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Autoimmune Comorbidities and Metabolic Outcomes in Type 1 Diabetes: A Retrospective Cross-Sectional Study

Tip 1 Diyabette Otoimmün Komorbiditeler ve Metabolik Sonuçlar: Retrospektif Kesitsel Bir Çalışma

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Autoimmune Comorbidities and Metabolic Outcomes in Type 1 Diabetes: A Retrospective Cross-Sectional Study

ABSTRACT

Objective: Type 1 diabetes mellitus (T1DM) is a chronic metabolic disorder frequently accompanied by autoimmune diseases. This study aimed to investigate the impact of coexisting autoimmune disorders, particularly celiac disease, on metabolic control and diabetic complications in patients with T1DM.

Material and Methods: This retrospective cross-sectional study evaluated the prevalence of autoimmune diseases among patients with T1DM. Metabolic regulation and diabetic complications in patients with T1DM who also had celiac disease or Hashimoto's hypothyroidism were compared with those in patients with T1DM alone.

Results: Among 155 patients with T1DM, 26.5% had Hashimoto-related autoantibody positivity (n=41), 7.7% had celiac-related autoantibody positivity (n=12), and 1.9% had Graves-related autoantibody positivity (n=3). Endoscopic duodenal biopsy was performed in three symptomatic patients with positive celiac autoantibodies, and histopathological findings consistent with celiac disease were identified in one patient. Eight seropositive patients declined biopsy but became asymptomatic after starting a gluten-free diet. No significant differences in metabolic control or diabetic complications were observed between patients with or without autoimmune comorbidities.

Conclusion: Although autoimmune disorders are more prevalent in individuals with T1DM than in the general population, no statistically significant association with glycemic regulation was detected in this cohort. Nonetheless, routine screening remains advisable to enhance quality of life and reduce the burden of comorbidities.

Keywords: Autoimmune diseases, Celiac disease, Diabetes complications, Gluten-free diet, Hypothyroidism.

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ÖZ

Amaç*:* Tip 1 diyabetes mellitus (T1DM), sıklıkla otoimmün hastalıklarla birlikte görülen kronik bir metabolik bozukluktur. Bu çalışmanın amacı, özellikle çölyak hastalığı başta olmak üzere, T1DM'ye eşlik eden otoimmün hastalıkların metabolik kontrol ve diyabetik komplikasyonlar üzerindeki etkisini araştırmaktır.

Gereç ve Yöntem: Bu retrospektif kesitsel çalışmada, T1DM'li hastalar arasında otoimmün hastalıkların prevalansı değerlendirildi. Çölyak hastalığı veya Hashimoto hipotiroidisi bulunan T1DM'li hastalarda metabolik regülasyon ve diyabetik komplikasyonlar, yalnızca T1DM'si olan hastalarla karşılaştırıldı.

Bulgular: Toplam 155 T1DM'li hastanın %26,5'inde Hashimoto'ya bağlı otoantikor pozitifliği (n=41), %7,7'sinde çölyakla ilişkili otoantikor pozitifliği (n=12) ve %1,9'unda Graves'le ilişkili otoantikor pozitifliği (n=3) saptandı. Çölyak otoantikorları pozitif olan semptomatik üç hastaya endoskopik duodenum biyopsisi yapıldı ve bir hastada çölyak hastalığı ile uyumlu histopatolojik bulgular tespit edildi. Sekiz seropozitif hasta biyopsiyi reddetti, ancak glutensiz diyet başlandıktan sonra semptomları geriledi. Otoimmün komorbiditesi olan ve olmayan hastalar arasında metabolik kontrol veya diyabetik komplikasyonlar açısından anlamlı bir fark saptanmadı.

Sonuç: Otoimmün hastalıklar, genel popülasyona kıyasla T1DM'li bireylerde daha sık görülmesine rağmen, glisemik regülasyon üzerinde anlamlı bir etkide bulunmamaktadır. Bununla birlikte, yaşam kalitesini artırmak ve komorbiditelerin yükünü azaltmak amacıyla rutin tarama önerilmektedir.

