), However, the results of the study were not consistent with those of (Chen et al. 2015) (Assi, Alhasan, and Salman 2024).

Level of IL-6 in Patients and Control Group.

The results of Table (3) showed that there was no significant difference in the expression level of IL-6 as it reached (18.2604 ± 9.84984) compared to the control group (19.4459 ± 12.60720).

Table (3): The IL-6 Level in patients and control groups

levels of IL-6		T-test	p-value
Patients Group (No. 50) (Mean \pm SD)pg/ml	Control Group (No. 25) (Mean \pm SD)pg/ml		
18.2604 ± 9.84984	19.4459 ± 12.60720	-0.524	0.601 NS

NS: Non-significant.

Thyroid dysfunction has been associated with decreased serum IL-6 levels, as well as impaired oxidative status. Therefore, studies have emphasized the role of nutritional supplements as well as the antioxidant defense system in improving thyroid dysfunction (Abdullah et al. 2024).

Level of IL-6 in Patients and Control Group Based on Age

The results in a table (4) showed a significant difference in IL-6 level patient as it reached (21.2198 ± 7.40226) in the age group (≥ 60) compared with the control group (33.4202 ± 7.43473) ($P \leq 0.01$) However, the difference was non-significant in the age group (≤ 50 , 51-59), as it reached (17.2763 ± 11.93140 , 17.9277 ± 7.22475) compared with the control group (18.6866 ± 10.07850 , 11.3953 ± 11.69071) respectively . However, there was a highly significant difference in its level among all age groups of control ($P \leq 0.001$) but there was non-significant in patients group (≤ 50 , 51-59, ≥ 60).

Table (4) : Association of IL-6 level with age in the patients and control group.

Age	IL-6						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 50)				
	No.	%	Mean \pm SD	No.	%	Mean \pm SD		
≤ 50	25	50%	17.2763 ± 11.93140	25	50%	18.6866 ± 10.07850	-.451	0.654 NS
51-59	15	30%	17.9277 ± 7.22475	15	30%	11.3953 ± 11.69071	1.841	0.076 NS
≥ 60	10	20%	21.2198 ± 7.40226	10	20%	33.4202 ± 7.43473	- 3.677	0.002**
F-test	0.575			14.246				
P-value	0.567 NS			0.000***				

NS: Non-significant. **: significant ($p \leq 0.01$), ***: significant ($p \leq 0.001$).

The results of the current study were consistent with one study that showed an increase in expression levels (IL-6) with age among groups of thyroid patients (Maggio et al. 2006), although the difference was not significant. The same applies to healthy groups, where there was a significant difference ($p \leq 0.001$), This is because IL-6 is linked to aging and chronic diseases, being one of their major signaling pathways (Maggio et al. 2006).

Level of IL-6 in Patients and Control Group Based on Sex.

The results in a table (5) showed a highly significant difference in IL-6 level control as it reached (16.2766 ± 6.87162) ($P \leq 0.001$) in the sex group (female) compared with the control group (3.4363 ± 1.20474) . However, the difference was non-significant in the sex group (male), as it reached (19.5830 ± 11.33441) compared with the control group (23.4483 ± 10.82640) . However, there was a highly significant difference in its level sex groups of control ($P \leq 0.001$) but there was non-significant in patient group.

Table (5): Association of IL-6 level with sex in the patients and control group.

Sex	Level of IL-6 in						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 25)				
	No.	%	(Mean±SD)pg/ml	No.	%	(Mean±SD)pg/ml		
Male	30	60%	19.5830 ±11.33441	40	80%	23.4483 ±10.82640	- 1.449	0.152 NS
Female	20	40%	16.2766 ± 6.87162	10	20%	3.4363 ±1.20474	5.815	0.000***
T-test			1.167			5.792		
P-value			0.249 NS			0.000***		

NS: Non-significant. ***: significant ($p \leq 0.001$)

Interleukin-6 (IL-6) plays a role in regulating immunity and energy metabolism. It affects the biological clock in both males and females, despite the differences between the two sexes in the biological clock and immune processes It also plays a role in regulating metabolism and reproduction. It operates 24 hours a day, but is affected by factors such as sleep (González-Vila et al. 2025).

Level of TSH in Patients and Control Group.

The results of Table (6) showed a highly significant difference ($p \leq 0.01$) in the level of expression of TSH, which reached (5.3053 ± 7.84264) in patients compared to the control group (2.3450 ± 1.98495) .

Table (6): The TSH Level in patients and control groups

levels of TSH		T-test	p-value
Patients Group (No. 50) (Mean±SD)pg/ml	Control Group (No. 25) (Mean±SD)pg/ml		
5.3053 ± 7.84264	2.3450 ± 1.98495	2.588	0.01**

** : significant ($p \leq 0.01$).

The results of the current study were consistent with one study showing a higher level of (TSH) in patients compared to healthy individuals (Machala et al. 2019) (Y. J. Abdullah, Essa, and Jumaa 2022). This is explained by the fact that in cases of hypothyroidism, the pituitary gland increases its production of TSH, which stimulates the thyroid gland to increase its activity (Sadra,F.,2023).

