




# Thyroid function status at initial presentation in children with Hashimoto's thyroiditis: A retrospective evaluation

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## ABSTRACT

**Objective:** The objective of this study was to assess thyroid function status at the time of diagnosis in children with Hashimoto's thyroiditis (HT) and to analyze the clinical and biochemical features of different presentations.

**Material and Methods:** Pediatric patients diagnosed with HT between January 2018 and December 2022 were retrospectively enrolled. At the initial evaluation, thyroid function status was used to categorize patients into five groups. Comparative analyses were performed to evaluate demographic, clinical, and laboratory characteristics among these categories.

**Results:** Among the 270 patients included in the study (aged 2–18 years; mean age 12.1±3.5 years), 81.5% were female, 73.3% were pubertal, and 41.1% had a family history of thyroid disease. Most patients were identified through blood tests performed because of a positive family history or routine screening. Indications included annual screening for type 1 diabetes mellitus (5.9%), neck swelling (4.1%), constipation (1.9%), and vitiligo (1.5%). At diagnosis, 51.5% of patients were euthyroid, while 84 (31.1%) had subclinical hypothyroidism, 31 (11.5%) had overt hypothyroidism, 12 (4.4%) had subclinical hyperthyroidism, and 4 (1.5%) had overt hyperthyroidism.

**Conclusion:** Most pediatric patients with HT in this study had normal or mildly affected thyroid hormone levels at diagnosis. A substantial proportion of patients were identified through a positive family history and routine screening for other autoimmune diseases, emphasizing the importance of antibody screening in children with a positive family history and in selected cases.

**Keywords:** Children, Hashimoto's thyroiditis, thyroid function tests.

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## INTRODUCTION

Hashimoto's thyroiditis (HT) is the most common cause of acquired hypothyroidism in children living in areas with adequate iodine intake. Its frequency in the pediatric population has been estimated at approximately 1–3%, with a marked increase during adolescence.<sup>[1–4]</sup> At the initial evaluation, many children and adolescents are asymptomatic; however, some may present with goiter or manifestations related to thyroid dysfunction. In addition, HT is often identified incidentally, either through routine screening of at-risk populations or during the assessment of unrelated medical conditions.<sup>[5]</sup>

The diagnosis is primarily based on the detection of antithyroglobulin (TG-Ab) and/or antithyroid peroxidase (TPO-Ab) antibodies in serum and is supported by ultrasonographic findings showing a diffusely hypoechoic and heterogeneous thyroid parenchyma.<sup>[6]</sup> The clinical presentation varies according to thyroid function status, ranging from euthyroidism to subclinical or overt hypothyroidism, with hyperthyroidism in rare cases. Consequently, children diagnosed with HT require regular clinical and laboratory follow-up to detect evolving thyroid dysfunction. Treatment is based on the clinical status and disease stage, and levothyroxine (LT4) therapy is initiated in cases of hypothyroidism.<sup>[2–4,7]</sup>

This study aims to provide a comprehensive overview of thyroid function patterns at initial presentation in children with Hashimoto's thyroiditis and to identify their clinical and laboratory correlates, thereby offering insights for early risk stratification.

## MATERIAL AND METHODS

A total of 270 pediatric patients aged 2–18 years who were diagnosed with HT were retrospectively evaluated. These patients were followed in the pediatric endocrinology outpatient clinic of our institution between January 2018 and December 2022. The diagnosis of HT was confirmed by the presence of TPO-Ab and/or TG-Ab. Children who had already been diagnosed with HT and had started LT4 therapy before admission to our clinic were excluded. The study was conducted in accordance with the principles of the Declaration of Helsinki II and received approval from the local Ethics Committee (approval number/date: B.10.1.TKH.4.34.H.GP.0.01/88-2023). At baseline, all patients underwent a detailed physical examination and laboratory assessment, including serum thyroid-stimulating hormone (TSH), free thyroxine (fT4), and free triiodothyronine (fT3). In cases of hyperthyroidism, thyroid-stimulating hormone receptor antibody (TRAb) levels were also measured, along with autoantibody levels and thyroid ultrasonography. Goiter was defined as a thyroid volume above the 97<sup>th</sup> percentile of the World Health Organization reference values for thyroid volume in children, calculated by ultrasonography.<sup>[8]</sup> Additionally, demographic characteristics (age, sex, perinatal history), anthropometric parameters [height, weight, body mass index–standard deviation score (BMI-SDS)], pubertal status, presenting symptoms, biochemical findings, and radiological features at diagnosis were systematically collected. Thyroid function at presentation was subsequently categorized into five groups.