Anahtar Sözcükler: Otoimmün hastalıklar, Çölyak Hastalığı, Diyabet komplikasyonları, Glutensiz diyet, Hipotiroidizm.

Introduction

Type 1 diabetes mellitus (T1DM) is characterized by insulin deficiency secondary to T-lymphocyte–mediated autoimmune destruction of pancreatic β-cells, resulting from the interaction between genetic susceptibility and environmental factors. Numerous genetic variations, primarily polymorphisms in the human leukocyte antigen (HLA) region, impair immune tolerance, while environmental exposures such as infections, gut microbiota, and nutrition influence disease onset. During this process, the early detection of autoantibodies against insulin or glutamic acid decarboxylase (GAD) may indicate autoimmune activity that precedes the clinical onset of T1DM by several years (1-3). Although T1DM is most often diagnosed during childhood and adolescence, it can occur at any age and is associated with increased morbidity and mortality in both the pre- and post-adolescent periods (4-6). Globally, approximately 9.5 million individuals are currently living with T1DM, and this number is projected to rise to 14.7 million by 2040 (7).

T1DM is a systemic autoimmune condition that may be accompanied by other systemic autoimmune disorders. The most common associations are autoimmune thyroid diseases—particularly Hashimoto's thyroiditis and Graves' disease—which occur in approximately 17–30% of patients (8). Other autoimmune disorders that may coexist with T1DM include celiac disease, primary adrenal insufficiency, rheumatoid arthritis, Sjögren's syndrome, systemic lupus erythematosus, psoriasis, vitiligo, chronic urticaria, multiple sclerosis, autoimmune gastritis, and autoimmune hypoparathyroidism. The coexistence of these autoimmune disorders may adversely affect blood glucose regulation and long-term clinical outcomes. Hypothyroidism can increase hypoglycemia by leading to the deterioration of the counterregulatory system that develops via the growth hormone and cortisol. Decreased gluconeogenesis and glucagon secretion are also other mechanisms associated with hypoglycemia (9). On the other hand, celiac disease can lead to glycemic fluctuations and especially unexplained hypoglycemia in individuals with diabetes due to intestinal malabsorption. Initiating a gluten-free diet can improve nutrient absorption, increase insulin requirements, and reduce glycemic variability, resulting in more predictable metabolic control (10). Therefore, early detection and inclusion of related autoimmune diseases in routine screening protocols are essential to prevent complications and enable timely treatment (11,12). The American Diabetes Association (ADA) recommends routine screening for Hashimoto's thyroiditis in individuals with T1DM and screening for celiac disease autoantibodies in the presence of clinical suspicion based on symptoms or findings (13).

Accordingly, this study aimed to determine the prevalence of coexisting autoimmune disorders in individuals with T1DM and to evaluate their potential impact on metabolic regulation and diabetic complications.

Materials and Methods

Study Design and Population

This retrospective cross-sectional study included 155 patients diagnosed with T1DM who presented to the Endocrinology and Metabolic Diseases Clinic at Ankara Etlik City Hospital between January 2023 and June 2025. The study protocol was approved by the local ethics committee (Decision no: AEŞH–BADEK2-2025-367, Date: 22.07.2025). All procedures were conducted in accordance with the principles of the Declaration of Helsinki, and patient confidentiality was strictly maintained. Because of the retrospective study design, the requirement for informed consent was waived by the ethics committee.

For this retrospective analysis, patients were included if they were aged over 18 years, had a confirmed diagnosis of T1DM, and had available medical records documenting screening tests for other autoimmune disorders and diabetic complications. Only patients with sufficient follow-up data recorded at routine outpatient visits (typically every 3–6 months) were eligible for analysis.

Exclusion criteria included: absence of confirmed T1DM diagnosis, ongoing immunosuppressive therapy, history of thyroidectomy, incomplete clinical or laboratory data, and retinopathy or nephropathy attributable to non-diabetic causes.