Level of TSH in Patients and Control Group Based on Age

The results in a table (7) showed a highly significant difference in TSH level patients as it reached (7.5355 ± 10.52750) in the age group (≤ 50) compared with the control group (1.9520 ± 1.96500) ($P \leq 0.05$). However, the difference was non-significant in the age group (51-59) and (≥ 60), as it reached (2.6540 ± 1.57926) and (3.7069 ± 2.66064) compared with the control group (3.0000 ± 1.91764) and (2.3450 ± 2.07129) respectively. However, there was a non-significant difference in its level among all age groups of patients and controls group (≤ 50 , 51-59, ≥ 60).

Table (7) : Association of TSH level with age in the patients and control group.

Age	TSH						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 50)				
	No.	%	Mean \pm SD	No.	%	Mean \pm SD		
≤ 50	25	50%	7.5355 ± 10.52750	25	50%	1.9520 ± 1.96500	2.607	0.012*
51-59	15	30%	2.6540 ± 1.57926	15	30%	3.0000 ± 1.91764	-0.539	0.594 NS
≥ 60	10	20%	3.7069 ± 2.66064	10	20%	2.3450 ± 2.07129	1.277	0.218 NS
F-test			2.175			1.324		
P-value			0.125 NS			0.276 NS		

NS: Non-significant. *: significant ($p \leq 0.05$).

A high level of TSH expression in the age group (≤ 50) indicates that this group has low thyroid hormone expression.

Level of TSH in Patients and Control Group Based on Sex.

The results in a table (8) showed a significant difference in TSH level patient as it reached (7.3205 ± 9.63679) in the sex group (male) compared with the control group (2.3450 ± 1.99003) ($P \leq 0.01$) However, the difference was non-significant in the sex group (female), as it reached (2.2826 ± 0.92083) compared with the control group (2.3450 ± 2.07129). However, there was a significant

difference in its level sex groups of patient ($P \leq 0.05$) but there was non-significant in control group.

Table (8) : Association of TSH level with sex in the patients and control group.

Sex	Level of TSH in						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 25)				
	No.	%	(Mean±SD)pg/ml	No.	%	(Mean±SD)pg/ml		
Male	30	60%	7.3205 ±9.63679	40	80%	2.3450±1.99003	3.183	0.002**
Female	20	40%	2.2826±.92083	10	20%	2.3450±2.07129	-0.115	0.909NS
T-test			2.323			0.000		
P-value			0.024*			1.000 NS		

NS: Non-significant. *: significant ($p \leq 0.05$) **: significant ($p \leq 0.01$).

The current study showed that males had higher TSH levels than females. This may be due to: The effect of testosterone on thyroid function, which attempts to increase T4 levels. It is believed that testosterone stimulates the conversion of T4 to T3, the more active hormone (Szalai et al. 1998).

Level of T3 in Patients and Control Group.

The results of Table (9) showed no significant difference in the expression level of TSH, which reached ($1.1760 \pm .18867$) in patients compared to the control group ($1.1850 \pm .39901$).

Table (9): The T3 Level in patients and control groups

levels of T3		T-test	p-value
Patients Group (No. 50) (Mean±SD)pg/ml	Control Group (No. 25) (Mean±SD)pg/ml		
1.1760 ± .18867	1.1850 ± .39901	-0.144	0.886 NS

NS: Non-significant

The results of the current study were consistent with one study that showed no significant difference in the level of (T3) between patients compared to healthy individuals (Machala et al. 2019).

Level of T3 in Patients and Control Group Based on Age

The results in a table (10) showed a highly significant difference in T3 level patients as it reached ($1.1020 \pm .15331$) in the age group (51-59) compared with the control group ($1.3167 \pm .38548$) ($P \leq 0.05$). However, the difference

was non-significant in the age group (≤ 50 , ≥ 60), as it reached ($1.2476 \pm .21892$, $1.1080 \pm .03048$) compared with the control group ($1.1060 \pm .39500$, $1.1850 \pm .41637$) respectively . However, there was a significant difference in its level among all age groups of patients but the difference was non-significant in the s controls group (≤ 50 , $51-59$, ≥ 60).

Table (10) : Association of T3 level with age in the patients and control group.

Age	T3						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 50)				
	No.	%	Mean \pm SD	No.	%	Mean \pm SD		
≤ 50	25	50%	1.2476 $\pm .21892$	25	50%	1.1060 \pm .39500	1.568	0.124 NS
51-59	15	30%	1.1020 $\pm .15331$	15	30%	1.3167 $\pm .38548$	- 2.004	0.05*
≥ 60	10	20%	1.1080 $\pm .03048$	10	20%	1.1850 \pm .41637	- 0.583	0.567 NS
F-test			4.053			1.324		
P-value			0.024*			0.276 NS		

NS: Non-significant. *: significant ($p \leq 0.05$) .

The current study showed a significant difference in the expression of (T3) in the age group (51-59) among patients compared to healthy individuals. This may be due to the fact that this age group witnesses hormonal changes, which may affect the level of (T3) expression

Level of T3 in Patients and Control Group Based on Sex.

