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Evaluation of Anti-Thyroglobulin, Anti-Thyroid Peroxidase Autoantibodies and Thyroid Stimulating Hormone in Autoimmune Thyroiditis Patients

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ABSTRACT

Background: *Thyroiditis is a broad term used to describe a range of clinical illnesses characterized by inflammation and damage to cells in the thyroid gland. These abnormalities may arise from several causes, such as radiation exposure, microbial infection, or association with autoimmune thyroid illnesses, such as Hashimoto's thyroiditis (HT) and Graves' disease (GD).* ***Aim of the study****: This cross-sectional study aimed to evaluation of anti-thyroid antibodies (anti-thyroglobulin and anti-thyroid peroxidase) and thyroid stimulating hormone (TSH) thyroiditis patients. The study involved a 100 patients afflicted with Thyroid dysfunction can be detected through a physical examination and certain tests.* ***Method and results:*** *The concentrations of thyroid hormones (thyroxine (T4) and 3,5,3'-triiodothyronine (T3)) and TSH were measured to determine the patients who have hypothyroidism or have hyperthyroidism. Then the patients determined which of them had autoimmune thyroid disease by the detection of thyroid autoantibodies (anti-thyroglobulin (anti-TG) and anti-thyroid peroxidase (anti-TPO) antibodies). The tests were separated into two groups (Graves and Hashimoto). Mean levels of serum TSH are 19.79 ± 2.62 and 0.39±0.11, in patients with HT and patients with GD respectively; The levels of HT patients are much greater compared to GD patients, with a very significant difference (P < 0.001). The present results show the mean level of anti-TPO Abs in patients with HT is non-significant difference than the mean of anti-TPO Abs level in patients with GD, 745.74 ± 82.02 versus 841.07 ± 92.01 respectively, (P= 0.440). Also, the mean level of anti-TG Abs is higher in patients with HT in comparison with patients with GD and the difference is non-significant, (P= 0.929).The mean age of patients diagnosed with HT is 41.49 ± 10.57 years, with a range of 15 to 65 years. On the other hand, the mean age of patients diagnosed with GD is 42.35 ± 11.64 years, with a range of 21 to 70 years. Indeed, there is no significant difference in mean age between patients groups (P= 0.698). Sex, in overall, 19 (19.0%) males and 81 (81.0%) females are included. patients with HT included 13 (23.6%) cases are males and 42 (76.4%) cases are females, while patients with GD, 6 (13.3%) cases are males and 39 (86.7%) cases are females, there is no significant variation in the frequency distribution of both groups of patients based on sex (P = 0.191). BMI, the present results show the mean of BMI is higher in patients with HT (30.01 ± 7.08) in comparison that of patients with GD (27.24±4.83) (P=0.034).* ***Conclusion:*** *The serum TSH, anti-TPO and anti-TG Abs levels can serve as an important predictive biomarker in AITDs diagnosis.*

Keywords: AITDs, HT, GD, TSH, Anti-TPO, Anti-TG.

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INTRODUCTION

Autoimmune thyroid diseases (AITDs) commonly affect more females than males, as in many other autoimmune diseases, antithyroid antibodies is most common in individuals between the ages of 45 and 55. Hypothyroidism caused by Hashimoto's thyroiditis (HT) is more prevalent in older individuals. The occurrence of HT and ATAs varies among different racial groups (1). HT and GD are the main clinical manifestations of AITDs. These conditions are defined by the infiltration of lymphocytes into the thyroid tissue, resulting in hypothyroidism and hyperthyroidism, respectively. AITDs results in an immunological assault on the thyroid, the precise mechanisms of which remain uncertain. Genetic vulnerability and environmental stimuli interact as the main active components in development (2). HT is characterized by increased thyroid volume, lymphocyte infiltration of the parenchyma, and the presence of antibodies specific to thyroid antigens (3). The first event in the development of HT is thought to be a functional change in B cells, leading to the production of autoantibodies. Furthermore, T cell dysfunction is linked to the disruption of immunological homeostasis against thyroid tissue. Thus, it can be postulated that both humoral and cellular immunity have a role in the development of HT (4).

GD is a result of the presence of thyroid stimulating immunoglobulin (TSI), which is sometimes referred to as thyroid stimulating antibody. TSI is mainly produced in thyroid cells, although it can also be produced in lymph nodes and bone marrow. T cells, which become sensitized by antigens in the thyroid gland, activate B lymphocytes. TSI attaches to the TSH-receptor located on the surface of thyroid cells and enhances the activity of TSH. It promotes the production of thyroid hormones and the enlargement of the thyroid gland, leading to the development of hyperthyroidism and an enlarged thyroid gland (5). The patients of HT have thyroid function test results, elevated serum TSH level, but normal or low serum levels of thyroxine (T4) and 3,5,3′-triiodothyronine (T3) (6). Patients with GD often have a larger thyroid size than patients without thyroid disease. These patients also have elevated T3 and T4 with decreased TSH (7). The increased levels of thyroid autoantibodies (anti-TPO and anti-TG) have been associated with a diagnosis of AITDs (8).

PATIENTS AND MATERIALS

The population of Najaf city in Iraq was the subject of this hospital-based nested a cross-sectional study. A total of almost 400 patients provided blood samples between July 2023 and November 2023. A total of 100 patients, comprising both ill were chosen. The present study involved a total of 100 volunteers, who were separated into three groups as follows: The user did not provide any text. Group 1. HT, identified as 55 cases. Group 2. GD, identified as 45 cases.

Approval of the Ethical Committee

The Medical Ethics Committee authorized the research of the College of Medicine, University of Kufa, following a review process. The study received research ethical approval from the Iraqi Ministry of Health, as well as from the Environment/Oncology Hospital, Al-Sadr Teaching Hospital, and the Endocrine Centre.