Participants were classified according to the presence of celiac autoantibody positivity and overt hypothyroidism. Comparisons between groups were performed with respect to demographic characteristics, metabolic outcomes, daily insulin dose requirements, and diabetes-related microvascular complications, allowing assessment of the potential impact of these associated autoimmune conditions on metabolic control.

Data Collection and Variables

Data were retrospectively obtained from the hospital's electronic medical records. Demographic and clinical variables included age, sex, age at T1DM diagnosis, duration of diabetes, total daily insulin dose, 24-hour urinary albumin excretion, neuropathy symptoms, electromyography (EMG) findings, fundus examination results, daily levothyroxine dose, and celiac disease–related symptoms or signs (fatigue, abdominal pain, bloating, chronic diarrhea, skin rash, joint pain, and iron-deficiency anemia).

Laboratory parameters included glycated hemoglobin (HbA1c), fasting plasma glucose (FPG), anti-thyroid peroxidase (anti-TPO), anti-thyroglobulin (anti-Tg), serum immunoglobulin A (IgA), anti-tissue transglutaminase (anti-tTG), anti-endomysial antibody (EMA), thyroid-stimulating immunoglobulin (TSI), antinuclear antibody (ANA), and anti-double-stranded DNA (anti-dsDNA). Thyroid ultrasonography and endoscopic duodenal biopsy findings were also recorded.

Diabetic nephropathy was defined as an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m^2 according to Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) or albuminuria ≥30 mg/24 h persisting for at least three months. Diabetic neuropathy was diagnosed based on compatible symptoms and EMG findings, and diabetic retinopathy was confirmed by fundus examination.

For celiac disease screening, total serum IgA and anti-tTG IgA were measured in all patients. Anti-tTG IgA positivity was defined as ≥10× the upper limit of normal. Symptomatic celiac disease was defined by the presence of at least one characteristic feature, such as chronic diarrhea, signs of malabsorption (e.g., weight loss, anemia, or vitamin/mineral deficiencies), abdominal distension, recurrent abdominal pain, or aphthous stomatitis. Endoscopic duodenal biopsies were evaluated in seropositive patients according to the Marsh classification (14). In patients with positive celiac serology who declined endoscopic biopsy, HLA-DQ2 and/or HLA-DQ8 typing was not performed, as these analyses were not routinely available within the retrospective study framework.

Metabolic assessments were performed using data obtained before the initiation of a gluten-free diet in patients with celiac autoantibody positivity. Systematic screening was routinely performed for autoimmune thyroid disease and celiac autoimmunity. In addition to autoimmune thyroid disease and celiac autoantibody positivity, patients were systematically evaluated for other autoimmune comorbidities associated with T1DM, including atrophic gastritis/pernicious anemia, vitiligo, primary adrenal insufficiency, hypoparathyroidism, and alopecia areata; however, no confirmed cases of these conditions were identified in the study cohort.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics, version 27. Continuous variables are presented as mean±standard deviation or median (interquartile range), as appropriate; categorical variables are summarized as frequency (percentage). Between-group comparisons of continuous variables were conducted using the Mann–Whitney U test, since parametric test criteria were not met. Categorical variables were compared using the chi-square test. All tests were two-

sided; a *p-value <0.05* was considered statistically significant.

Results

A total of 155 patients with T1DM were included in the study. The mean age was 29.75±9.56 years, and 68 (43.9%) were male. The mean age at T1DM diagnosis was 18.40±8.35 years, and the mean disease duration was 11.66±8.32 years. The mean HbA1c was 9.21±2.23%, the mean FPG was 197.68±73.29 mg/dL, and the mean total daily insulin dose was 53.33±19.57 IU. Among the microvascular complications, 23 patients (14.8%) had neuropathy, 15 (9.7%) had retinopathy, and 12 (7.7%) had nephropathy.

