



## The Effect of Thyroid Disorders on Some Physiological Parameters of Women

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### Abstract

**Objective:** The current study aimed to determine the relationship between thyroid disorders, lipid levels, liver function, age group, and blood type in women.

**Method:** The study sample was divided into two groups. The first group was a control group (healthy people) and the second group was patients with thyroid disorders (hypothyroidism, hyperthyroidism).

**Result:** The results of this study showed a significant increase in lipid concentrations and a significant decrease in AST and ALT in women with thyroid disorders compared to the control group. The highest incidence occurred in people aged 25 to 54 years and with blood type A+.

**Conclusion:** There are negative effects of thyroid disorders on physiological parameters.

**Keywords:** thyroid gland, fats, liver. Enzyme and disorders.

## تأثير اضطرابات الغدة الدرقية على بعض المعايير الفسيولوجية لدى النساء

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### الخلاصة

**الهدف:** هدفت الدراسة الحالية إلى تحديد العلاقة بين اضطرابات الغدة الدرقية ومستويات الدهون ووظائف الكبد والفئة العمرية وفصيلة الدم لدى النساء.

**طريقة العمل:** تم تقسيم عينة الدراسة إلى مجموعتين المجموعة الأولى كانت مجموعة ضابطة (أشخاص أصحاء) والمجموعة الثانية كانت مرضى اضطرابات الغدة الدرقية (قصور الغدة الدرقية، فرط نشاط الغدة الدرقية).

**النتائج:** أظهرت نتائج هذه الدراسة زيادة معنوية في تراكيز الدهون وانخفاض معنوي في AST و ALT لدى النساء المصابات باضطرابات الغدة الدرقية مقارنة بالمجموعة الضابطة. حدثت أعلى نسبة إصابة لدى الأشخاص الذين تتراوح أعمارهم بين 25 إلى 39 عامًا وأصحاب فصيلة الدم A+.

**الاستنتاجات:** هناك آثار سلبية لاضطرابات الغدة الدرقية على المعايير الفسيولوجية المدروسة.

**الكلمات المفتاحية:** الغدة الدرقية، الدهون، الكبد. الانزيمات والاضطرابات



## 1. Introduction

The thyroid gland is an important endocrine gland. It is lined with epithelial tissue and filled with a homogeneous colloidal protein substance called a colloid, which is rich in iodine [1]. It produces its own hormones and stores them inside itself, then releases them into the bloodstream, where it directly affects the effectiveness of the body's cells. Thyroid cells are the only cells in the body that absorb iodine. It is characterized by its weight and size changing according to age from one person to another. It is characterized by its size being slightly larger in women than in men. Goiter occurs in women during menstruation and pregnancy [2]. Thyroid hormones are the only amino hormones that contain iodine.

In vertebrates [2] [3] is any enlargement other than that which occurs in women during the menstrual cycle and pregnancy. It is considered a pathological condition. There are two main types of thyroid disorders, one is hyperthyroidism, where hormone concentrations are above normal limits, and the second is hypothyroidism. Thyroid hormone concentrations are below normal limits [4] [5]. The rate of thyroid activity varies with age. It is more common in women over the age of 65, and its prevalence varies with age [5] [6].

An increase in thyroid hormones leads to increased oxygen consumption, leading to a greater supply of energy. In the form of ATP molecules, it has also been found that thyroid hormones activate the formation of respiratory enzymes located within the mitochondria, which play an important role in influencing the growth, maturation, and formation of various organs in the body [7]. It has been observed that administration of thyroid hormones to animals causes an increase in the number of mitochondria, as well as an increase in their size and mitochondrial surface area. The membrane, therefore, will increase the phosphorylation process [8].

Thyroid hormones have many functions and their effect is at the nuclear level, where they stimulate the synthesis of messenger ribonucleic acid (RNA), messenger ribonucleic acid (mRNA), and ribosomes. This process is important for protein synthesis, and it takes approximately 12–14 hours for these hormones to become effective [9]. The production of thyroid hormones is regulated mainly through the hypothalamus-pituitary-thyroid axis. The hypothalamus secretes pituitary-stimulating hormone (TRH), which stimulates the release of TSH from the pituitary gland, which in turn stimulates the thyroid gland to produce thyroxine monoxide, which is released into the thyroid gland. Through a negative feedback mechanism, blood concentration affects the secretion of TSH and TRH as well as the effect of glucocorticoids, somatostatin and dopamine on the regulation of thyroid hormones [10] [11]. In addition to other reasons such as previous thyroid surgery, exposure to ionizing radiation, and chronic infections in the digestive system. (Autoimmune thyroiditis) Iodine deficiency and lack of enzymes necessary to make thyroid hormone and various types of medications. [12] This has been observed [13] [14].