Evaluation using Statistical Methods

The data were gathered, condensed, examined, and shown using the statistical package for social sciences (SPSS) version 26 and Microsoft Office Excel 2010. The numeric data were reported as the mean and standard deviation after doing the Kolmogorov-Smirnov normality test and determining

whether the variables were normally or non-normally distributed. The independent sample t-test was employed to examine the disparity in means between two groups, assuming that the variable follows a normal distribution. The chi-square test was employed to examine the relationship between two categorical variables. The level of significance was set at a P-value of less than 0.05, with a highly significant level at 0.01 or below (9).

RESULTS

The findings of this analysis are presented in table (1). Mean levels of serum TSH are 19.79 ± 2.62 and 0.39±0.11, in patients with HT and patients with GD respectively; The levels of HT patients are much greater compared to GD patients, with a very significant difference (P < 0.001).

Regarding the anti-TPO Abs, the present results show the mean levels of anti-TPO Abs in patients with HT were non-significant difference than the mean of anti-TPO Abs levels in patients with GD, 745.74 ± 82.02 versus 841.07 ± 92.01 respectively, (P= 0.440). Also, the mean levels of anti-TG Abs were higher in patients with HT in comparison with patients with GD and the difference is non-significant, (P= 0.929).

Table (1): Mean levels of TSH and anti-TPO and anti-TG in patients with HT and patients with GD.

	Patients with HT ***n* = 55**	**Patients with GD** ***n* = 45**	***P***
TSH level (µIU/ml)			
Mean± SE	**19.79 ± 2.62**	**0.39 ± 0.11**	**< 0.001** † **HS**
Range	5.63 – 92.99	0.01- 2.79	
Anti-TPO Abs level (pg/ml)			
Mean± SE	**745.74 ± 82.02**	**841.07 ± 92.01**	**0.440** † **NS**
Range	117.24 -3480.50	81.98 – 2542.56	
Anti-TG Abs level (pg/ml)			
Mean± SD	**579.99 ± 92.56**	**569.97 ± 50.22**	**0.929** † **NS**
Range	25.19 -5018.13	31.84 – 1397.96	

n: *number of cases****; SE:*** *Standard error;* ***SD****: standard deviation; †: independent samples t-test;* ***HS****: Highly significant at P ≤ 0.001.* ***NS****: not significant at P > 0.05;*

The mean age of patients diagnosed with HT is 41.49 ± 10.57 years, with a range of 15 to 65 years. On the other hand, the mean age of patients diagnosed with GD is 42.35 ± 11.64 years, with a range of 21 to 70 years. Indeed, there is no significant difference in mean age between patients groups (*P*= 0.698). The frequency distribution of patients with HT and patients with GD according to age group is also shown in table (2). Again, there is no statistically significant variation in the frequency distribution of patient groups based

on age group (P = 0.838). On the other hand, most of patients with both AITDs enrolled in the present study are less than 40 years of age, as shown in table (2).

Regarding to sex, in overall, 19 (19.0%) males and 81 (81.0%) females are included. patients with HT included 13 (23.6%) cases are males and 42 (76.4%) cases are females, while patients with GD, 6 (13.3%) cases are males and 39 (86.7%) cases are females, there is no significant variation in the frequency distribution of both groups of patients based on sex (P = 0.191). Patients with HT included 41 (74.5%) from urban area and 12 (25.5%) from rural area, whereas, patients with GD included 29 (64.4%) from urban area and 16 (35.6%) from rural area but there is no statistically significant variation in the frequency distribution of both groups of patients based on residency (P = 0.273). Regarding to BMI, the present results show the mean of BMI is significantly higher in patients with HT (30.01 ± 7.08) in comparison that of patients with GD (27.24±4.83) (P=0.034).

Table (2): Demographic characteristics of patients with HT and patients with GD.

Characteristic	**Patients with HT** ***n* = 55**	**Patients with GD** ***n* = 45**	***P***
Age (years)			
Mean ±SD	41.49 ± 10.57	42.35 ± 11.64	0.698 † NS
Range	15 –65 years	21– 70 years	
< 40, *n* (%)	24 (43.6%)	17 (37.8%)	0.838 ¥ NS
40-49, *n* (%)	19 (34.5%)	17 (37.8%)	
≥ 50, *n* (%)	12 (21.9%)	11 (24.4%)	
Sex			
Male, *n* (%)	13 (23.6%)	6 (13.3 %)	0.191 ¥ NS
Female, *n* (%)	42 (76.4%)	39 (86.7%)	
Residency			
Urban, *n* (%)	41 (74.5%)	29 (64.4 %)	0.273 ¥ NS
Rural, *n* (%)	14 (25.5%)	16 (35.6%)	
Body mass index (BMI) kg/m2			
Mean ± SD	**30.01 ± 7.08**	**27.24 ± 4.83**	**0.034** † **S**
Range	19.10– 54.52	20.32–44.86	

***SD:** standard deviation; †: independent samples t-test; ¥: Chi-square test; **NS:** not significant at P > 0.05; S: significant at P <0.05.*