Thyroid function at presentation was classified into five distinct groups:

- Euthyroid, defined by normal serum levels of fT4 and TSH.
- Overt hypothyroidism, defined by elevated TSH and reduced fT4.
- Subclinical hypothyroidism, defined by elevated TSH with normal fT4.
- Subclinical hyperthyroidism, defined by suppressed TSH with normal fT4 and fT3 levels.
- Overt hyperthyroidism, defined by suppressed TSH with elevated fT4 and/or fT3.

Height and weight were recorded using a portable stadiometer and a digital scale (Seca, Hamburg, Germany). BMI-SDS was calculated using an online calculator based on Türkiye reference data. Obesity was defined as a BMI-SDS greater than +2.<sup>[9]</sup> Pubertal development was evaluated according to Tanner staging.<sup>[10]</sup>

Fasting venous blood samples were obtained from the antecubital vein between 08:00 and 10:00 a.m. during routine biochemical testing. TPO-Ab, TG-Ab, TSH, fT4, and fT3 levels were measured using an electrochemiluminescence immunoassay on a Cobas 8000 analyzer (Roche Diagnostics, reference number: 04625889, GmbH 68298, Mannheim, Germany). Thyroid ultrasonography was performed on separate days by a pediatric radiologist. Reference ranges were as follows: TSH (0.35–4.94 mIU/L), fT3 (2–4.4 ng/L), fT4 (0.85–1.70 ng/dL), TRAb (>1.75 IU/L positive), TPO-Ab (0–34 IU/mL), and TG-Ab (0–115 IU/mL).

Thyroid ultrasonography was carried out by a pediatric radiologist on different days using high-frequency linear transducers (4.8–11 MHz or 5–14 MHz) with Toshiba Aplio 500/300 or Siemens Acuson S3000 systems. Examinations were performed with the patient in the supine position and the neck in hyperextension, employing both grayscale and color Doppler imaging in transverse and longitudinal planes. Thyroid echogenicity and the presence of nodular structures were evaluated using standardized imaging protocols.

## Statistical Analysis

Statistical analyses were performed using SPSS version 27. The distribution of continuous variables was evaluated using the Kolmogorov–Smirnov test. Categorical variables were summarized as frequencies and percentages, whereas continuous variables were expressed as mean±standard deviation or median with interquartile range (IQR), based on their distribution. For group comparisons, the chi-square test or Fisher's exact test was applied for categorical variables, whereas the Mann–Whitney U test was used for continuous variables not following a normal distribution. Pearson correlation analysis was conducted to evaluate relationships between continuous variables. A p-value of <0.05 was considered statistically significant.

## RESULTS

The study cohort consisted of 270 pediatric patients, with a mean age of 12.1±3.5 years at the time of diagnosis. The majority were female (81.5%, n=220), while 18.5% (n=50) were male. A total of 199 patients (73.7%) were pubertal.

Analysis of demographic and anthropometric parameters showed that the mean body weight and height SDS were 0.23±1.62 and –0.14±1.24, respectively. The mean BMI was 20.7±5.2kg/m<sup>2</sup>. Based

on BMI SDS values, 40 patients (14.8%) had obesity (BMI SDS $\geq$ +2). A positive family history was reported in 111 patients (41.1%). Three patients had Down syndrome. Coexisting autoimmune disorders were identified in 18 patients, including type 1 diabetes mellitus (T1DM) in 16 cases and both T1DM and celiac disease in two cases.

