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# Laboratory Investigations in Patients with Hypothyroidism and Compared with Healthy Control Group in Baquba Teaching Hospital

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## Abstract

**Background:** One of the utmost prevalent endocrine disorders is hypothyroidism, which can reason moderate symptoms like depression, cold sensitivity, fatigue, and weight gain, as well as further severe one's alike myxedema and mortality.

**Objective:** To assess the laboratory investigations in patients with hypothyroidism and compared with healthy control group in Baquba Teaching Hospital.

**Method:** Cross sectional study was fixed amongst 90 individuals (60 patients with hypothyroidism and 30 healthy control) from Baquba Teaching Hospital, Diyala. The study was finished in the dated from December 2024 to February 2025. We estimated thyroid function (T3, T4, TSH) and hematological analysis (WBC, RBC, and platelets count) to find the relationship between them and compared with healthy control.

**Results:** The results exhibited count of WBC in patients' group was statistically non-significant lessened as associated with control group. The RBC count displayed enlarged level in control group as associated to patients with statistically exposed no significant connection. The platelets count presented enlarged level in control group as related to patients with statistically

exhibited no significant connection. The results illustration Mean ±SE of platelets counts in patient's male more than in female with statistically significant relationship. The patients were separated into three age groups, (<40 years), (40-50 years) and (>50 years) and all hematological analysis were divided into the age groups. It was shown through the statistical results that age does not affect the results of the hematological test.

**Conclusion:** The study found that thyroid issues affect women more often than they do men. It is crucial for hematological testing on hypothyroid patients.

**Keywords:** Patients, hypothyroidism, hematological, analysis.

## Introduction

The initial endocrine gland to develop in humans was the thyroid gland. It comes from the thyroid diverticulum, which is placed on the pharynx's middle ventral side. [(1)] Because it secretes hormones that control growth, development, and metabolism, the thyroid gland is a significant constituent of the human endocrine system. [(2)] Thyroid autoimmunity in iodine-replete populations and iodine insufficiency in iodine-deficient populations are the utmost common reasons of thyroid dysfunction. Nonetheless, it is important to remember that a third of the world's population still lives in regions with low iodine levels. [(3)]

The thyroid gland, which weighs unevenly 14–18 grams and is larger in females than in males, is the body's largest endocrine gland. Its products the thyroid hormones T4 and T3, with T3 being a more powerful hormone than T4. [(1,4,5)] Thyroid hormones are crucial for preserving metabolic homeostasis in adults and for cell differentiation throughout development.

Among the vital hormones are thyroid hormones. For almost every tissue to mature, differentiate, preserve metabolic balance, and operate physiologically, they are essential. Among the most prevalent endocrine illnesses are those affecting thyroid function. [(2)]

When higher levels of serum thyroid stimulating hormone (TSH) than the upper border of the reference range whereas free T4 concentrations are normal, this is mentioned to as subclinical hypothyroidism (SH), or mild thyroid failure. [(6)]

Amongst endocrine system problems, hypothyroidism is prevalent. In hypothyroidism, the thyroid gland does not create thyroid hormones in proportion to the body's needs. Thyroid stimulating hormone (TSH) and thyroxine levels in the blood can be measured to approve the diagnosis of hypothyroidism. Hypothyroidism affects women more often than it does males. [(7)]

A primary issue in the thyroid gland itself or a secondary/central one resulting from hypothalamus or pituitary dysfunction, hypothyroidism is the term used to designate the thyroid gland's inadequate synthesis of thyroid hormones. The grade of primary hypothyroidism recognized as overt hypothyroidism is categorized by a drop in thyroxin levels due to negative feedback and an increase in serum TSH, typically exceeding 10 mIU/L. An increase in serum TSH (T4), often between 4 and 10 mIU/L, accompanied with normal levels of serum thyroxin (T4) and triiodothyronine (T3), is mentioned to as sub-clinical hypothyroidism. [(8)]

There is a positive association between hypothyroidism and both autoimmune thyroiditis and other autoimmune illnesses in the family. [(9)]

So, the existing study was designed to measure the laboratory investigations in patients with hypothyroidism and compared with healthy control group in Baquba Teaching Hospital.

## Patients and Methods

### *1-The samples*

Cross sectional study was fixed amongst 90 individuals in from Baquba Teaching Hospital, Diyala. The study was finished in the dated from December 2024 to February 2025. We assessed thyroid function (T3, T4, TSH) and hematological analysis (WBC, RBC, and platelets count) to find the relationship between them and associated with healthy control.

Study samples comprise of:

1- Patients (Group 1): - Sixty patients with hypothyroidism twenty-seven males and thirty-three females.

2- Control (Group 2): - Thirty healthy individuals fourteen male and sixteen female.

Informed consent from all patients and control group was gained and the study was approved by Department of Medicine, College of Medicine, Diyala University.

### *2- Methods*

Questionnaires were used to gather the data. There were two parts to the questionnaires. Personal information was proscribed in the first section. Thyroid function (T3, T4, TSH) and hematologic

analysis (WBC, RBC, and platelets count) were observed in the second section.