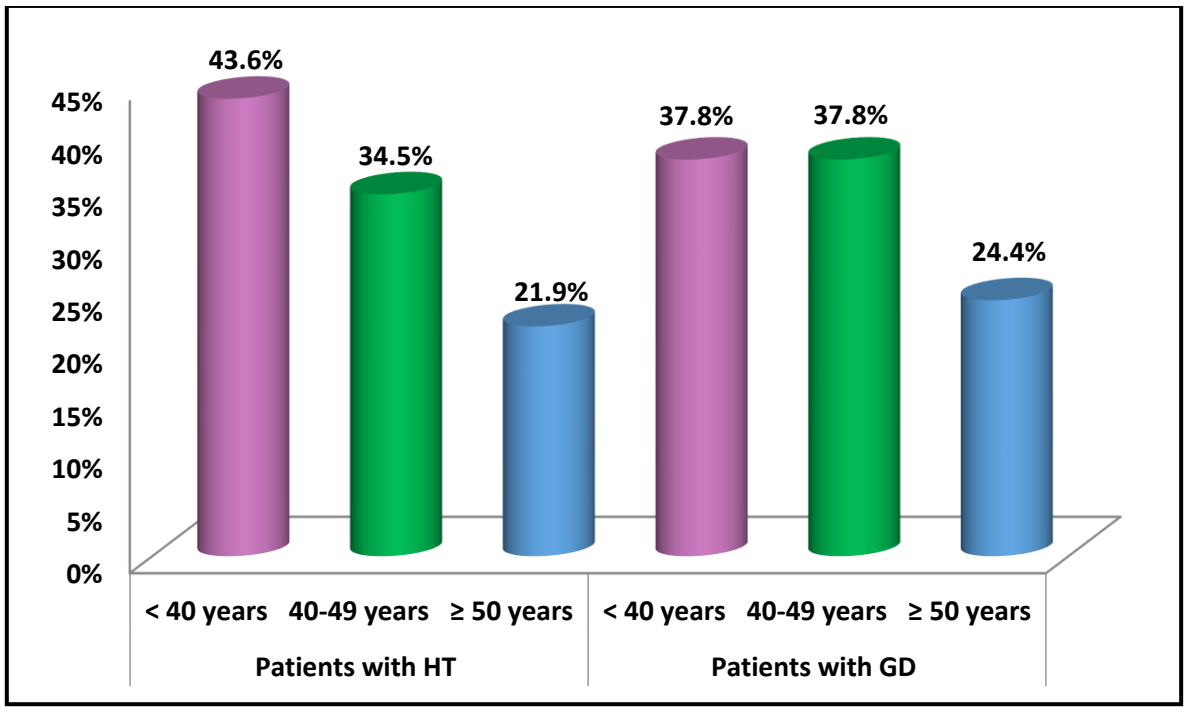

Figure (1): Distribution of patients according to age groups of patients.

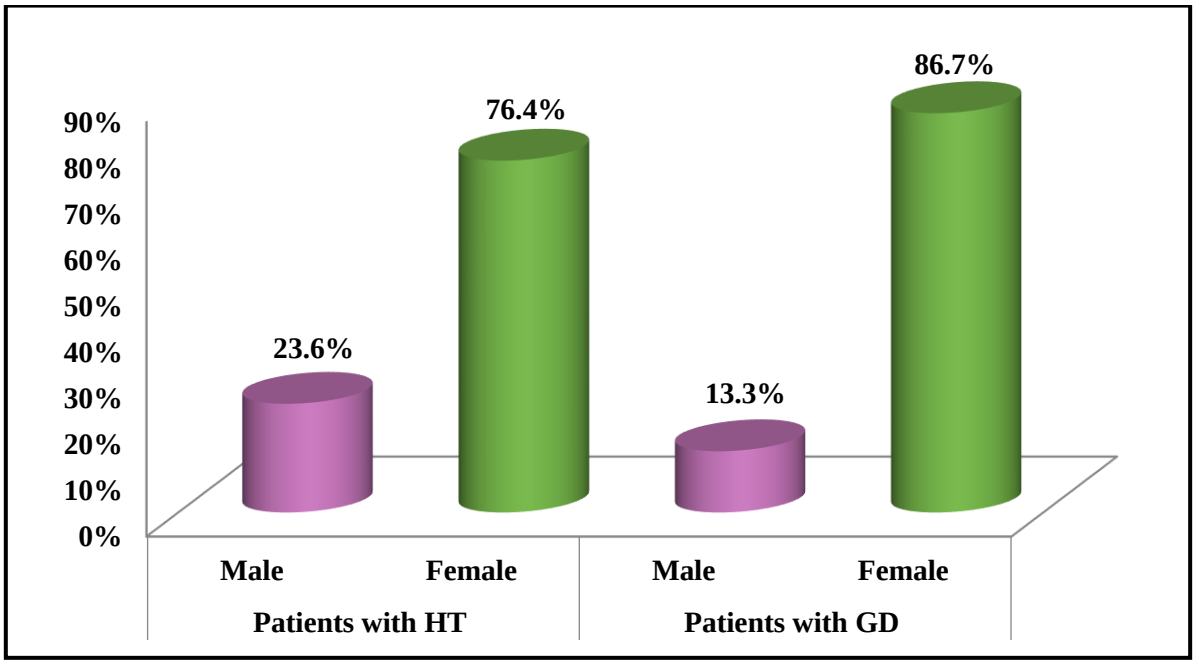

Figure (2): Distribution of patients groups according to sex.

Out of the HT patients, 40.0% are obese (BMI > 30 kg/m2), 38.2% are overweight (BMI ≥ 25-29 kg/m2), and only 21.8% have a normal weight (BMI = 18.5 - 24.9 kg/m2). On the other hand, patients with GD enrolled in the present study are as the followings: 18 (40.0%) of GD patients is overweight, 17 (37.8%) of GD patients is normal weight and only 10 (22.2%) of GD patients is obese, however, there is no statistically significant disparity in the frequency distribution of both groups of patients in relation to obesity (P = 0.098).

