Frequency of Anti-Thyroid Peroxidase (Anti-TPO) in Diabetes Mellitus Type 1 Patients

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ABSTRACT

Background and Objectives: : The association between autoimmune thyroiditis and diabetes mellitus type 1 is of great significance, as both are autoimmune disorders. The presence of one autoimmune disorder increases the risk of developing another autoimmune disorder. To determine the frequency of anti-thyroid peroxidase (anti-TPO) antibodies in individuals diagnosed with diabetes mellitus type 1. On the basis of gender, age and among the diagnosed patients of hypothyroidism and hyperthyroidism with diabetes mellitus type 1.

METHODOLOGY: A retrospective study was conducted in University of Lahore Teaching Hospital, Lahore, Punjab. The study was conducted during the 3 months from May to July, 2023. The research involved examining of 135 diabetes type 1 patients, with an average age of 27.44 years, comprising 60 males (44.44%) and 75 females (55.56%) with different age groups. Cobas C-311 and Enzyme-linked Immunosorbent assay (ELISA) were used to analyze glycosylated hemoglobin (HbA1c) and anti-thyroid peroxidase antibodies (anti-TPO) respectively. A self-designed Performa was used to collect the patient data. Data were entered and analyzed by using excel and displayed by using Tables and Bar Charts.

RESULTS: Anti-TPO antibodies were detected in 25 patients (18.52%) out of the 135 participants, although they were absent in 110 patients (81.48%). Notably, females (76%) were more likely to have anti-TPO antibodies than men (24%), especially in those between the ages of 10 and 25 (64%). Only one of the 135 people had anti-TPO antibodies, despite the fact that five of them had hypothyroidism. Three of the 135 patients were diagnosed cases of hyperthyroidism, and all three were anti-TPO negative.

CONCLUSION: The conclusion of this study is that anti-TPO antibodies are very common in diabetes mellitus type 1 patients and gender and age have a significant impact on the formation of anti-TPO antibodies.

KEYWORDS: Anti-Thyroid peroxidase antibodies (anti-TPO), glycosylated hemoglobin (HbA1c), Hyperthyroidism, Hypothyroidism, Autoimmune thyroiditis.

INTRODUCTION

Diabetes affects the body's capacity to turn food into energy and is a chronic disorder. Blood sugar is used as an energy by the release of a hormone called insulin from the pancreas. The alpha and beta cells within the islets of Langerhans produce glucagon and insulin, respectively. Insulin is released when blood glucose levels are high, facilitating the body's utilization of glucose[1]. Due to the body's elimination of pancreatic beta cells, diabetes mellitus type 1 is a chronic autoimmune illness that causes inadequate insulin production. The blood sugar levels rise as a result of this[2]. Research into the autoimmune causes of diabetes mellitus type 1, sometimes referred to as "Juvenile diabetes," began in the 1970s. However, study on the involvement of pancreas in diabetes mellitus type 1 began in 1927 and the first direct evidence that the disease is an insulin- deficient disease was observed in 1951[3]. The development of diabetes mellitus type 1 is influenced by both genetic and environmental factors. Genetic components include subtypes of human leukocyte antigen (HLA) on chromosome 6 and a family history of diabetes. Ambient factors can also influence the occurrence of the disease. It may include microorganisms present in the person's

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surroundings such as rubella and enterovirus (4). Clinical symptoms of the disease appear within 2 weeks after the onset of the disease which include excessive urination, excessive thirst and weight loss(5). Diabetes mellitus type 1 had a 9.5% global prevalence and a 15 per 100,000 population incidence in 2020(6). In 2022, the prevalence of diabetes in Pakistan is 26.7% and number of cases are increasing day by day(7).

Thyroid gland is a butterfly shaped, soft and reddish parenchymal organ which is located in the neck just anterior to the trachea weighing between 15 and 20 grams(8). Thyroid hormones T3 and T4, produced by the thyroid gland, are essential for normal growth, mental development, regulation of sexual maturation, increasing oxygen consumption, and influencing a wide range of metabolic processes within the body(9). Abnormality in structure and function of thyroid gland can cause a number of different diseases which include hypothyroidism, hyperthyroidism, Graves' disease and autoimmune thyroiditis. The development of anti-thyroid antibodies causes Hashimoto's thyroiditis, also known as autoimmune thyroiditis, a chronic illness that impairs the thyroid's ability to produce hormones(10). Environmental variables and various genetic factors may lead to autoimmune thyroiditis such as excessive iodine consumption, selenium insufficiency, exposure to pollutants like cigarette smoke, and some viral disorders like chronic hepatitis C. Thyroiditis might also possibly be brought on by exposure to some medicines(11). Thyroid peroxidase antibodies were first recognized in 1964 and the level of these antibodies increase in thyroiditis(12). The generation of thyroid hormones, notably T3 and T4, depends on thyroid peroxidase. However, thyroid peroxidase-blocking antibodies reduce the ability of the body to produce these hormones(13).