***3-Biochemical study***

The blood was drawn into a small tube of plastic polyethylene and used for several biochemical tests, including thyroid function, platelet count, WBC, and RBC count.

***4-Inclusion Criteria***

1. Patients diagnosed with hypothyroidism (based on clinical and laboratory findings).

2. Healthy control group with no history of thyroid disorders.

3. Both male and female participants, aged 18-65 years.

***5-Exclusion Criteria***

1. Patients with a history of other major endocrine disorders (e.g., diabetes, adrenal insufficiency).

2. Individuals taking medication that could significantly affect thyroid function (e.g., corticosteroids, lithium).

3. Pregnant or breastfeeding women.

4. Participants with severe comorbidities that might affect the study results, such as severe cardiovascular diseases or autoimmune disorders.

**Statistical analysis**

To find out how different groups exaggerated the study parameters, the Statistical Packages of Social Sciences-SPSS (2019) program was employed. In order to significantly compare the means in this study, the T-test and Least Significant Difference (LSD) were employed. [10]

## Results

The results demonstration in this study the number of males affected with hypothyroidism (27) less than the number of females (33)

Table 1 showed a comparison between patient and control groups in WBC, RBC and PLT count. The results exhibited count of WBC in patients' group was statistically non-significant lessened as related with control group with Mean ± SE (7.76 ±0.25) versus Mean ± SE (7.84 ±0.32).

The RBC count displayed enlarged level in control group as associated to patients with statistically exposed no significant connection with Mean ± SE (4.77 ±0.06) versus Mean ± SE (4.78 ±0.07).

The PLT count presented enlarged level in control group as related to patients with statistically exhibited no significant connection with Mean ± SE (320.70 ±15.66) versus Mean ± SE (289.86 ±11.26), as showed in table (1).

**Table 1: Comparison between patient and control groups in WBC, RBC and PLT**

| Group | Means ±SE | | |
|---|---|---|---|
| | WBC ($x10^3$) | RBC ($x10^6$) | PLT ($x10^3$) |
| Patients | 7.76 ±0.25 | 4.77 ±0.06 | 289.86 ±11.26 |
| Control | 7.84 ±0.32 | 4.78 ±0.07 | 320.70 ±15.66 |
| T-test | 0.841 NS | 0.198 NS | 38.556 NS |
| P-value | 0.833 | 0.973 | 0.1197 |
| NS: Non-Significant. | | | |

Table 2 displayed a comparison between patient and control groups in TSH, T3 and T4 level. The result display level of T3 in control group was statistically highly significant enlarged as compared with patients' group with Mean ± SE (1.74 ±0.07) versus Mean ± SE (0.710 ±0.02).

The serum T4 exhibited increased level in control group as compared to patients with statistically exposed highly significant correlation with Mean ± SE (9.86 ±0.17) versus Mean ± SE (6.39 ±0.12).

The serum TSH exhibited increased level in patients' group as compared to control with statistically displayed no significant correlation with Mean ± SE (7.49 ±0.19) versus Mean ± SE (2.16 ±0.20), as showed in table (2).

**Table 2: Comparison between patient and control groups in TSH, T3 and T4**

| Group | Means ±SE | | |
|---|---|---|---|
| | TSH (Nmol/L) | T3 (ng/dl) | T4 (ng/dl) |
| Patients | 7.49 ±0.19 | 0.710 ±0.02 | 6.39 ±0.12 |
| Control | 2.16 ±0.20 | 1.74 ±0.07 | 9.86 ±0.17 |
| T-test | 0.621 ** | 0.114 ** | 0.412 ** |
| P-value | 0.0001 | 0.0001 | 0.0001 |
| ** (P≤0.01). | | | |

Table 3 displayed effect of gender in parameters study of patients group. The results displays Mean ±SE of WBC, RBC, TSH, T4, and T3 in patients male (7.56 ±0.43), (4.73 ±0.08), (7.85 ±0.26), (6.41 ±0.15) and (0.670 ±0.03) respectively and Mean ±SE of WBC, RBC, TSH, T4, and T3 in patients female (7.92 ±0.28), (4.80 ±0.09), (7.20 ±0.29), (6.38 ±), and (0.742 ±0.02) respectively with statistically no significant correlation.

While the results illustration Mean ±SE of PLT count in patient's male (313.34 ±16.37), more than mean ±SE of PLT count in patient's female (270.66 ±14.88), with statistically significant correlation.

**Table 3: Effect of Gender in parameters study of patients group**

| Group | Means ±SE | | | | | |
|---|---|---|---|---|---|---|
| | WBC ($x10^3$) | RBC ($x10^6$) | PLT ($x10^3$) | TSH (Nmol/L) | T3 (ng/dl) | T4 (ng/dl) |
| Male | 7.56 ±0.43 | 4.73 ±0.08 | 313.34 ±16.37 | 7.85 ±0.26 | 0.670 ±0.03 | 6.41 ±0.15 |
| Female | 7.92 ±0.28 | 4.80 ±0.09 | 270.66 ±14.88 | 7.20 ±0.29 | 0.742 ±0.02 | 6.38 ± |
| T-test | 1.029 NS | 0.240 NS | 37.329 * | 0.805 NS | 0.072 NS | 0.493 NS |
| P-value | 0.488 | 0.579 | 0.0498 | 0.1481 | 0.1722 | 0.915 |
| * (P≤0.05), NS: Non-Significant. | | | | | | |

Table 4 showed effect of age in parameters study of patients group. The patients were separated into three age groups, (<40 years), (40-50 years) and (>50 years) and all hematological analysis were divided into the age groups. It was shown through the statistical results that age does not affect the results of the hematological test.