This study showed 18 (32.7%) of HT patients have positive family history, and 15 (33.3%) of GD patients have positive family history, there is no statistically significant variation in the frequency distribution of both groups of patients based on family history (P = 0.949), table (4).

The table (5) displays the frequency distribution of AITDs patients based on certain parameters. The present results showed 17 (30.9%) of HT patients have chronic disease (type 1 diabetic mellitus and pressure), and 17 (37.8%) of GD patients have chronic disease, however, there is no notable disparity in the frequency distribution between the two groups of patients in relation to chronic disease (P = 0.471).

The frequency distribution of patients with AITDs based on their stable psychological condition is as follows: 11 (20.0%) of HT patients have stable state and 14 (31.1%) of GD patients have stable psychological state, but there is no notable disparity in the frequency distribution of both groups of patients based on their stable psychological state (P = 0.202).

The results show partial surgery of thyroid gland distribution among AITDs patients was as follows: 9 (16.4%) of HT patients have partial surgery of thyroid gland and 11 (24.4%) of GD patients have partial surgery of thyroid gland, but there was no notable disparity in the frequency distribution of both groups of patients based on their partial surgery of thyroid gland (P = 0.315).

The smoking frequency distribution among AITDs patients is as follows: 12 (21.8%) of HT patients have smoking and 7 (15.6%) of GD patients have smoking, but there is no discernible disparity in the frequency distribution between the two groups of patients based on smoking.

(P = 0.427).

Table (3): The frequency distribution of patients with AITDs according to obesity.

Characteristic	Patients with HT *n* = 55	Patients with GD *n* = 45	*P*
Normal weight, *n* (%)	12 (21.8%)	17 (37.8%)	0.098 ¥ NS
Overweight, *n* (%)	21 (38.2%)	18 (40.0%)	
Obese, *n* (%)	22 (40.0%)	10 (22.2%)	

n: *number of cases;* ***¥:*** *Chi-square test;* ***NS:*** *not significant at P > 0.05.*

Table (4): The frequency distribution of patients with AITDs according to family history.

Characteristic	Patients with HT *n* = 55	Patients with GD *n* = 45	*P*
Positive, *n* (%)	18 (32.7%	15 (33.3%)	0.949 ¥ NS
Negative, *n* (%)	37 (67.3%)	30 (66.7%)	

n: *number of cases;* ***¥:*** *Chi-square test;* ***NS:*** *not significant at P > 0.05.*

Table (5): Frequency distribution of AITDs patients according to some features.

Characteristic	Patients with HT *n* = 55	Patients with GD *n* = 45	
Chronic diseases			
Positive, *n* (%)	17 (30.9%)	17 (37.8%)	0.471 ¥ NS
Negative, *n* (%)	38 (69.1%)	28 (62.2%)	
Stable psychological state			
Yes, *n* (%)	11 (20.0%)	14 (31.1%)	0.202 ¥ NS
No, *n* (%)	44 (80.0%)	31 (68.9%)	
Surgery			
Partial remove thyroid, *n* (%)	9 (16.4%)	11 (24.4%)	0.315 ¥ NS
Without surgery, *n* (%)	46 (83.6%)	34 (75.6%)	
Smoking			
Positive, *n* (%)	12 (21.)	7 (15.6%)	0.427 ¥ NS
Negative, *n* (%)	43 (78.2%)	38 (84.4%)	

n: number of cases; **¥:** Chi-square test; **NS:** not significant at P > 0.05.

DISCUSSION

The increased levels of thyroid autoantibodies have been associated with a diagnosis of AITDs (10). Each patient in the study underwent an assessment of their serum levels of T3, T4, TSH, anti-TPO, and anti-TG Abs. The latest research discovered a significant increase in blood TSH levels (P <0.001) in patients with HD compared to patients with GD. Mean levels of TSH is higher in HT patients in comparison with GD patients, 19.79 ± 2.62 versus 0.39 ± 0.11, respectively.

Hypothyroidism is a medical state that arises due to the insufficiency of thyroid hormones including T4 and T3, whose function is to maintain the basal metabolic rate. To compensate for the insufficiency of thyroid hormones, the pituitary gland releases a large amount of TSH to maintain the hemostatic of the body. The serum estimation of TSH is used for the detection of thyroid dysfunctions (11).

The present result shows the levels of anti–TPO are non-significant difference in HT patients with against GD patients. According to (12) In hypothyroidism, the prevalence of anti-TPO Abs was 100%, but in hyperthyroidism it was 76.3%. The study found that the hypothyroidism group had the highest percentage of patients with anti-TPO Abs, suggesting a heightened risk of HD. These results were consistent with a study in

Egypt that showed that more than 95% of the patients with HT are positive for anti-TPO antibodies, and many physicians consider anti-TPO antibody positivity sufficient to confirm HT (13). Anti-TPO antibody is readily accessible and frequently utilized in clinical diagnostic laboratories for the detection of HT (14). The antibodies mentioned are the primary anti-TPO Abs found in HD. Elevated levels of anti-TPO antibodies have been linked to the emergence of clinical signs that suggest the future advancement of the illness. Additionally, it has been established that assessing the level of anti-TPO Abs in the bloodstream can be a dependable marker for promptly identifying the initiation of thyroid autoimmunity. Furthermore, it is recommended to incorporate these tests into the current roster of thyroid function tests, which consist of T3, T4, and TSH (15).