Thyroid autoantibodies are more likely to develop in people with diabetes mellitus type 1, particularly when they have certain risk factors. These risk factors may include elements like age, gender, weight, and the length of the person's diabetes(14). The production of thyroid peroxidase antibodies (TPO), which may increase or decrease the body's level of thyroid hormones, is significantly influenced by hyperglycemia. In diabetes mellitus type 1 patients, physicians recommend the anti TPO test to identify the thyroid disorders(15).

METHODOLOGY

It was a retrospective study. Data was collected from the University of Lahore Teaching Hospital, Lahore, Punjab. Total 135 samples of diabetes mellitus type 1 were collected from the University of Lahore Teaching Hospital, Lahore, Punjab. Patients who were diagnosed with diabetes mellitus type 1 by clinicians were included.

A Performa were used to collect patient data of diabetes mellitus type 1 patients. Aseptic phlebotomy procedures were used to obtain intravenous blood samples from diabetes type 1 patients. The methods and instruments we used for analysis were; Enzyme Linked Immunosorbent Assay (ELISA) and Cobas C 311.

Enzyme-linked immunoassay operates on the principle that the interaction between antigens and antibodies in a patient's sample reveals the presence and quantity of antibodies. By combining antibodies with a designated enzyme (such as horseradish peroxidase or alkaline phosphatase enzyme) and a chromogen, specific color is generated as a result of the binding between antibodies and specific antigens. Cobas C 311 works on the principles of spectrophotometry, particularly the Beer-Lambert Law. As stated by this law, the level of light absorbed by a sample corresponds directly to the concentration of the substance it contains. In addition to spectrophotometry, Cobas C 311 also follows the principles of potentiometry and ion selective electrode (ISE).

Data were entered and analyzed by using excel for statistical analysis. Tables and Bar charts were used to display the data.

RESULTS

The research was carried out in the University of Lahore Teaching Hospital, Lahore, Punjab. A group of 135 individuals diagnosed with diabetes mellitus type 1, including 60 males (44.44%) and 75 females (55.56%), were examined to detect the existence of anti-thyroid peroxidase (anti-TPO) antibodies.

Table 1 Gender Based Distribution of Diabetes Mellitus Type 1 Patients

Total	Males (%)	Females (%)
135	60 (44.44%)	75 (55.56%)

Anti-thyroid peroxidase antibodies (anti-TPO) were found in 18.52% (or 25 patients) of the 135 people with diabetes mellitus type 1 whereas they were absent in 81.48% (or 110 patients) of the patients.

Table 2 Frequency of Anti-thyroid peroxidase Antibodies

Total	Anti-TPO positive patients	Anti-TPO negative patients
135	25 (18.52%)	110 (81.48%)

Results revealed that anti-thyroid peroxidase antibodies (anti-TPO) were tested in a group of 25 patients, and it was found that 6 patients (24% of the group) were male and 19 patients (76% of the group) were female.

Table 3 Prevalence of Anti-thyroid peroxidase Antibodies in Hypothyroidism

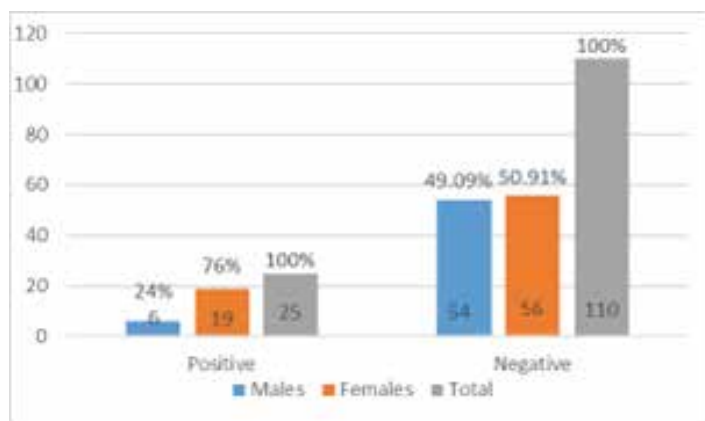| Disease Category	Anti-TPO positive	Anti-TPO negative	Total
Hypothyroidism	1 (20%)	4 (80%)	5
Non-Hypothyroidism	24 (18.46%)	106 (81.54%)	130
Total	25 (18.52%)	110 (81.48%)	135

Figure 1 Gender based Prevalence of Anti-thyroid peroxidase Antibodies

Among the group of 25 patients who were found to have positive results for anti-thyroid peroxidase antibodies (anti-TPO), a total of 16 patients (64%) were between the ages of 10 and 25 years, including 2 males and 14 females. Furthermore, within the study, 8 patients (32%) fell into the 26-40 age range, comprising of 4 males and 4 females. Additionally, there was one female patient (4%) who belonged to the 41-60 age group.
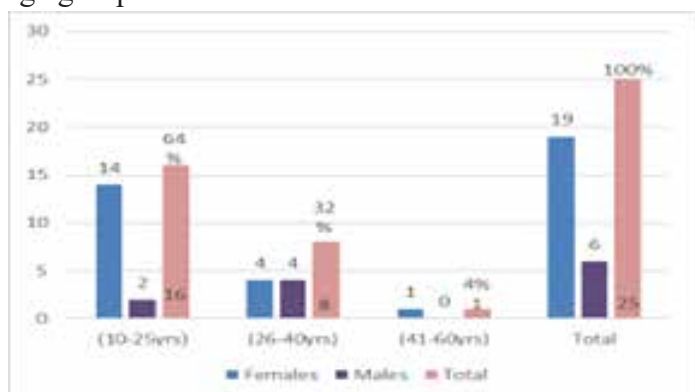