**Table 4: Effect of Age in parameters study of patients group**

| Age group (year) | Means ±SE | | | | | |
|---|---|---|---|---|---|---|
| | WBC ($x10^3$) | RBC ($x10^6$) | PLT ($x10^3$) | TSH (Nmol/L) | T3 (ng/dl) | T4 (ng/dl) |
| <40 yr. | 7.55 ±0.42 | 4.84 ±0.09 | 281.41 ±18.21 | 7.52 ±0.34 | 0.708 ±0.03 | 6.49 ±0.20 |
| 40-50 yr. | 7.84 ±0.43 | 4.74 ±0.12 | 291.40 ±18.68 | 7.35 ±033 | 0.713 ±0.03 | 6.35 ±0.22 |
| >50 yr. | 7.92 ±0.44 | 4.70 ±0.09 | 298.43 ±21.23 | 7.55 ±0.34 | 0.709 ±0.03 | 6.32 ±0.21 |
| LSD | 1.278 NS | 0.298 NS | 55.86 NS | 0.998 NS | 0.0892 NS | 0.613 NS |
| P-value | 0.807 | 0.598 | 0.803 | 0.920 | 0.993 | 0.829 |
| NS: Non-Significant. | | | | | | |

## Discussion

The thyroid gland is a hormone-manufacturing organ that adjusts growth, metabolism, and blood levels of electrolytes like calcium through the excretion of thyroid hormone and calcitonin. [11] A communal disorder with potentially dangerous health effects that affects individuals worldwide, hypothyroidism is produced by inadequate thyroid function and can be produced by problems with the thyroid gland (primary thyroid disease), the hypothalamus or pituitary gland (central hypothyroidism), or external factors. [12]

In our study, the majority of participants were female as is the case with most articles, indicating that thyroid abnormalities are prevalent in the population and more public in women such as Ahmed and Mohammed, [13] Dorgalaleh et al., [14] but is lower than the results of some other investigators such as Preeti et al., [15] and Iddah et al., [16] who exhibited higher ratio in females and 1:3.8 is the male to female ratio.

The results exhibited WBC and PLT count in patients' group was statistically non-significant decreased as associated with control group, this approves with study done by Kadgi et al., [17] who detailed that there was no statistically significant alteration in the total leukocyte and platelet counts between the hypothyroid and control groups.

Numerous additional investigate has exposed that thyroid function status has less of an impact on platelets. This may be because platelets are non-nucleated, have a short lifespan, and undergo constant rapid turnover. [18]

The RBC count exhibited increased level in control group as compared to patients with statistically displayed no significant correlation also the present study agrees with study of Dorgalaleh et al., [14] who specified no significant correlation about RBC, WBC and PLT count, this can be clarified by that the thyroid gland plays a critical function in hematopoiesis and overall body metabolism. Because thyroid hormones play a critical character in the growth and metabolism of red blood cells and all other blood components, blood problems are generally observed in people with thyroid diseases. [19,20]

Lima et al., [21] specified that regarding white blood cells and thrombocytes, hypothyroid patients have been institute to have thrombocytopenia, neutropenia, and a slightly diminished total leucocyte count.

The present study disagrees with study done by Kawa et al., [22] who informed that there was a statistically significant alteration in RBC between the hypothyroidism patients and the control group.

Thyroid dysfunction patients' anemia is triggered by both nutritional deficiencies and thyroid hormone reduction, which impairs the bone marrow's aptitude to stimulate erythrocyte precursors, diminishes the amount of oxygen reaching various tissues, and lowers the level of erythropoietin. [23,24] Anemia restrictions the quantity of oxygen that red blood cells can

transport. This suggests that the body's organs and tissues absorb fewer oxygen from the blood. [25]

## Conclusion

The study found that thyroid issues affect women more often than they do men. It is crucial for hematological testing on hypothyroid patients.

**Author's Contribution:** All authors contributed equally in writing the research. **Hayder Mahdi Idan** planned the research paper, organized the original draft article, and reviewed the whole work. **Hayder Asaad Jasim** contributed to patient groupings, investigational procedures, specimen gathering, and data analyses. **Rafid Abdul-Mahdi Hasani** was involved in collecting data on hypothyroidism patients, performing statistical analyses, interpreting data and preparing tables

**Conflict of Interest:** None

**Data availability** Data are accessible from corresponding author upon appropriate request.

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**Ethical clearance:** This study was conducted with the approval of the College of Medicine /University of Diyala and according to the ethical guidelines of the Declaration of Ethical Committee of the College (Code No. 2025HMI 908).

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