At diagnosis, 119 patients (51.5%) were euthyroid, 84 (31.1%) had subclinical hypothyroidism (SCH), 31 (13.4%) had overt hypothyroidism (OH), 12 (5.2%) had subclinical hyperthyroidism, and four (1.7%) had overt hyperthyroidism (Fig. 1). Most patients were diagnosed incidentally during routine health evaluations. Presenting complaints are detailed in Table 1.

Thyroid function test results demonstrated TSH values ranging from 0 to 500mIU/L, with a mean of 16.2 $\pm$ 60.4mIU/L. The mean serum fT4 concentration was 1.01 $\pm$ 0.3ng/dL. TPO-Ab were positive in 236 patients (87.4%), while Tg-Ab were detected in 269 patients (99.6%); both antibodies were simultaneously present in 235 patients (87%). On physical examination, all patients were normal except for goiter, which was identified in 52 cases (19.3%). Thyroid ultrasonography at diagnosis was performed in 209 patients. Thirty-three patients (15.8%) showed a homogeneous thyroid parenchyma. Findings consistent with thyroiditis were observed in 176 patients (84.2%), among whom 10 had hypoechoic nodules. Fine-needle aspiration biopsy was performed in only one patient (size>1cm, thick-walled nodule), which was diagnosed as a keratinous cyst.

Approximately 75% of the patients did not require treatment at the initial evaluation. Levothyroxine therapy was initiated in a total of 56 patients due to SCH (TSH>10 $\mu$ IU/mL) or OH. Eight patients with persistent thyrotoxicosis, markedly suppressed TSH, elevated thyroid hormone levels, and a prolonged disease course were treated with beta-blockers and subsequently methimazole; TRAb positivity in several cases supported the decision for antithyroid therapy. Follow-up confirmed the diagnosis of Hashimoto's thyroiditis in all patients.

When patients were stratified according to the presence of goiter, no significant differences were observed in sex distribution, demographic characteristics, or most anthropometric and laboratory parameters. However, the goiter group demonstrated significantly lower fT4 levels (p=0.006), along with higher thyroid volume SDS and TG-Ab levels (p=0.005 and p=0.033, respectively). In addition, the prevalence of goiter was significantly greater among patients with autoimmune diseases (p=0.029) (Table 2).

Statistical analysis of laboratory parameters and anthropometric characteristics revealed significant differences in age, TSH, fT3, and thyroid volume SDS between euthyroid and SCH patients, the most common presentation of HT (Table 3).

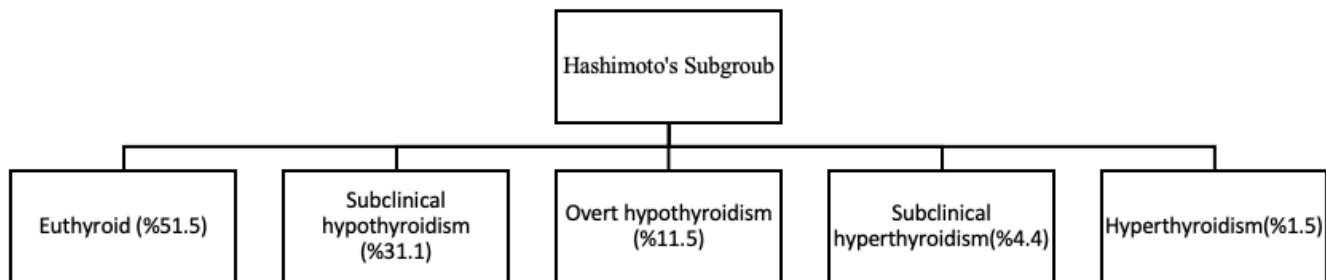
**Table 1: Clinical presentation of the patients with Hashimoto's Thyroiditis**