At least one non–diabetes-related autoantibody positivity was present in 51 (32.9%) patients. The most common autoimmune antibodies associated with T1DM were, in order, Hashimoto-related autoantibody positivity (n=41, 26.5%), celiac-related autoantibody positivity (n=12, 7.7%), and Graves-related autoantibody positivity (n=3, 1.9%). Clinical autoimmune thyroiditis was diagnosed based on laboratory and ultrasound findings in 17 (41.5%) of the 41 patients with Hashimoto-related autoantibody positivity, representing 11.0% of the entire cohort. The median daily levothyroxine replacement dose among these patients was 100 µg (71.5–110.5 µg). There were no significant differences in HbA1c levels [8.70 (7.50-10.60)% vs. 8.85 (7.80-10.50)%; *p=0.879*], daily insulin requirements [50 (42-67) IU vs. 50 (38-66) IU; p=0.490], and microvascular complications [retinopathy n=4, 23.5% vs. n=22, 16.0% (*p=0.071*); nephropathy n=2, 11.8% vs. n=10, 7.2% (*p=0.511*); neuropathy n=2, 11.8% vs. n=21, 15.2% (*p=0.706*)] between patients with clinical hypothyroidism and euthyroid patients. There was no significant difference in overall autoantibody positivity between patients with a T1DM duration ≥10 years (n=31, 37.3%) and those with <10 years (n=22, 30.6%) (*p=0.374*).

Total serum IgA was measured in all patients, and no IgA deficiency was detected. All 12 patients with positive celiac autoantibodies had at least one symptom or finding related to celiac disease. Endoscopic duodenal biopsy was performed in three of these patients; duodenal villous atrophy and increased intraepithelial lymphocytes consistent with celiac disease were observed in one patient. The nine seropositive patients who declined biopsy were followed and became asymptomatic after starting a gluten-free diet.

All three patients with Graves-related autoantibody positivity had Graves' disease confirmed by compatible clinical findings, laboratory evidence of thyrotoxicosis, and thyroid ultrasonography. Systemic lupus erythematosus was confirmed in one patient with ANA and anti-dsDNA positivity. Additionally, one patient had clinically diagnosed multiple sclerosis without disease-specific serum autoantibodies (Table I).

Table I. Prevalence of Autoimmune Disorders in Patients with Type 1 Diabetes Mellitus

Autoimmune disorders	**Prevalence, n (%)** (Total n=155)
General autoantibody positivity	51 (32.9)
Hashimoto's Disease	
Autoantibody positivity	41 (26.5)
Clinical autoimmune thyroiditis	17 (11.0)
Celiac Disease	
Autoantibody + symptoms/signs	11 (7.1)
Autoantibody + symptoms/signs + endoscopic diagnosis	1 (0.6)
Graves' Disease	3 (1.9)
Multiple Sclerosis	1 (0.6)
Systemic Lupus Erythematosus	1 (0.6)
Psoriasis	1 (0.6)

Patients with positive versus negative celiac autoantibodies were comparable in age at T1DM diagnosis [14.0 (11.0 - 14.5) years vs. 18.0 (12.0 - 24.5) years] and sex distribution (male; n=5, 41.7% vs. n=63, 44.1%) (*p=0.185* and *p=0.873*). T1DM duration [8.5 (6.5 - 11.5) years vs. 10 (5.5 - 16.5) years] and metabolic regulation parameters, including HbA1c [9.3 (7.75 - 10.70)% vs. 8.7 (7.55 - 10.50)%], FPG [182.5 (126.0 - 247.5) mg/dL vs. 197.0 (147.5 - 242.0) mg/dL], and total daily insulin dose [62.0 (42.5 - 72.0) IU vs. 49.0 (38.0 - 65.5) IU] were also insignificant between groups (*p=0.286, p=0.683, p=0.545* and *p=0.139*). The prevalence of microvascular complications (retinopathy n=2, 16.9% vs. n=13, 9.1%;

nephropathy n=1, 8.3% vs. n=11, 7.7%; and neuropathy n=2, 16.7% vs. n=21, 14.7%) also insignificant between the two groups (*p=0.394, p=0.936* and *p=0.853*) (Table II).