Figure 2 Prevalence of Anti-thyroid peroxidase Antibodies on the basis of Age

Among 135 diagnosed patients of diabetes mellitus type 1, 5 patients (3.70% of patients) had known hypothyroidism, out of which 1 patient was anti- TPO positive and 4 patients were anti-TPO negative. Among

135 diagnosed patients of diabetes mellitus type 1, 3 patients (2.22% of patients) had the known hyperthyroidism, and all the 3 patients were ant-TPO negative.

Table 4 Prevalence of Anti-thyroid peroxidase Antibodies in Hyperthyroidism

Disease Category	Anti-TPO positive	Anti-TPO negative	Total
Hyperthyroidism	0 (0%)	3 (100%)	3
Non-hyperthyroidism	25 (18.94%	107 (18.06%)	132
Total	25 (18.52%)	110 (81.48%)	135

DISCUSSION

An autoimmune condition called diabetes mellitus type 1 is particularly associated with insulin deficiency and high glucose levels in the body. The body's other cells and organs get damaged when glucose levels are high. Elevated levels of glucose cause other autoimmune disorders like autoimmune thyroiditis and pernicious anemia.

A research study was conducted at the University of Lahore Teaching Hospital, Lahore to examine the presence of anti-TPO antibodies in individuals diagnosed with diabetes mellitus type 1 and evaluate the prevalence of these antibodies among both males and females. The study produced significant results, indicating that 18.52% of the total 135 patients tested positive for anti-TPO antibodies. Notably, our findings align with previous studies conducted over a considerable duration.

Balram Sharma et al. in 2019 studied the prevalence of different autoimmune disorders and autoantibodies in 150 patients of diabetes mellitus type 1. Anti-TPO was tested positive in 20.7% patients and hypothyroidism was diagnosed in 14.1% patients. Both anti-TPO antibodies and hypothyroidism were more prevalent in females than in males (16). Hiralal Konar et al. in 2018 studied the frequency of thyroid disorders among pregnant women with diabetes mellitus was investigated by A total of 64 pregnant women diagnosed with both gestational diabetes mellitus (GDM) and pregestational diabetes mellitus (PGDM) were included in the study. 40% females had thyroid disorder and hypothyroidism was the most prevalent (37.5%) thyroid disease among them(17).

Alien Dantas Costa Riquetto et al. conducted a study in 2015 to evaluate the prevalence of thyroid diseases in a sample of 233 patients diagnosed with diabetes

mellitus type 1. The findings indicated that 21% of the patients had autoimmune thyroiditis, and 30.6% had anti-TPO antibodies. It was observed that females were more likely than males to possess anti-TPO antibodies, with a prevalence of 71.4% in females and 28.6% in males[18].

Kostas Kakleas et al., in 2009 revealed that among the 144 patients diagnosed with diabetes mellitus type 1, 17.4% had anti-thyroid peroxidase (anti-TPO) antibodies. The research findings highlighted a higher prevalence of these antibodies in females than in males. Additionally, the study identified several influential factors such as age, gender, and duration of diabetes that significantly impacted the development of anti-TPO antibodies[19]. Kordonouri O. et al., examined the frequency of anti-thyroid peroxidase (anti-TPO) and other thyroid antibodies in children and teenagers with diabetes mellitus type 1. The examination of thyroid antibodies comprised 216 individuals in total. Anti-TPO antibodies were found in 10% of the patients (22 individuals), which is a substantial occurrence, according to the research. Notably, females were more commonly found to have greater anti-TPO titers than men[20].

Our study is comparable to these studies as the results revealed that the 25 patients (18.52% patients) of total 135 patients of diabetes mellitus type 1 had anti-TPO antibodies. Female patients (76% of patients) had anti-TPO antibodies more frequently than male patients (24% of patients). The majority of the patients (64% of patients) who tested positive for anti-TPO were between the ages of 10 and 25 years. One of the five individuals with diagnosed hypothyroidism also tested positive for anti-TPO antibodies. Three patients were the confirmed cases of hyperthyroidism who were negative for anti-TPO antibodies.

CONCLUSION

The occurrence of anti-thyroid peroxidase (anti-TPO) antibodies is closely linked to diabetes mellitus type 1. It is noteworthy that both age and gender play significant roles in the development of anti-TPO antibodies among individuals with diabetes. Based on our findings, it is advisable to include anti-TPO testing as a part of routine monitoring to enable early detection of thyroid disorders in patients with diabetes mellitus type 1.

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Data Availability:
All raw and processed data is available.
Disclaimer:

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