Symptoms	Number (n)	Percentage (%)
Routine health evaluations	166	61.5
Swelling in the neck	11	4.1
Constipation	5	1.9
Routine screening of patients diagnosed with type 1 DM	16	5.9
Vitiligo	4	1.5
Down syndrome	2	0.7
Hair loss	20	7.4
Weight loss	2	0.7
Weight gain	19	7.0
Palpitations	5	1.9
Menstrual irregularity	4	1.5
Irritability	1	0.4
Dry skin	1	0.4
Tremor	2	0.7
Screening based on family history	12	4.4
Total	270	100.0

DM: Diabetes mellitus.

Hashimoto's thyroiditis was diagnosed predominantly in pubertal girls. Comparison between pubertal and prepubertal patients revealed that median age and BMI were markedly higher in the pubertal group (p<0.001), while TSH, fT4, and fT3 levels were significantly higher in the prepubertal group (p=0.001, p<0.001, and p=0.006, respectively) (Table 4).

Correlation analysis was performed to evaluate the relationships between thyroid autoantibodies and thyroid function tests. A weak negative correlation was found between anti-TPO and fT4 (r=-0.387, p<0.001) and between TSH and fT4 (r=-0.326, p<0.001). A weak negative correlation was also identified between anti-Tg and fT4 (r=-0.150, p=0.014). The fT4 and fT3 levels demonstrated a weak positive correlation (r=0.391, p<0.001).



**Figure 1:** Distribution of thyroid function subtypes at diagnosis in patients with Hashimoto's thyroiditis.

**Table 2: Biochemical and anthropometric profile comparison in pediatric patients with Hashimoto's thyroiditis according to the presence or absence of goiter**

Variables	With Goiter	Without Goiter	p
Gender, n (%)			
Female	46 (88.4)	174 (79.8)	0.873
Male	6 (11.6)	44 (20.2)	
Median (IQR)			
Age (years)	13.7 (3.4)	14.1 (5.6)	0.873
TSH (mIU/L)	3.89 (9.26)	3.3 (4.97)	0.208
fT4 (ng/dL)	0.88 (0.12)	0.97 (0.27)	<b>0.006</b>
fT3 (ng/dL)	3.5 (0.4)	3.5 (0.8)	0.734
Anti-TPO (IU/mL)	709 (702)	363 (678)	0.910
Anti-TG (IU/mL)	566 (819)	392 (831)	<b>0.033</b>
Weight-SDS	0.41 (2.37)	0.07 (2.09)	0.935
Height-SDS	-0.74 (0.99)	-0.21 (1.96)	0.117
Thyroid volume-SDS	3.1 (7.57)	1.2 (4.0)	<b>0.005</b>
Family history of HT, n (%)			0.078
Present	27	84	
Absent	25	134	
Puberty status, n (%)			0.260
Pubertal	42	157	
Prepubertal	10	61	
Autoimmune disease, n (%)			<b>0.029</b>
Present	0	18	
Absent	52	200	
Treatment, n (%)			0.080
Receiving treatment	16 (28.6)	40 (71.4)	
Not receiving treatment	35 (71.4)	171 (83.0)	

Continuous variables were compared using the Mann–Whitney U test. Categorical variables were analyzed using the Chi-square test. TSH: Thyroid stimulating hormone; fT4: Free thyroxine; fT3: Free triiodothyronine; TPO-Ab: Anti-thyroid peroxidase antibody; TG-Ab: Anti-thyroglobulin antibody; SDS: Standard deviation score; HT: Hashimoto's thyroiditis. Bold values indicate statistical significance ( $p < 0.05$ ).

## DISCUSSION

Hashimoto's thyroiditis is the leading cause of acquired thyroid dysfunction in children and adolescents.<sup>[9,11]</sup> In our study, most patients were asymptomatic and diagnosed during routine health evaluations. Most were in the euthyroid or subclinical hypothyroid state at baseline; therefore, treatment was not initially required for the majority. These findings highlight the heterogeneous and often indolent course of pediatric HT, emphasizing the necessity for tailored and long-term follow-up strategies.