The results in a table (11) showed a non-significant difference in T3 level patient as it reached ($1.1270 \pm .22722$, $1.2495 \pm .05934$) in the sex group (male, female) compared with the control group ($1.1850 \pm .40003$, $1.1850 \pm .41637$) respectively. However, there was a significant difference in its level sex groups of patient ($P \leq 0.05$) but there was non-significant in control group.

Table (11) : Association of T3 level with sex in the patients and control group.

Sex	Level of T3 in						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 25)				
	No.	%	(Mean±SD)pg/ml	No.	%	(Mean±SD)pg/ml		
Male	30	60%	1.1270 ±.22722	40	80%	1.1850±.40003	-0.712	0.479 NS
Female	20	40%	1.2495 ±.05934	10	20%	1.1850±.41637	0.691	0.495 NS
T-test			-2.351			0.000		
P-value			0.023*			1.000 NS		

NS: Non-significant. *: significant ($p \leq 0.05$).

Level of T4 in Patients and Control Group.

The results of Table (12) showed a highly significant difference ($p \leq 0.01$) in the level of expression of T4, which reached (6.7440 ± 1.42115) in patients compared to the control group (7.9500 ± 3.08097).

Table 12: The T4 Level in patients and control groups

levels of T4		T-test	p-value
Patients Group (No. 50) (Mean±SD)pg/ml	Control Group (No. 25) (Mean±SD)pg/ml		
6.7440 ±1.42115	7.9500 ± 3.08097	-2.513	0.01**

** : significant ($p \leq 0.01$).

The results of the current study were consistent with one study that showed no significant difference in the level of (T3) between patients compared to healthy individuals (Machala et al. 2019).

Level of T4 in Patients and Control Group Based on Age

The results in a table (13) showed a highly significant difference in T4 level patient as it reached ($5.8733 \pm .82155$) in the age group (51-59) compared with the control group (8.9667 ± 2.97650) ($P \leq 0.001$). However, the difference was non-significant in the age group (≤ 50 , ≥ 60), as it reached (7.4440 ± 1.45175 , 6.3000 ± 1.21747) compared with the control group (7.3400 ± 3.05000) and (7.9500 ± 3.21498) respectively. However, there was a highly significant difference in its level among all age groups of patients

($P \leq 0.001$) but there was non-significant in controls group (≤ 50 , $51-59$, ≥ 60).

Table (13) : Association of T4 level with age in the patients and control group.

Age	T4						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 50)				
	No.	%	Mean \pm SD	No.	%	Mean \pm SD		
≤ 50	25	50%	7.4440 \pm 1.45175	25	50%	7.3400 \pm 3.05000	0.154	0.878 NS
51-59	15	30%	5.8733 \pm 0.82155	15	30%	8.9667 \pm 2.97650	- 3.880	0.001* **
≥ 60	10	20%	6.3000 \pm 1.21747	10	20%	7.9500 \pm 3.21498	- 1.518	0.146 NS
F-test	8.197			1.324				
P-value	0.001***			0.276 NS				

NS: Non-significant. ***: significant ($p \leq 0.001$).

The current study showed a decrease in the expression level of (T4) in the age group (51-59) among patients compared to healthy people. This may be due to the decrease in the expression level of (TSH) in the same age group, as shown in Table (7), which led to an inability to stimulate the thyroid gland and, consequently, an inability to raise the level of (T4).

Level of T4 in Patients and Control Group Based on Sex.

The results in a table (14) showed a significant difference in T4 level patient as it reached (6.4600 \pm 0.49460) in the sex group (female) compared with the control group (7.9500 \pm 3.21498) ($P \leq 0.05$) However, the difference was non-significant in the sex group (male), as it reached (6.9333 \pm 1.77751) compared with the control group (7.9500 \pm 3.08886). However, there was a non-significant difference in its level sex groups of both patient and control group.



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Table (14) : Association of T4 level with sex in the patients and control group.

Sex	Level of T4 in						T-test	P-value
	Patients Group (No. 50)			Control Group (No. 25)				
	No.	%	(Mean±SD)pg/ml	No.	%	(Mean±SD)pg/ml		
Male	30	60%	6.9333 ±1.77751	40	80%	7.9500±3.08886	- 1.612	0.112 NS
Female	20	40%	6.4600 ±.49460	10	20%	7.9500±3.21498	- 2.060	0.049 *
T-test			1.158			0.000		
P-value			0.253 NS			1.000 NS		

NS: Non-significant. *: significant ($p \leq 0.05$).

Recommendations

1. We recommend targeting the IL-6/IL-6 signaling pathway, which is a major signaling pathway for dendritic cells.
2. Attention should be paid to nutritional supplements as well as stimulating the antioxidant defense system to improve thyroid dysfunction.

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وقائع المؤتمر العلمي الدوري الثاني للمديرية العامة للتربية في بغداد الرصافة الثانية الموسوم:

(البحث العلمي وسيلة حضارية لتطوير العملية الاشرافية والنهوض بالواقع التربوي)

وتحت شعار

(البحث العلمي والاشراف التربوي رؤى مشتركة لبناء عملية تربوية ناجحة)

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