However, cases of hyperthyroidism are less than cases of hypothyroidism, and this is consistent with the results of our current study, as the incidence of hyperthyroidism was Thyroid activity is 40% and the incidence of hypothyroidism is 60%.



Objective: The current study aimed to determine the relationship between thyroid disorders, lipid levels, liver function, age group, and blood type in women.

## 2. Methods

### 2.1 Collecting blood samples and methods

The study sample included 200 medical cases of women attending Al-Rifai University Hospital. Blood samples were collected periodically by direct collection from the patient and then allowed to clot at room temperature. Blood samples were centrifuged for 10 minutes in a centrifuge at 3500 rpm to separate the serum. Serum samples were stored in a refrigerator at (-20°C) for subsequent chemical tests.

### 2.2 Measuring TSH, T4, and T3 levels

TSH, T4, and T3 were measured in the female's serum using an El Maglumi800 device From Al-Sanabi Company. Through prefabricated blocks of German origin.

### 2.3 Measuring liver enzyme levels and lipid imaging

AST, ALT, ALP were measured. Measure cholesterol concentration and triglyceride levels, HDL, LDL, and VLDL using the Spin 120 device from Spinrest. Using kits prepared for this Hispanic device.

### 2.4 Statistical Analysis

The Statistical Analysis System (SAS 2018) program was used to detect the effect of different groups (patients and controls) on study parameters. A t-test was used to significantly compare between means in this study.

## 3. Results and discussion

### 3.1 Concentrations of thyroid hormones T4, T3, and TSH:

The results of the current study showed a significant decrease ( $p < 0.05$ ) in the concentration of in hormones (T3, T4) in the second group (hypothyroidism), a significant increase in the third group compared to the control group (healthy people), and a significant increase in the third group compared to the the second group when The aforementioned probability level, and the results showed a significant increase in the concentration of the hormone (TSH) in the second group and a significant decrease at the probability level ( $p < 0.05$ ) in the third group compared to the healthy group (control). It was also shown that there was a significant decrease in the third group compared to the second group ( $P < 0.05$ ) Table 1.



Table 1- Concentration of thyroid hormones in women

Standards	Average ± standard error			
	Incidence rate (%)	T3 (ng/ml)	T4 (ng/ml)	TSH (µIL /ml)
Healthy group (the control)		1.443_ b ±.063 0	94.260 b 2.564±	2.150 b 0.143±
the second group (hypothyroidism)	%60	0.558_ c 0.016±	45.923 c 1.626±	6.854 a 0.346±
The third group (hyperthyroidism)	%40	3.457 a 0.264_ ±	145.640 a 4.163±	0.142 c 0.031±
LSD		0.415	8.180	0.728

The different letters refer to a significant difference (P < 0.05).

A disorder in the thyroid gland may originally result from a disorder in the pituitary gland, which controls the functions of the thyroid gland through the secretion of the hormone TSH, which stimulates the thyroid gland to secrete its hormones, which leads to stopping the rhythm of harmony between it and the thyroid gland, and thus Its secretion of the hormone increases or decreases (TSH). stimulates the production of thyroid hormones (T4, T3). This is what the results of our current study indicate, as it became clear that there was a significant increase in the concentration of (TSH). In the second group with hypothyroidism and a significant decrease in TSH concentration) In the third group with hyperthyroidism, low levels of thyroid hormones in the blood are accompanied by high levels of TSH and vice versa, and this was confirmed by the study of [15] and showed [16]. Indicated that a high increase in the level of TSH in the blood indicates a decrease in levels of Thyroid hormones: This is called hypothyroidism, as hypothyroidism depends on several factors, such as iodine supplements, age and gender. Ethnicity and antibody status in addition to other factors such as systolic blood pressure, body mass index, total cholesterol, smoking, erythrocyte sedimentation rate, and diabetes, there is a significant association between hypothyroidism and the prevalence of heart disease. On the other hand, the results of the study by [15] are identified as the results of our study, as it showed that an excessive secretion of thyroid hormones occurred when compared with the concentration of the TSH hormone, which indicates a decrease in the secretion of the pituitary gland, which may be the result of a defect in the pituitary gland, which led to an increase in the level and concentration of T3 and T4 hormones in the group. The third (hyperthyroidism) or hypothyroidism may be the result of a decrease in the supply of iodine in the daily diet, as iodine is considered one of the most important of these minerals that must be available in food, and the nutritional deficiency of minerals and vitamins such as iron, selenium, and vitamin D. It may cause hypothyroidism because it is deprived of the essential factor that contributes to making its hormones [16] indicated that if the daily iodine processing rate decreases to less than <25 µg, a person suffers from hypothyroidism, as 80% of people suffer from an enlarged thyroid gland in areas that suffer from a severe iodine deficiency. On the other hand, the cause of a disorder in the thyroid gland may be attributed to a disorder in the sex hormones such as progesterone and estrogen. Studies