Table II. Comparison of Demographic, Metabolic, and Clinical Data of Patients with Positive and Negative Celiac Autoantibodies

	Celiac autoantibody negative (n=143)	Celiac autoantibody positive (n=12)	*p-value*
Age at diagnosis, years	18.0 (12.0 - 24.5)	14.0 (11.0 - 14.5)	*0.185*
Gender: male, n (%)	63 (44.1)	5 (41.7)	*0.873*
Duration of DM, years	10 (5.5 - 16.5)	8.5 (6.5 - 11.5)	*0.286*
Daily insulin dose, IU	49.0 (38.0 - 65.5)	62.0 (42.5 - 72.0)	*0.139*
HbA1c, %	8.7 (7.55 - 10.50)	9.3 (7.75 - 10.70)	*0.683*
FPG, mg/dL	197.0 (147.5 - 242.0)	182.5 (126.0 - 247.5)	*0.545*
Diabetic neuropathy, n (%)	21 (14.7)	2 (16.7)	*0.853*
Diabetic retinopathy, n (%)	13 (9.1)	2 (16.7)	*0.394*
Diabetic nephropathy, n (%)	11 (7.7)	1 (8.3)	*0.936*

DM, diabetes mellitus; FPG, fasting plasma glucose; HbA1c, glycated hemoglobin; IU, international units.

Discussion

In this study, we investigated the prevalence and clinical implications of co-occurring autoimmune disorders in patients with T1DM. Our findings revealed that approximately one-third (32.9%) of the cohort had at least one non-diabetes-related autoantibody, most commonly those associated with Hashimoto thyroiditis, followed by celiac disease and, less frequently, Graves' disease. These results are consistent with previous reports demonstrating that autoimmune thyroid disease and celiac disease are the most prevalent autoimmune comorbidities in T1DM populations. Literature reports indicate that at least one additional autoantibody is present in 32.6% of T1DM cases, whereas only 18.6% have been diagnosed with at least one non–diabetic autoimmune disease. Among these, autoimmune thyroid disease and celiac disease are the most common (15). Although large-scale studies from Türkiye have reported the prevalence of autoimmune comorbidities in patients with type 1 diabetes, these cohorts have largely consisted of pediatric populations; therefore, direct comparison with our adult cohort may be limited due to age-related differences in autoimmune disease prevalence and clinical presentation. In addition, adult data from Türkiye are available. In a large single-center study including adult patients with T1DM, nearly half of the cohort (44.6%) had at least one non–diabetes-related autoantibody, with autoimmune thyroid disease being the most common, followed by celiac disease. These findings are largely concordant with our results and provide important population-specific epidemiological context (16). Importantly, when patients were stratified by celiac autoantibody status, no statistically significant differences were observed between seropositive and seronegative groups in terms of age at T1DM diagnosis, sex distribution, metabolic parameters (HbA1c, FPG, and total daily insulin dose), or the prevalence of microvascular complications.

The prevalence of autoimmune thyroid disease in patients with T1DM (17–30%) is higher than in the general population. The HLA-DQ2 and DQ8 antigens are thought to contribute to a shared genetic predisposition for T1DM and autoimmune thyroid disease; however, this association cannot be explained solely by genetics, as environmental factors are also important triggers (17,18). Hashimoto-related hypothyroidism occurs more frequently in T1DM than in the general population, with prevalence estimates ranging from 4% to 18%. Thyroid hormones influence gluconeogenesis and glycogenolysis, affecting endogenous glucose production and altering the risk of hypo- or hyperglycemia depending on thyroid status (8,19,20). In our cohort, consistent with prior literature, autoimmune thyroid disorders constituted the most common comorbidities. Hashimoto-associated autoantibody positivity was observed in 26.5%, whereas clinically overt hypothyroidism was present in 11.0% of the cohort. No significant differences were noted in HbA1c or total daily insulin dose between patients with clinical hypothyroidism and euthyroid patients, likely reflecting effective levothyroxine titration and

restoration of euthyroidism. Graves' disease was less frequent, identified in 1.9% of patients.