**Table 3: Laboratory parameters and anthropometric characteristics of patients with Hashimoto's thyroiditis in euthyroid state and subclinical hypothyroidism**

Parameters	Euthyroid Median (IQR)	Subclinical hypothyroidism Median (IQR)	p
Age (years)	14.95 (3.0)	12.1 (4.6)	<b>0.005</b>
TSH (mIU/L)	2.45 (2.46)	7.0 (6.1)	<b>&lt;0.001</b>
fT4 (ng/dL)	0.95 (0.12)	0.90 (0.17)	0.997
fT3 (ng/dL)	3.37 (0.45)	3.64 (0.52)	<b>0.003</b>
Anti-TPO (IU/mL)	438 (697)	451 (858)	0.380
Anti-TG (IU/mL)	459 (865)	392 (776)	0.263
Weight-SDS	0.13 (2.28)	0.99 (2.04)	0.204
Height-SDS	-0.34 (1.92)	-0.21 (1.58)	0.803
Thyroid volume-SDS	1.97 (3.51)	3.9 (5.3)	<b>0.040</b>

Continuous variables were compared using the Mann–Whitney U test. TSH: Thyroid stimulating hormone; fT4: Free thyroxine; fT3: Free triiodothyronine; TPO-Ab: Anti-thyroid peroxidase antibody; TG-Ab: Anti-thyroglobulin antibody; SDS: Standard deviation score. Bold values indicate statistical significance ( $p < 0.05$ ).

**Table 4: Laboratory and anthropometric characteristics in pubertal and prepubertal patient groups**

Parameters	Pubertal Median (IQR)	Prepubertal Median (IQR)	p
Age (years)	14.8 (3.0)	8.6 (1.9)	<b>&lt;0.001</b>
TSH (mIU/L)	3.13 (4.05)	4.65 (8.72)	<b>0.001</b>
fT4 (ng/dL)	0.93 (0.16)	1.00 (0.25)	<b>&lt;0.001</b>
fT3 (ng/dL)	3.43 (0.62)	3.80 (0.79)	<b>0.006</b>
Anti-TPO (IU/mL)	394 (782)	537 (627)	0.750
Anti-TG (IU/mL)	478 (831)	283 (845)	0.983
Weight-SDS	0.21 (2.23)	0.03 (1.93)	0.401
Height-SDS	-0.36 (1.57)	0.58 (2.08)	0.206
BMI	21.9 (7.2)	15.7 (6.5)	<b>&lt;0.001</b>
Thyroid volume-SDS	2.25 (4.3)	2.14 (3.9)	3.9

Continuous variables were compared using the Mann–Whitney U test. TSH: Thyroid stimulating hormone; fT4: Free thyroxine; fT3: Free triiodothyronine; TPO-Ab: Anti-thyroid peroxidase antibody; TG-Ab: Anti-thyroglobulin antibody; BMI: Body mass index; SDS: Standard deviation score. Bold values indicate statistical significance ( $p < 0.05$ ).

Reports consistently demonstrate that HT is more prevalent in females, with female-to-male ratios varying between 2:1 and 9:1.<sup>[12–17]</sup> In our study, this ratio was 4.4:1. Although cases under the age of three are rare, two patients in our cohort were diagnosed before the age of three. The mean age at diagnosis in our cohort was 12 years, with most patients being pubertal, which is consistent with the pediatric HT literature.<sup>[5,18]</sup>

Our observation of a 41% family history rate is in line with prior studies (39%–52%), underscoring the role of genetic susceptibility in HT.<sup>[5,19–21]</sup> While thyroid autoimmunity is strongly clustered within families, current guidelines do not recommend universal screening of relatives.<sup>[11]</sup> However, our findings underline the relevance of family history as a clinical risk factor.