have indicated that there is a direct relationship between estrogen and thyroxine, as estrogen directly affects the thyroid gland, and any decrease in estrogen reflects negatively on the secretion of thyroxine from the thyroid gland. Thyroid glands to the point that a woman may suffer from hypothyroidism resulting from low estrogen concentration, and this explains the condition in many menopausal women, as he pointed out [17] that women are diagnosed with thyroid disease through changes in hormone levels such as estrogen and progesterone, as estrogen is the hormone that enhances the function of the thyroid gland. If estrogen levels are low, the function of the thyroid gland also decreases, and this is one of the reasons. The main reason that causes many women to suffer from a disorder in the secretion of the thyroid gland is that, in rare cases, there is a decrease in the activities of thyroid hormones within the body's tissues, which leads to a decrease in the functional performance of the body. Sometimes the disorder or imbalance occurring in the thyroid gland is of two types. The first is abnormal activity of the immune system, as this system mistakenly attacks the cells of the thyroid gland, thus affecting its production of hormones and resulting in a decrease in the concentration of thyroxine within the body in the pathological condition known as thyroiditis. (Autoimmunity) The situation may be the opposite of what was previously mentioned, as a viral infection causes inflammation of the thyroid gland, resulting in that gland releasing its stores of the hormone thyroxine all at once into the blood, and this is what causes hyperthyroidism, as indicated by [18] indicated that infections may be a cause of hypothyroidism or hyper production. If the infections result from the immune system attacking thyroid cells, they cause hypothyroidism, but if they result from a viral infection, they cause hyperthyroidism. The second is that it may be a defect in the thyroid gland itself, which is considered a pathological condition characterized by a decrease in the secretion of thyroid hormones through blood, as he explained [16] , as we have shown, the thyroid gland may become inflamed, which negatively affects its secretion of hormones, or the reason for this may be the thyroid gland's infection with Graves' disease, multi-nodular goiter, benign of tumor, etc., and this is consistent with the study Gudisa [19]. Autoimmune diseases, genetic factors, and environmental factors, especially chemical pollutants, may also be a cause of thyroid disorder through their effect on thyroid tissue. It is known that (diethyl Hexy) ethylhexy phthalate (DEHP) is one of the chemical pollutants that cause... Pathological changes in the structure of the thyroid gland] [20] On the other hand, the use of some types of treatments may cause an imbalance in thyroid secretions [21] showed that when amiodarone is used to treat arrhythmia, it causes a disturbance in thyroid secretions by reducing T3 production and increasing it slightly. In T4, the TSH concentration does not change in the pathological condition called thyrotoxicosis resulting from amiodarone (ALT) ( Amiodar in induced thyrotoxicosis) [21].

### *3.2 The relationship between thyroid disorder and lipid profile*

The results of the current study showed a significant increase ( $p \leq 0.05$ ) in the concentration of both cholesterol and triglycerides. HDL, VLDL, LDL, in the second group (hypothyroidism) and the third group (Hyperthyroidism) when compared to the control group (healthy people), except cholesterol, and a significant decrease in the third group when compared to the second group. (Hypothyroidism) at the mentioned probability level, except LDL and cholesterol in the third group, did not show a significant difference when compared with the second group at the mentioned probability level, Table (2).