Celiac disease is an autoimmune disorder of the intestinal mucosa that develops in genetically predisposed individuals, with environmental factors such as early gluten exposure and viral infections increasing risk (8, 21). Although anti–tTG antibodies have high specificity (94–100%) and sensitivity (93–98%) for diagnosis, endoscopic duodenal biopsy remains the gold standard (8, 22). In a large national study in Sweden including 5,295 children with T1DM, the prevalence of celiac disease was 9.8%. Overall, celiac disease affects approximately 8% of individuals with T1DM, significantly higher than in the general population. In patients adhering to a gluten-free diet, carbohydrate absorption improves, and while hypoglycemic events may decrease, HbA1c levels generally remain unchanged (8,23). From a metabolic perspective, untreated celiac disease may influence insulin requirements and glycemic control through intestinal malabsorption, impaired carbohydrate uptake, altered incretin responses, and nutritional deficiencies. These mechanisms are particularly relevant in the period preceding diagnosis or in patients with active intestinal involvement.

A systematic review reported inconsistencies in metabolic outcomes between celiac T1DM patients on a gluten-free diet and non-celiac T1DM patients. Although one study found lower HbA1c levels in celiac T1DM patients, most studies reported no significant difference in HbA1c or total daily insulin dose (24). The heterogeneity of these findings may reflect differences in disease severity, timing of metabolic assessment relative to diagnosis, and variability in dietary adherence. Consistent with the majority of the literature, we observed no significant differences in HbA1c, FPG, or total daily insulin dose between T1DM patients who were celiac autoantibody–positive and those who were negative. Given that metabolic parameters in our cohort were evaluated at the time of initial assessment, prior to the initiation of a gluten-free diet, the absence of significant differences may also be influenced by the limited number of celiac autoantibody–positive patients and the variable clinical expression of intestinal involvement. These findings indicate that, within this cohort, no statistically significant differences were observed in short-term glycemic control or microvascular outcomes according to celiac autoantibody status. Supporting our findings, data from adult T1DM cohorts in Türkiye indicate that the presence of additional autoimmune diseases does not necessarily translate into higher rates of microvascular complications when patients are appropriately followed. In a large tertiary-center study comparing adult-onset and child–adolescent-onset T1DM, the overall prevalence of autoimmune comorbidities was high in both groups, yet the rates of microvascular complications were primarily driven by diabetes duration, hypertension, and metabolic factors rather than autoimmunity itself. This observation is consistent with our results, in which autoimmune comorbidity status was not independently associated with differences in glycemic control or microvascular outcomes (25).

In a study by Bakker et al., T1DM patients with celiac disease were compared with those without celiac disease regarding metabolic status and microvascular complications. HbA1c levels were comparable between groups; however, diabetic retinopathy was significantly more prevalent in the non-celiac group. By contrast, the incidence of diabetic nephropathy was comparable in all groups (26). Furthermore, Creanza et al. reported no statistically significant differences between T1DM patients with and without celiac disease in HbA1c or in the prevalence of diabetic nephropathy, neuropathy, and retinopathy (27). No statistically significant differences were found between groups regarding the prevalence of diabetic nephropathy, retinopathy, or neuropathy within this cohort. Although this finding contrasts with the higher retinopathy rates reported by Bakker et al., results for the other microvascular outcomes were concordant with the literature. This discrepancy in retinopathy prevalence may be related to differences in study design, population characteristics, or our cohort's adherence to a gluten-free diet among celiac antibody–positive patients.