Previous studies have shown that many children with HT are asymptomatic at diagnosis.<sup>[20–22]</sup> Demirbilek et al.<sup>[23]</sup> reported that 11.1% of cases were incidentally identified with goiter during routine physical examinations, while 6.2% of patients with type 1 diabetes mellitus (T1DM) were diagnosed with HT through thyroid screening. In our cohort, 61.5% of patients were detected during routine health check-ups, 8.1% were evaluated because of comorbid conditions, and 4.4% were screened due to a family history of thyroid disease. The high proportion of screening-based diagnoses may reflect the impact of expanding preventive health measures and routine evaluations.

In pediatric HT, neck swelling is generally the most common presenting symptom, although nonspecific complaints such as hair loss, short stature, and fatigue are also observed.<sup>[2,22]</sup> Similarly, Özden and Döneray (2024) reported neck swelling (37%) as the most common symptom and a high frequency of hair loss (23.5%).<sup>[24]</sup> In our cohort, the most frequently reported symptom was hair loss (7.4%), followed by weight gain (7.0%) and neck swelling (4.1%). Hair loss in our study was recorded based on patient or parent self-report during the initial clinical visit, without objective measurement methods. This finding may be explained by increased cosmetic concerns during adolescence, making hair loss more readily recognized and reported. Although this represents a limitation when interpreting the results, previous studies have also highlighted hair loss as an important clinical manifestation associated with thyroid autoimmunity.<sup>[15,16]</sup>

According to the literature, the prevalence of asymptomatic goiter ranges from 40% to 90%.<sup>[5,19,23,25,26]</sup> Several studies have shown that the proportion of patients reporting goiter-related symptoms is markedly lower than the prevalence of goiter detected on physical examination.<sup>[5,20,23]</sup> In our study, only 4.1% of patients presented with neck swelling, whereas goiter was detected in 19.3% on examination. This finding highlights the critical role of physical examination in the early identification of thyroid disorders in pediatric populations.

Hashimoto's thyroiditis is frequently associated with other autoimmune diseases.<sup>[1,11,27,28]</sup> Radetti et al.<sup>[28]</sup> first demonstrated an increased prevalence of HT in children with T1DM compared with the general population (3.9% vs. 1.2%). Subsequent studies have consistently reported substantial rates of T1DM and celiac disease among pediatric HT cohorts.<sup>[17,25]</sup> In our series, 5.9% of patients were affected by T1DM, with two cases presenting concurrent T1DM and

celiac disease. Collectively, these findings emphasize the importance of systematic and longitudinal screening for concomitant autoimmune diseases at diagnosis and during follow-up in children with HT.

The thyroid functional status at diagnosis in patients with HT can vary. According to the literature, most patients are diagnosed during the euthyroid or SCH phase<sup>[3,6,21,24,29,30]</sup> Similarly, in our study, 51.5% of patients were diagnosed in the euthyroid phase and 31.1% in the SCH phase. The absence of clear clinical manifestations in the initial stages of the disease, together with increased awareness among families, may account for this finding.

The detection of elevated thyroid autoantibodies is a significant finding in HT and is considered an indicator of autoimmune damage to the gland.<sup>[31]</sup> However, studies investigating the relationship between autoantibody levels and thyroid function have reported differing results. While several studies found no significant association between autoantibody titers and thyroid function<sup>[17,21,24,26]</sup> others have demonstrated higher rates of autoantibody positivity in the hypothyroid group.<sup>[30]</sup> In our study, the copositivity rates of both antibodies were high. When evaluating the association between thyroid autoantibodies and thyroid function tests, only a weak correlation was observed between TPO-Ab and fT4 levels. Furthermore, autoantibody levels did not differ significantly between patients with euthyroidism and those with SCH, the two most common presentations.