The present result shows the levels of anti–TG Abs are non-significant elevated in HT patients with against GD patients. According to (16), Elevated levels of thyroglobulin antibodies may be seen in both HT and GD, and these antibodies can impact thyroglobulin levels. Elevated levels of TG in the bloodstream do not independently lead to the production of antibodies against TG. However, they may be induced by significant damage to the thyroid gland **(**17). Modest amounts of self-antigens often trigger tolerance (18). According to one theory, T cells develop self-tolerance when blood triglyceride levels are within the normal range, whereas B cells do not. B lymphocytes that identify TG limit their movement in the T cell zone of peripheral lymphoid organs, even when they do not engage with CD4 helper populations. A lack of contact induces death in the B cells and inhibits their migration from the T cell zones to the follicles. Due to the actions of B cells, individuals in good health typically have minimal quantities of anti-TG Abs, which are below the threshold for detection. In the context of increased TG levels after tissue damage, modified conformation of the TG molecule caused by high I2 levels, and high TSH levels, the anti-TG Abs titers become abnormal (19).

AITDs are the most prevalent organ-specific autoimmune diseases (AIDs) and affect 2- 5% of the population. AITDs include GT and HD (20). On the other hand, AIDs of the thyroid gland are polygenic disorders resulting from the combination of a genetic predisposition and an environmental trigger (12). The current study showed privilege the proportion of HT (hypothyroidism) (55.0%) over the proportion of GD (hyperthyroidism) is (45%). These results are similar to the study in Turkey, revealed the most common form was hypothyroidism 10.0%, while hyperthyroidism was 3.3% (21). In Nigeria, 58.0% of the population had hyperthyroidism, 39.0% had hypothyroidism and euthyroid sick syndrome at 3.0% and this finding was disagreement to the results of our study (22).

HT, one of the most common AIDs and the most common endocrine sickness, is described as chronic inflammation of the thyroid gland (23).

AITDs can occur at any age, however it is more prevalent in women between 30 to 60 years (24). The present finding show mean age of patients with HT is 41.49± 10.57 years and the mean age of patients with GD is 42.35±11.64 years and there is no statistically significant difference in mean age across the patient groups (P= 0.698). This finding aligns with the results of a study conducted in Dohuk, Iraq, which revealed that the highest prevalence of thyroid diseases was observed among those between the ages of 30 and 50 (25). A cross-sectional study conducted in Egypt revealed a prevalence of generalized goiter in the age category of 49.5 ± 15.2, indicating thyroid dysfunction (26).

Multiple research conducted in Iraq have yielded similar findings: according to

(27), the prevalence of autoimmune thyroiditis was highest among patients aged 40-49 years. (28) found that the highest frequency of autoimmune thyroiditis was observed in patients aged 31-40 years. (29), found that thyroid disorder is a common occurrence in middle age. Autoimmune thyroiditis is highly abundant in females with an incidence ration of about 8:1 (24). Regarding the present results, in overall, there was no significant difference in the percentage of distribution of HT in males than the distribution of GD in males, also there was no significant difference in the percentage of distribution of HT in females than the distribution of GD in females, (P = 0.191), but the distribution of HT and GD were higher in females than males. These data suggest that females have a higher susceptibility to acquiring AITDs compared to males. In other words, being females is a risk factor for the incidence of autoimmune thyroiditis. Multiple studies consistently demonstrate a higher prevalence of thyroid illnesses in females compared to males. An investigation carried out in Iraq's Diyala Governorate found that the prevalence of thyroid disorders among females was 86.57%, but among males it was 13.43% (30). The current discovery aligns with the findings of (31), indicating that a large majority of patients with AITDs were females (82%). This outcome holds great significance, as seen by a very significant p-value of 0.001. Globaly, various epidemiological studies conducted worldwide have consistently shown a significant predominance of AITDs in females.

For instance, (32) reported that the incidence of HT is around ten times greater in females compared to males. The prevalence of AITDs in females can be explained by the development of an immunological response to X-linked antigens, leading to a loss of self-tolerance. Emerging evidence indicates that skewed X-chromosome inactivation (XCI), which involves the deactivation of one X chromosome in around 80% of cells, is considered a risk factor for the development of AITDs in females (33). Furthermore, it has been proposed that the estrogen-induced immune response plays a role in making women more susceptible to autoimmunity by triggering a pro-inflammatory response (34). The sex hormone directly engages with immune system cells through the receptor located on or within immune cells. Steroid hormones are recognized for their impact on the formation of antibodies and the proliferation of immune cells (35).

Additionally, a research conducted on Danish twins revealed a strong correlation between skewed X-chromosome inactivation (XCI) and serum concentrations of anti-TPO Abs in dizygotic twin pairs, but not in monozygotic twin pairs. This suggests that there are shared genetic factors influencing both XCI pattern and anti-TPO Abs production, rather than a direct causal relationship (36). side from genetic predisposition, other environmental factors, including nutrition, pollutants, medicines, infections, stress, lifestyle, and socioeconomics, can significantly influence gene expression through epigenetic pathways, ultimately leading to the development of autoimmunity (37). The same table revealed that 41 (74.5%) of the patients with HT are from urban areas and 14 (25.5%) cases from rural areas, while patients with GD included 29 (64.4 %) cases form urban areas and 16 (35.6%) cases from rural areas and there is no significant difference in the frequency distribution of both patients groups (P = 0.273). One of the explanations for increased AITDs in urban area may be associated with the increase in a sedentary lifestyle, increased life stress, and availability of processed foods (38). In addition, the presence of other contaminants, such as benzene, carbon monoxide, and organochlorines, has been linked to disruptions in thyroid function (39).

Thyroid autoimmunity can be triggered by stress, and there is a strong connection between stress and GD (40).