Table 2- The relationship between thyroid disorder and lipids in women

Standards Groups	Average ± standard error				
	Cholesterol mg/ dL	Triglyceride mg/ dL	HDL mg/ dL	LDL mg/ dL	VLDL mg/ dL
Healthy group ( the control )	174.40 b 4.81±	109.60 c 2.477±	38.200 c 2.477±	91.730 b 2.477±	20.610 c 0.304 ±
the second group (hypothyroidism)	188.00 a 3.42 ±	246.384 a 7.968±	65.453 a 2.330±	147.846 a 0.925±	60.061 a 1.630 ±
The third group (hyperthyroidism)	182.50 ab 3.42±	175.10 b 3.839±	47.700 b 1.366±	146.800 a 3.767 ±	44.200 b 1.083 ±
LSD	11.332	17.392	5.524	7.463	3.683

The different letters refer to a significant difference (P < 0.05).

Thyroid hormones act directly on almost all tissues of the body, and any imbalance in their secretion will cause an imbalance in the functions of multiple organs, leading to a disturbance in metabolism, as they affect all major metabolic pathways. They regulate the process of basic energy expenditure through their effect on protein metabolism. Carbohydrates and fat metabolism, and this effect may be direct or indirectly via modification of hormones. Others, such as insulin, affect fat metabolism in the body significantly, as it maintains the initial level of phospholipids in cell membranes and the formation of fatty acids, where triiodothyronine plays a role [T3], plays an important role in fat metabolism and regulates genes involved in fat formation and lipolysis. The process that regulates thyroid hormones affects the rate at which cells burn calories and produce heat in the body, and thus, when the thyroid gland does not work properly. This can lead to a group of health problems, including disorders that affect the thyroid gland, such as hypothyroidism and hyperthyroidism, as hypothyroidism results from a decrease in the secretion of thyroid hormones (T4, T3), which leads to a decrease in their concentration in the blood and thus an increase in fat concentration.

In the blood, hypothyroidism is characterized by an increase in total cholesterol in the blood and a noticeable increase in LDL due to a decrease in the partial clearance of LDL in its receptors in the liver, which may increase the risk of atherosclerosis and cardiovascular disease, as in patients with hypothyroidism the fatty abnormalities are the most common. On the other hand, hyperthyroidism can lead to hyperthyroidism, a condition in which the thyroid gland produces too many hormones to gain weight. This is considered a result of increased appetite, increased energy consumption, loss of muscle



mass, nervousness, irritability, excessive sweating, and heart palpitations, as there is no effective thyroid gland. The body will not be able to break down proteins and will not be able to process carbohydrates and vitamins. For this reason, problems with this gland can lead to uncontrollable weight gain. It is known that thyroid hormones participate in regulating fat and lipoprotein metabolism. Therefore, any change or disturbance in these hormones which leads to a significant change in the concentrations of these fats in the body [12] [22] [23] There is a relationship between fat metabolism and thyroid hormones because these hormones stimulate the synthesis process by stimulating an enzyme. HMGCo -A reductase, which is regulated HDL concentration, is associated with hypothyroidism, and the results of the current study are consistent with the results of a study by Which [24] [25] Which showed that the rise All levels of fats in the blood are linked to hypothyroidism, as it causes an increase in the concentration of total cholesterol, triglycerides, LDL, and VLDL., TC/HDL ratio and LDL/HDL ratio This increases the risk of atherosclerosis and cardiovascular disease. Therefore, a thyroid hormone test must be performed for all patients with dyslipidemia, especially women between the ages of 40–60 years. This will reduce the number of deaths and the worsening of heart disease and atherosclerosis, as he pointed out [26] indicated that there is an.

The association between hypercholesterolemia and some risk factors causing atherosclerosis in individuals who suffer from hypothyroidism, as hypothyroidism is associated with an increase in the levels of TG, VLDL, and LDL. VLDL is lower than the normal range due to. direct effect on fat metabolism in the body This is consistent with what was indicated in the study of [27] [28] showed that total cholesterol, triglycerides, and LDL rise significantly in patients with hypothyroidism. This indicates the need to monitor their levels in patients with hypothyroidism to avoid the risk of cardiovascular disease, and that the increase in the level of LDL is a common cause of secondary dyslipidemia, as indicated by [29] showed that hyperthyroidism in many cases is subclinical Serum levels of total cholesterol, LDL and TG were .