## CONCLUSIONS

This study demonstrates that HT in childhood may present with various thyroid function abnormalities at diagnosis and that a substantial proportion of patients are detected asymptotically through routine screening. As with other autoimmune diseases, diagnosing HT is important for determining the frequency of follow-up blood tests and imaging and for monitoring other conditions that may arise during follow-up. Our findings underscore the importance of individualized follow-up and treatment plans tailored to the patient's initial thyroid status. Despite its strengths, the single-center design of this study, conducted in a tertiary care setting, represents a methodological limitation that may restrict the generalizability of the findings. Because the patient profile of tertiary referral centers may not fully reflect the general population, multicenter and prospective studies are needed to validate these results in broader populations.

## Disclosures

**Ethics Committee Approval:** The study was approved by University of Health Science Umraniye Training and Research Hospital Ethics Committee (No: B.10.1.TKH.4.34.H.GP.0.01/88-2023, Date: 21.03.2023).

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## REFERENCES

1. Wasniewska MG, Gawlik AM, Aversa T. Editorial: autoimmune thyroid pathology-specificity of the pediatric age. *Front Endocrinol (Lausanne)* 2021;12:645278.
2. Ralli M, Angeletti D, Fiore M, D'Aguanno V, Lambiase A, Artico M, et al. Hashimoto's thyroiditis: An update on pathogenic mechanisms, diagnostic protocols, therapeutic strategies, and potential malignant transformation. *Autoimmun Rev* 2020;19:102649.
3. Smith JR, Smith AJW. Thyroiditis. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, editors. *Nelson textbook of pediatrics*. 21st ed. Philadelphia: Elsevier; 2020. p.2923–5.
4. Ragusa F, Fallahi P, Elia G, Gonnella D, Paparo SR, Giusti C, et al. Hashimotos' thyroiditis: Epidemiology, pathogenesis, clinic and therapy. *Best Pract Res Clin Endocrinol Metab* 2019;33:101367.
5. de Vries L, Bulvik S, Phillip M. Chronic autoimmune thyroiditis in children and adolescents: at presentation and during long-term follow-up. *Arch Dis Child* 2009;94:33–7.
6. Wasniewska M, Corrias A, Salerno M, Mussa A, Capalbo D, Messina MF, et al. Thyroid function patterns at Hashimoto's thyroiditis presentation in childhood and adolescence are mainly conditioned by patients' age. *Horm Res Paediatr* 2012;78:232–6.
7. Leung AKC, Leung AAC. Evaluation and management of the child with hypothyroidism. *World J Pediatr* 2019;15:124–34.
8. Zimmermann MB, Hess SY, Molinari L, De Benoist B, Delange F, Braverman LE, et al. New reference values for thyroid volume by ultrasound in iodine-sufficient schoolchildren: a world health organization/nutrition for health and development iodine deficiency study group report. *Am J Clin Nutr* 2004;79:231–7.
9. LaFranchi S. Disorders of the thyroid gland. In: Behrman RE, Jensen HB, Stanton BF, Kliegman RM, editors. *Nelson textbook of pediatrics*. 18th ed. Philadelphia: WB Saunders; 2007. p.2327–9.
10. Tanner JM. Growth and maturation during adolescence. *Nutr Rev* 1981;39:43–55.
11. Dayan CM, Daniels GH. Chronic autoimmune thyroiditis. *N Engl J Med* 1996;335:99–107.
12. Weetman AP, McGregor AM. Autoimmune thyroid disease: further developments in our understanding. *Endocr Rev* 1994;15:788–30.