Our study has several limitations. First, its single-centre, retrospective design may limit generalizability and introduce information bias. The lack of a formal power analysis and the small number of patients with celiac autoantibody positivity constitute limitations of this study. Second, the modest sample size reduces statistical power and limits precise estimation of the prevalence of rarer autoimmune comorbidities. Third, in a subset of celiac autoantibody–positive patients, the lack of confirmatory endoscopic biopsy raises the possibility of disease misclassification. The absence of HLA-DQ2/DQ8 typing in serology-positive patients who did not undergo biopsy represents a limitation that may have affected the precision of celiac disease classification. Furthermore, standardized continuous glucose monitoring data, including time in range and glycemic variability metrics, were not consistently available. Detailed information regarding hypoglycemia frequency, insulin delivery modality (insulin pump versus multiple daily injections), and diabetic ketoacidosis or hospitalization history could not be systematically retrieved from medical records. Insulin doses were analyzed as absolute daily values rather than weight-adjusted doses due to incomplete body weight data. These limitations precluded more detailed analyses of glycemic variability and acute metabolic outcomes. The extremely limited number of patients with multiple sclerosis and systemic lupus erythematosus limits any robust conclusions regarding their metabolic impact and related complications. Future multicenter studies with larger, more heterogeneous cohorts, including systematic histopathologic confirmation where indicated, are warranted to provide more robust and externally valid estimates.

This study has several notable strengths. It comprehensively assesses multiple autoimmune comorbidities in a well-defined cohort of adults with T1DM, integrating both serological and clinical evaluations. Including detailed metabolic parameters and microvascular complication data allows for a thorough analysis of the potential impact of these comorbidities on glycemic control and long-term outcomes. Furthermore, the study follows current guideline-based screening protocols, enhancing its clinical relevance and applicability to routine practice.

Conclusion

This study demonstrates that autoimmune comorbidities, particularly autoimmune thyroid disease and celiac disease, are more prevalent in individuals with T1DM compared to the general population. Despite some contradictory findings in previous studies, standardized and comprehensive screening for these conditions may improve patients' quality of life and support overall metabolic management.

References

1. Ilonen J, Lempainen J, Veijola R. The heterogeneous pathogenesis of type 1 diabetes mellitus. Nat Rev Endocrinol 2019;15(11):635-650.

2. Tuomela K, Levings MK. Genetic engineering of regulatory T cells for treatment of autoimmune disorders including type 1 diabetes. Diabetologia 2024;67(4):611-622.

3. Pisetsky DS. Pathogenesis of autoimmune disease. Nat Rev Nephrol 2023;19(8):509-524.

4. Ebrahimpour Y, Khatami S, Saffar M, et al. A Comprehensive Review of Novel Advances in Type 1 Diabetes Mellitus. J Diabetes 2025;17(8):e70120.

5. Samuelsson J, Bertilsson R, Bülow E, et al. Autoimmune comorbidity in type 1 diabetes and its association with metabolic control and mortality risk in young people: a population-based study. Diabetologia 2024;67(4):679-689.

6. Chalakova T, Yotov Y, Tzotchev K, et al. Type 1 Diabetes Mellitus - Risk Factor for Cardiovascular Disease Morbidity and Mortality. Curr Diabetes Rev 2021;17(1):37-54.

7. Ogle GD, Wang F, Haynes A, et al. Global type 1 diabetes prevalence, incidence, and mortality estimates 2025: Results from the International diabetes Federation Atlas, 11th Edition, and the T1D Index Version 3.0. Diabetes Res Clin Pract 2025;225:112277.

8. Popoviciu MS, Kaka N, Sethi Y, Patel N, Chopra H, Cavalu S. Type 1 Diabetes Mellitus and Autoimmune Diseases: A Critical Review of the Association and the Application of Personalized Medicine. J Pers Med 2023;13(3):422.

9. Kalra S, Unnikrishnan AG, Sahay R. The hypoglycemic side of hypothyroidism. Indian J Endocrinol Metab 2014;18(1):1–3.

10. Scaramuzza AE, Mantegazza C, Bosetti A, Zuccotti GV. Type 1 diabetes and celiac disease: The effects of gluten free diet on metabolic control. World J Diabetes 2013;4(4):130-134.