### *3.3 The relationship between thyroid disorder and liver function*

The results of the current study showed a significant decrease ( $p \leq 0.05$ ) in concentration (ALT, AST) in the second group (hypothyroidism) and the third group (hyperthyroidism) when compared to the healthy group (control). The results also showed that there was no significant difference ( $p \leq 0.05$ ) in the concentration of (ALP) in the second group and the third group when compared to the healthy people (control) and there were no significant differences between them in the concentration of liver enzymes at the mentioned probability level Table (3).



**Table 3-** The relationship between thyroid disorder and liver enzymes in women

Standards Groups	Average ± standard error		
	ALT U/L	AST U/L	ALP U/L
Healthy group ( the control )	22.00 a 0.887 ±	20.400 a 0.933 ±	173.600 a 2.902±
the second group (hypothyroidism)	11.923 b 0.604 ±	13.461 b 0.756 ±	173,000 a 5. 833±
The third group (hyperthyroidism)	10.400 b 0.476 ±	13.100 b 0.481 ±	173.100 a 4.064±
LSD	1. 950	2.199	13.924

The different letters refer to a significant difference (P < 0.05 ).

The results of the current study showed a significant decrease ( $p \leq 0.05$ ) in the concentration of ALT and AST in the second group (hormone deficiency) and the third group (hormone excess), which shows us that any defect in thyroid enzymes may directly affect the structure or function of the liver and thus affect the liver's function. The concentration of its secretions, and this is identical to the study of [30]. Another study confirmed that the appearance of any defect in the thyroid gland will cause a change in liver function tests and thus changes in liver secretions [31] Liver enzyme abnormalities are part of the spectrum of severe hyperthyroidism. Although Graves' disease is the most common cause of hyperthyroidism [32], the results of our study agreed with the results of the [33], which showed that patients with cirrhosis were more common in people with hypothyroidism, and this explains the lower concentration levels of both ALT and AST. In people with hypothyroidism, as a study showed [34] . High liver enzymes are associated with hypothyroidism, as it was noted that people with hypothyroidism have a significant increase in AST and ALT. It also showed that TSH is positively associated with ALT and AST, and the results of our study did not agree with the results of [35] which showed that ALT levels and ALP is frequently elevated in hyperthyroidism. The liver, in turn, metabolizes thyroid hormones. It regulates its systemic effects on endocrine glands. Therefore, a disorder in the thyroid gland may lead to a disorder in liver function. It causes liver disease and may alter thyroid hormones. Metabolism [31].

A histomorphological study revealed decomposition of liver cells in hypothyroidism and hyperthyroidism. It has been shown that the destroyed cells are caused by Thyroid disorders were more evident in hypothyroidism than in hyperthyroidism, as both conditions cause a change in the structure of the liver upon histological examination. This observation could indicate that the degranulation seen in hepatocytes was not significant enough in hyperthyroidism to modify it. While cell damage is prominent in hypothyroidism, it has been noted that hypothyroidism plays a greater role in liver dysfunction [3].





4-3 Distribution of injuries according to age groups

The current study showed the highest incidence of hypothyroidism and hyperthyroidism is among women aged (25-39) years, and the lowest incidence of hypothyroidism is (55-69) and hyperthyroidism (70-84). As shown in Table [4]. The current study showed the highest incidence of hypothyroidism and hyperthyroidism is among women aged (25-39) years, and the lowest incidence of hypothyroidism is (55-69) and hyperthyroidism (70-84). As shown in Table (4).

Table 4- Distribution of injuries according to age groups in women

age categories	5-14 year	15-24 year	25-39 year	40-54 year	55-69 year	70-84 year
	(%)	(%)	(%)	(%)	(%)	(%)
<b>Hypothyroidism</b>	4/200 (%2)	13/200 (%6.5)	63/200 (% 31.5)	35/200 (%17.5)	2/200 (%1)	6/200 (%3)
<b>Hyperthyroidism</b>	3/200 (%1.5)	10/200 (%5)	35/200 (%17.5)	18/200 (%9)	9/200 (%4.5)	2/200 (%1)