13. Admoni O, Rath S, Almagor T, Elias-Assad G, Tenenbaum-Rakover Y. Long-term follow-up and outcomes of autoimmune thyroiditis in childhood. *Front Endocrinol (Lausanne)* 2020;11:309.
14. Calcaterra V, Nappi RE, Regalbutto C, De Silvestri A, Incardona A, Amariti R, et al. Gender differences at the onset of autoimmune thyroid diseases in children and adolescents. *Front Endocrinol (Lausanne)* 2020;11:229.
15. Popa A, Carsote M, Cretoiu D, Dumitrascu MC, Nistor CE, Sandru F. Study of the thyroid profile of patients with alopecia. *J Clin Med* 2023;12:1115.
16. Aboalola D, Aouabdi S, Ramadan M, Alghamdi T, Alsolami M, Malibari D, et al. An update on alopecia and its association with thyroid autoimmune diseases. *touchREV Endocrinol* 2023;19:54–9.
17. Özsü E, Yeşiltepe Mutlu RG, Çizmeçi F, Hatun Ş. Hashimoto tiroiditi hastalarımızın özellikleri. *Turk Pediatri Ars* 2011;46:252–5. [Article in Turkish]
18. Tunç S, Özkan B. Retrospective analysis of Hashimoto's thyroiditis in children and adolescents: a single-center experience. *J Behcet Uz Child Hosp* 2021;11:314–20.
19. Dündar B, Boyacı A, Sangün Ö, Dündar N. Hashimoto's thyroiditis in children and adolescents: evaluation of clinical and laboratory findings. *Turk Pediatri Ars* 2011;46:318–22.
20. Kara Ö. Clinical and laboratory characteristics of children and adolescents with hashimoto thyroiditis at diagnosis and during follow-up. *J Ankara Univ Fac Med* 2019;72:314–9. [Article in Turkish]
21. Korkmaz Ö, Özen S, Gökşen D, Darcan Ş. Çocukluk çağı Hashimoto tiroiditi tanılı olguların klinik özellikleri ve izlem bulguları: retrospektif tek merkez deneyimi. *Konuralp Tıp Derg* 2019;11:89–94. [Article in Turkish]
22. Cappa M, Bizzarri C, Crea F. Autoimmune thyroid diseases in children. *J Thyroid Res* 2010;2011:675703.
23. Demirbilek H, Kandemir N, Gonc EN, Ozon A, Alikasifoglu A, Yordam N. Hashimoto's thyroiditis in children and adolescents: a retrospective study on clinical, epidemiological and laboratory properties of the disease. *J Pediatr Endocrinol Metab* 2007;20:1199–205.
24. Ozden A, Doneray H. Clinical and laboratory findings in children with Hashimoto's thyroiditis. *Eurasian J Med* 2024;56:178–81.
25. Yeşilkaya E, Belen B, Bideci A, Çamurdan O, Boyraz M, Cinaz P. Kronik otoimmün tiroiditi çocuk ve ergenlerin klinik özellikleri. *Gulhane Med J* 2008;50:147–50. [Article in Turkish]
26. Dilek E, İscan B, Ekuklu G, Tutunculer F. A retrospective evaluation of the cases diagnosed as Hashimoto's thyroiditis. *J Child* 2013;11:73–7.
27. Gönç EN, Yordam N. Çocukluk ve adölesanda tiroid hastalıkları. In: Öcal G, Yordam N, Kurtoğlu S, Günöz H, editors. *Pediyatrik endokrinoloji*. Ankara: Kalkan Matbaacılık; 2003. p. 261–70.
28. Radetti G, Gottardi E, Bona G, Corrias A, Salardi S, Loche S, et al. The natural history of euthyroid Hashimoto's thyroiditis in children. *J Pediatr* 2006;149:827–32.
29. De Luca F, Santucci S, Corica D, Pitrolo E, Romeo M, Aversa T. Hashimoto's thyroiditis in childhood: presentation modes and evolution over time. *Ital J Pediatr* 2013;39:8.
30. Skarpa V, Kousta E, Tertipi A, Anyfandakis K, Vakaki M, Dolianiti M, et al. Epidemiological characteristics of children with autoimmune thyroid disease. *Hormones (Athens)* 2011;10:207–14.
31. Yoshida H, Amino N, Yagawa K, Uemura K, Satoh M, Miyai K, et al. Association of serum antithyroid antibodies with lymphocytic infiltration of the thyroid gland: studies of seventy autopsied cases. *J Clin Endocrinol Metab* 1978;46:859–62.