Obesity might also induce thyroid autoimmunity by disrupting the pituitary-hypothalamic axis (41). Obesity or overweight is a medical condition characterized by an excessive BMI, which can lead to many health issues including elevated levels of cholesterol, triglycerides, insulin, blood pressure, sleep apnea, orthopedic concerns, and mental health problems (42). The present results show body mass index (BMI), was higher in patients with HT (30.01 ± 7.08) in comparison that of patients with GD (27.24±4.83) (P=0.034). The present results show most HT patients have obese (BMI ≥ 30 kg/m2) is 22 (40.0%) and most patients with GD enrolled in the present study have over weight, 18 (40.0%), but there is no statistically significant disparity in the frequency distribution of both groups of patients based on obesity (P= 0.098), and these means that most AITDs patients either obese or overweight. It is still hypothesized that adipose tissue might play a role in auto immunological processes related to the thyroid (43). It may be that another factor simultaneously raises BMI and causes AITDs disease, and that elevated BMI is merely a marker of this other causal factor (44). The previous studies show 15.5 - 46% of AITDs have obesity (45).

Both genetic and environmental factors play a role in the pathogenesis of AITDs (46). The contribution of the genetic component to the development of AITDs of the thyroid gland was studied in twins and, according to the authors, was about 75%, while the remaining 25% is due to environmental factors (47). The development of AITDs is commonly attributed to the intricate interplay between genetic predisposition, environmental variables, and immunological disorders (48). Identification of familial clustering in AITDs in different populations made it possible to establish that individuals with a family history of AITDs of the thyroid gland have a risk of developing HT and GD (49). The present study showed 18 (32.7%) of HT patients have positive family history, and 15 (33.3%) of GD patients have positive family history, there is no statistically significant variation in the frequency distribution of both groups of patients based on family history (P = 0.949). However, this fact in itself can speak both in favor of a connection with genetic factors and indicate the influence of environmental factors occurring in one family. A family history has been suggested as a strong link to genetic factors. A number of studies have shown that a family history of AITDs of the thyroid gland occurs in approximately 33–50% of cases of HT or GD (50).

Several previous investigations have documented a hereditary inclination for autoimmune thyroiditis. (51) conducted genome-wide association studies (GWAS) meta-analyses to investigate the relationship between anti-TPO Abs positive and anti-TPO Abs serum levels. Statistically significant relationships ($P<5\times 10^{-8}$) were found at the TPO (rs11675434) locus for both anti-TPO Abs positive and anti-TPO Abs levels. The concept of genetic expectation includes the introduction into practice of new diagnostic methods that make it possible to determine the risk of the disease and choose the optimal management tactics for such patients. This method is based on determining the genotype–phenotype relationship. In addition to patients studies searching for associations of single nucleotide polymorphisms with AITDs of the thyroid gland, work is being carried out using automated systems of algorithms that can significantly reduce the costs of labor and time of the researcher (52).

According to current study, there was no notable disparity in the frequency distribution of both groups (HT and GD) of patients based on chronic diseases, Stable psychological state,

partial surgery of thyroid gland and smoking. (53,54), in their work, they found that there were no differences in the impact of such risk factors as smoking, estrogen use, pregnancy and stress between patients with high and low levels of family history. While (55,56), found that the smoking has been identified as a significant environmental risk factor associated with AITDs. Additionally, genetic predisposition plays a crucial role in the susceptibility to mounting an autoimmune reaction triggered by smoking. Environmental factors like smoking, along with hormonal influences, contribute to the pathogenesis of AITDs in genetically predisposed individuals (57,58).

CONCLUSIONS

1. The serum TSH, anti-TPO and anti-TG Abs levels can serve as an important predictive biomarker in AITDs diagnosis.
2. Most patients with AITDs are diagnosed at more than 40 years age.
3. There is no notable difference in the frequency distribution between the two patient groups depending on sex.
4. The average BMI is greater in patients with HT compared to patients with GD.

REFERENCES

1. Brix, T. H., & Hegedüs, L. (2012). Twin studies as a model for exploring the aetiology of autoimmune thyroid disease. Clinical endocrinology, 76(4), 457-464.
2. Ferrari, S. M., Fallahi, P., Antonelli, A., & Benvenga, S. (2017). Environmental issues in thyroid diseases. Frontiers in endocrinology, 8, 50.
3. Ralli, M., Angeletti, D., Fiore, M., D'Aguanno, V., Lambiase, A., Artico, M., ... & Greco, A. (2020). Hashimoto's thyroiditis: an update on pathogenic mechanisms, diagnostic protocols, therapeutic strategies, and potential malignant transformation. Autoimmunity Reviews, 19(10), 102649.
4. McLachlan, S. M., & Rapoport, B. (2014). Breaking tolerance to thyroid antigens: changing concepts in thyroid autoimmunity. Endocrine reviews, 35(1), 59-105.
5. Banga, J. P., & Schott, M. (2018). Autoimmune thyroid diseases. Hormone and Metabolic Research, 50(12), 837-839.
6. Caturegli P, De Remigis A, Rose NR. (2014). Hashimoto thyroiditis: clinical and diagnostic criteria. Autoimmun Rev. 13(4–5):391-397.
7. Lushefski KN, Wolf M, Dove J, Fluck M, Oxenberg JC.(2024). The Correlation of Thyroid Hormone Levels and Anti-Thyroidal Drugs on Thyroid Size, Weight, and Ease of Surgical Dissection for Thyroidectomy for Graves' Disease. The American SurgeonTM. 2024;90(1):15-22.
8. Mondal, S., Raja, K., Schweizer, U., & Mugesh, G. (2016). Chemistry and biology in the biosynthesis and action of thyroid hormones. Angewandte Chemie International Edition, 55(27), 7606-7630.
9. Daniel W.W., (2018). Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons New York.
10. Vargas-Uricoechea H., Nogueira J.P., Pinzón-Fernández M.V., Schwarzstein D., (2023). The Usefulness of Thyroid Antibodies in the Diagnostic Approach to Autoimmune Thyroid Disease. Antibodies (Basel). 12(3):48.
11. Armstrong M., Asuka E., Fingeret A., (2023). Physiology, Thyroid Function. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.
12. Ojo, O. A., Ikem, R. T., Kolawole, B. A., Ojo, O. E., & Ajala, M. O.(2019). Prevalence and clinical relevance of thyroid autoantibodies in patients with goitre in Nigeria. Journal of Endocrinology, Metabolism and Diabetes in South Africa, 24(3), 92-97.