11. Derrou S, El Guendouz F, Benabdelfedil Y, Chakri I, Ouleghzal H, Safi S. The profile of autoimmunity in Type 1 diabetes patients. Ann Afr Med 2021;20(1):19-23.

12. Roep BO, Thomaidou S, van Tienhoven R, Zaldumbide A. Type 1 diabetes mellitus as a disease of the β-cell (do not blame the immune system?). Nat Rev Endocrinol 2021;17(3):150-161.

13. American Diabetes Association Professional Practice Committee. 4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes-2025. Diabetes Care 2025;48(1):59-85.

14. Rubio-Tapia A, Hill ID, Semrad C, et al. American College of Gastroenterology Guidelines Update: Diagnosis and Management of Celiac Disease. Am J Gastroenterol 2023;118(1):59-76.

15. Triolo TM, Armstrong TK, McFann K, et al. Additional autoimmune disease found in 33% of patients at type 1 diabetes onset. Diabetes Care 2011;34(5):1211-1213.

16. Bilginer MC, Faki S, Ozdemir D, et al. Organ-specific autoimmune markers in adult patients with type 1 diabetes mellitus. Int J Clin Pract 2021;75(12):e14842.

17. Giwa AM, Ahmed R, Omidian Z, et al. Current understandings of the pathogenesis of type 1 diabetes: Genetics to environment. World J Diabetes 2020;11(1):13-25.

18. Li L, Liu S, Yu J. Autoimmune thyroid disease and type 1 diabetes mellitus: same pathogenesis; new perspective? Ther Adv Endocrinol Metab 2020;11:2042018820958329.

19. Frommer L, Kahaly GJ. Type 1 Diabetes and Autoimmune Thyroid Disease-The Genetic Link. Front Endocrinol (Lausanne) 2021;12:618213.

20. Sharma H, Sahlot R, Purwar N, et al. Co-existence of type 1 diabetes and other autoimmune ailments in subjects with autoimmune thyroid disorders. Diabetes Metab Syndr 2022;16(2):102405.

21. Aboulaghras S, Piancatelli D, Oumhani K, Balahbib A, Bouyahya A, Taghzouti K. Pathophysiology and immunogenetics of celiac disease. Clin Chim Acta 2022;528:74-83.

22. Tarar ZI, Zafar MU, Farooq U, Basar O, Tahan V, Daglilar E. The Progression of Celiac Disease, Diagnostic Modalities, and Treatment Options. J Investig Med High Impact Case Rep 2021;9:23247096211053702.

23. Lindgren M, Norström F, Persson M, et al. Prevalence and Predictive Factors for Celiac Disease in Children With Type 1 Diabetes: Whom and When to Screen? A Nationwide Longitudinal Cohort Study of Swedish Children. Diabetes Care 2024;47(4):756-760.

24. Mozzillo E, Franceschi R, Di Candia F, et al. The impact of gluten-free diet on growth, metabolic control and quality of life in youth with type 1 diabetes and celiac disease: A systematic review. Diabetes Res Clin Pract 2022;191:110032.

25. Çakmak R, Çaklılı ÖT, Ok AM, et al. Clinical Characteristics and Development of Complications Differ Between Adult-Onset and Child-Adolescent-Onset Type 1 Diabetes: A Report From a Tertiary Medical Center in Türkiye. J Diabetes Res 2025;8860118.

26. Bakker SF, Tushuizen ME, von Blomberg ME, Mulder CJ, Simsek S. Type 1 diabetes and celiac disease in adults: glycemic control and diabetic complications. Acta Diabetol 2013;50(3):319-24.

27. Creanza A, Lupoli R, Lembo E, et al. Glycemic control and microvascular complications in adults with type 1 diabetes and long-lasting treated celiac disease: A case-control study. Diabetes Res Clin Pract 2018;143:282-287.