It is known that the incidence of thyroid disorder is directly linked to the age of childbearing in women. Therefore, we notice an increase in the incidence of infection between the ages of 25 and 35. This is also the case with infertility and its relationship to thyroid disorder, as indicated by [36] pointed out that thyroid disease is widespread in women of childbearing age, while infertility is common in women of this age, adding to the occurrence of a defect in the thyroid gland during this period, as recent studies have confirmed the existence of a link between high thyrotropin hormone ( TSH) and thyroid autoimmunity, infertility, and low ovarian reserve in women. Thyroid hormones play an important role in regulating reproductive tissues, and there is a relationship between thyroid autoimmunity and infertility, as it affects ovarian reserve and chromosomal abnormalities in sperm] [36] The reason for this may be that thyroid disorders coincide with pregnancy.

Thyroid disorders clearly coincide with childbearing age and are considered the second most common endocrine disorder that accompanies pregnancy, as they are diagnosed during pregnancy, especially after gestational diabetes. The incidence of them varies during the prenatal period. It is known that the thyroid gland adapts structurally to be able to meet the functional demand. Increasing, which may sometimes result in a decrease in the thyroid gland’s reserve of hormones, which indicates a state of hypothyroidism [37]. The results of our study are also consistent with the study of [22], as the increase in the age group (25-39) in addition to the group (40-54) may explain the nature of the mutually influential relationship between the thyroid gland and the reproductive glands. We previously pointed out that The nature of the relationship between the effect of estrogen on the secretion of the hormones of this gland, and it is known that the levels of this hormone and the rest of the reproductive hormones begin to decrease as the woman gets older, approaching menopause, as indicated by [18] pointed out that thyroid hormones



begin to decline with age and become more evident at ages over 60 years, and this corresponds to the decline in reproductive hormones. The cause may be Graves' disease and Hashimoto's disease Both show a strong correlation in age [38] This is supported by [39] who explained that hypothyroidism becomes more common in the age group (21-50) years.

### 5-3 Distribution of infections according to blood types

The results of our current study showed that the highest infection rate is in type A, and it was 50.5% distributed among hypothyroidism. 28% and hyperthyroidism (22.5%) The lowest infection rate is in type (B) and it was (7.5 %) distributed between Hypothyroidism (6.5%) and hyperthyroidism (1%). Our results showed that the incidence of hypothyroidism in all blood groups was higher than hyperthyroidism, as shown in Table (5).

**Table 5-** Distribution Injuries According to blood types in women

blood types Type of disorder	A+	O+	AB+	B+
	(%)	(%)	(%)	(%)
<b>Total hyperthyroidism and activity for each category</b>	(%50.5)	(%30.5)	(11.5%)	(7.5%)
	56/200	34/200	17/200	13/200
<b>Hypothyroidism</b>	(%28)	(%17)	(% 8.5)	(6.5%)
	45/200	27/200	6/200	2/200
<b>Hyperthyroidism</b>	( %22.5)	(%13.5)	(%3)	(%1)

Many studies have linked the relationship between blood types and the incidence of many diseases, such as viral infections, bacterial infections, cancer, thrombosis, and thyroid diseases, as he pointed out [40] [41] . The results of our current study showed a significant increase in the percentage of blood type (A) in both groups. Hypothyroidism and hyperthyroidism, which are consistent with the results of a study by [42] which showed that the highest infection rate is in the (A) Hypothyroidism and hyperthyroidism occurred in both groups, although the O type is the highest percentage among the population. Despite this, the results of our current study showed us that the percentage of infection in the A group is the highest and the lowest percentage in the B group in both cases. On the other hand, the results of our current study indicated that the incidence of thyroid disease in type (O) was higher in hypothyroidism than in hyperthyroidism, and this is consistent with other studies [43] [44].

which showed that patients with blood type (O) have a high chance of developing hypothyroidism from hyperthyroidism, and another study indicated a possible relationship between blood type (O) and thyroiditis (Hashimoto's). Our results were identical to the results of [44] It shows that patients with



blood type (O) have a greater chance of developing hypothyroidism than hyperthyroidism, as the percentage for type O in our study was 17 % in the hypothyroidism group, which is higher than the percentage of hyperthyroidism, which reached 13.5%. The results of our study were not consistent with other studies] [45] 45] This showed that people with blood type O were more likely to suffer from thyroid disorders followed by A and B types.

## 6- Conclusion

There are negative effects of thyroid disorders on physiological parameters.

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