13. Assaad S.N., Meheissen M.A., Elsayed E.T., Alnakhal S.N., & Salem T. M. (2020). Study of Epstein–Barr virus serological profile in Egyptian patients with Hashimoto's thyroiditis: A case-control study. Journal of Clinical & Translational Endocrinology, 20, 100222.
14. Fröhlich E and Wahl R (2017) Thyroid Autoimmunity: Role of Anti-thyroid Antibodies in Thyroid and Extra-Thyroidal Diseases. Front. Immunol. 8:521.
15. Siriwardhane T., Krishna K., Ranganathan V., Jayaraman V., Wang T., Bei, K., & Krishnamurthy, H. (2019). Significance of anti- TPO as an early predictive marker in thyroid disease. Autoimmune diseases, 2019, 1-7.
16. Cara Murphy, BA and Ankur Gupta, MD,(2020). MON-458 Elevated Thyroglobulin Level in Benign Thyroid Nodule. J Endocr Soc. May 8; 4(Suppl 1): MON-458.
17. Marcocci C, Marino M. ,(2005).Thyroid-directed antibodies. In: Braverman LE, Utiger R, editors. Part II Laboratory Assessment of Thyroid Function. Philadelphia, PA: Lippincott Williams and Wilkins. p. 360–72.
18. Janeway CJ, Travers P, Walport M, Shlomchik M.,(2001). Chapter 13: Autoimmunity and transplantation. In: Janeway CJ, Travers P, Walport M, Shlomchik M, editors. The Immune System in Health and Disease. New York, NY: Garland Science.
19. Hattori N, Ishihara T, Matsuoka N, Saito T, Shimatsu A.,(2017). Antithyrotropin autoantibodies in patients with macro-thyrotropin and longterm changes in macro-thyrotropin and serum thyrotropin levels. Thyroid 27:138–46.
20. Pisetsky D.S. (2023). Pathogenesis of autoimmune disease. Nat Rev Nephrol 19, 509–524.
21. Akbaş F., & Atmaca H.U. (2019). Thyroid disease rates/nature in Turkestanians living in Turkye: Impact of ethnicity on diseases. ESTÜDAM Halk Sağlığı Dergisi, 4(2), 116-121.
21. Okafor E.N., Ugonabo M.C., Chukwukelu E.E., Okonkwo I.N., Ezigbo E., & Odurukwe O. (2019). Prevalence and pattern of thyroid disorders among patients attending University of Nigeria Teaching Hospital, Enugu, Southeastern Nigeria. Nigerian Medical Journal: Journal of the Nigeria Medical Association, 60(2), 62.
22. Mathew, P., Rawla, P., & Fortes, K. (2021). Hyperthyroidism (Nursing). In: StatPearls Publishing, Treasure Island (FL).
23. Machała, E., Redynk, M., Iavorska, I., & Machała, P. (2019). Hashimoto's thyroiditis. World Scientific News, 128(2), 302-314.
24. Hasan R.I., & Raziq A.H. (2019). Studying the frequency of autoimmune thyroid diseases in Duhok Province. Science Journal of University of Zakho, 7(2), 45-49.
25. Rashad N.M., & Samir G.M. (2019). Prevalence, risks, and comorbidity of thyroid dysfunction: a cross-sectional epidemiological study. The Egyptian Journal of Internal Medicine, 31(4), 635-641.
26. Alwayly A.F. (2016). Estimation the local expression of Interleukin 17 & 4 in Hashimoto's Thyroiditis. Master thesis. College of Medicine / Al-Qadisiya University.
27. Amin Z.A., Tawfeeq R.D., & Kamal S. I. (2018). The frequency of autoimmune thyroid disorders in patients with thyroid dysfunction in Erbil city. Zanco Journal of Medical Sciences (Zanco J Med Sci), 22(3), 372-376.
28. Taha K.N., Risan F.A. andMohammed A.J., (2022). Possible Roles of Micro RNA-142-5p and Claudin-1 in

Development of Hashimoto's Thyroiditis in Iraqi Patients. Journal of Techniques, 4 (2): 50-55
29. Mohammud Habash, M. (2021). Prevalence of Thyroid Defects in Diyala, Iraq. Medico-Legal Update, 21(3).
30. Abdullah Y.J, Essa R.H, and Jumaa M.G., (2022). Incidence of Hashimoto's thyroiditis and its relationship to age, sex, smoking and blood groups. NTU Journal of Pure Sciences. 1 (2): 1-9.
31. Pirahanchi, Y.; Tariq, M.A.; Jialal, I. ,(2021).Physiology, Thyroid. In StatPearls; StatPearls Publishing: Treasure Island, FL, USA.
32. Shetty A., & Chowdappa V. (2019). Cytomorphological spectrum of Hashimoto's thyroiditis and its correlation with hormonal profile and hematological parameters. Journal of Cytology, 36(3), 137.
33. Desai, M. K., & Brinton, R. D. (2019). Autoimmune disease in women: endocrine transition and risk across the lifespan. Frontiers in endocrinology, 10,1-16.
34. Ben-Batalla I., Vargas-Delgado M.E., von Amsberg G., Janning M., Loges S., (2020). Influence of Androgens on Immunity to Self and Foreign: Effects on Immunity and Cancer. Front Immunol. 11:1184.
35. Carbone A., Rotondi M., Chiovato L. (2019). Chronic Autoimmune Thyroiditis. In: Luster M., Duntas L., Wartofsky L. (eds) The Thyroid and Its Diseases. Springer, Cham. pp 379-397.
36. Cara Murphy, BA and Ankur Gupta, MD,(2020). MON-458 Elevated Thyroglobulin Level in Benign Thyroid Nodule. J Endocr Soc. May 8; 4(Suppl 1): MON-458.
37. Marcocci C, Marino M. ,(2005).Thyroid-directed antibodies. In: Braverman LE, Utiger R, editors. Part II Laboratory Assessment of Thyroid Function. Philadelphia, PA: Lippincott Williams and Wilkins. p. 360–72.
38. Janeway CJ, Travers P, Walport M, Shlomchik M.,(2001). Chapter 13: Autoimmunity and transplantation. In: Janeway CJ, Travers P, Walport M, Shlomchik M, editors. The Immune System in Health and Disease. New York, NY: Garland Science.
39. Hattori N, Ishihara T, Matsuoka N, Saito T, Shimatsu A.,(2017). Antithyrotropin autoantibodies in patients with macro-thyrotropin and longterm changes in macro-thyrotropin and serum thyrotropin levels. Thyroid 27:138–46.
40. Grova N., Schroeder H., Olivier J.L., Turner J.D., (2019). Epigenetic and Neurological Impairments Associated with Early Life Exposure to Persistent Organic Pollutants. Int J Genomics. 2019:2085496.
41. Chen H., Liu Y., Li Z., et al., (2019). "Urbanization, economic development and health: evidence from China's labor-force dynamic survey," International Journal for Equity in Health, vol. 16, p. 207.
42. Chen Y., Han B., Yu J., Chen Y., Cheng J., Zhu C., Xia F., Wang N., Lu Y., (2021). Influence of Rapid Urbanization on Thyroid Autoimmune Disease in China. Int J Endocrinol. 2021:9967712.
43. Wang J., Chen Z., Carru C., Capobianco G., Sedda S., Li Z., (2023). What is the impact of stress on the onset and anti-thyroid drug therapy in patients with graves' disease: a systematic review and meta-analysis. BMC Endocr Disord. 23(1):194.
44. Walczak K. and Sieminska L., (2021). Obesity and Thyroid Axis. Int J Environ Res Public Health. 18(18):9434.
45. Fruh S.M., (2017). Obesity: Risk factors, complications, and strategies for sustainable long-term weight management. J Am Assoc Nurse Pract. 29 (S1):S3-S14.
46. Baranowska-Bik A. and Bik W., (2020). The Association of Obesity with

Autoimmune Thyroiditis and Thyroid Function-Possible Mechanisms of Bilateral Interaction. Int J Endocrinol. 2020:8894792.
47. Huo J., Xu Y., Yu J., Guo Y., et al., (2023). Causal association between body mass index and autoimmune thyroiditis: evidence from Mendelian randomization. Eur J Med Res. 28(1):526.
48. Fahed M., Abou Jaoudeh M.G., Merhi S., Mosleh M.B., et al., (2020). Evaluation of risk factors for insulin resistance: A cross sectional study among employees at a private university in Lebanon. BMC Endocr Disord 20(1):1–14.
49. Shukla, S. K., Singh, G., Ahmad, S., & Pant, P. (2018). Infections, genetic and environmental factors in pathogenesis of autoimmune thyroid diseases. Microbial Pathogenesis, 116, 279-288.
50. Brix T.H. and Hegedüs L., (2018). Twin studies as a model for exploring the aetiology of autoimmune thyroid disease. Clin Endocrinol (Oxf). 76(4):457-64.
51. Hu S. and Rayman M.P., (2017). "Multiple nutritional factors and the risk of Hashimoto's thyroiditis," Thyroid, vol. 27, no. 5, pp. 597–610.
52. Yu Y., Yang X., Wu J., Shangguan X., et al., (2024). A Mendelian randomization study of the effect of serum 25-hydroxyvitamin D levels on autoimmune thyroid disease. Front Immunol. 14:1298708.
53. Frommer L. and Kahaly G.J., (2021). Type 1 Diabetes and Autoimmune Thyroid Disease-The Genetic Link. Front Endocrinol (Lausanne). 12:618213.
54. Medici M., Porcu E., Pistis G., et al., (2014). "Identification of genetic loci associated with thyroid peroxidase antibodies and clinical thyroid disease," PLoS Genetics, vol.10, Article ID e1004123.
55. Quazi S., (2022). Artificial intelligence and machine learning in precision and genomic medicine. Med Oncol. 39(8):120.
56. Vos X.G., Endert E., Tijssen J.G., Wiersinga W.M., (2012). Genotypes in relation to phenotypic appearance and exposure to environmental fac@ tors in Graves' hyperthyroidism. Eur J Endocrinol. 2012;783@792.
57. Wang J., Hao Q.H., Tu Y., Peng W., et al., (2022). Assessing the Association Between Internet Addiction Disorder and Health Risk Behaviors Among Adolescents and Young Adults: A Systematic Review and Meta-Analysis. Front Public Health. 10:809232.
58. Uikey M.S. and Dayal P., (2023). Association Between Comorbid Psychiatric Disorders and Persistent Smoking After a Diagnosis of Chronic Obstructive Pulmonary Disease Among Patients Seeking Treatment at a Tertiary Care Hospital in India. Cureus. 15(4):e37688.

