Journal of Medicinal and Chemical Sciences 6 (2023) 2480-2493

Journal of Medicinal and Chemical Sciences

Journal homepage: http://www.jmchemsci.com/

Original Article

Evaluation of Thyroid Biomarkers in Patients with Alopecia Areata

Chiman Yousif Younis[1], Dindar Sharif Qurtas[2]*, Araz Hassan Muhammed[3]

[1]*Kurdistan Higher Council for Medical Specialties, Erbil Dermatology Teaching Center, Erbil City, Kurdistan Region, Iraq*
[2]*College of Medicine, Hawler Medical University, Head of Erbil Dermatology Teaching Center, Erbil city, Kurdistan Region, Iraq*
[3]*College of Medicine, Hawler Medical University; Erbil Dermatology Teaching Center, Erbil city, Kurdistan Region, Iraq*

ARTICLE INFO

Article history

Receive: 2023-03-17
Received in revised: 2023-04-12
Accepted: 2023-05-14
Manuscript ID: JMCS-2304-2038
Checked for Plagiarism: **Yes**
Language Editor:
Dr. Fatima Ramezani
Editor who approved publication:
Professor Dr. Ehab AlShamaileh

DOI:10.26655/JMCHEMSCI.2023.10.22

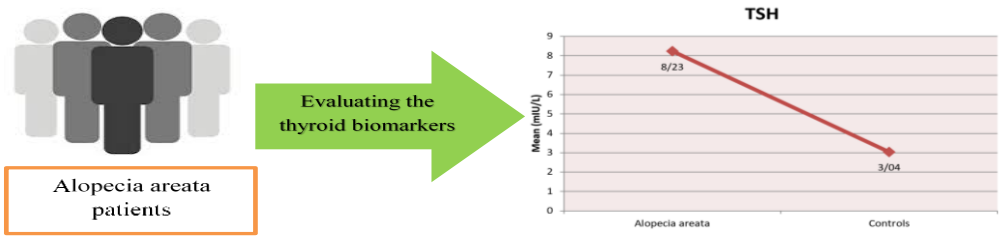
KEYWORDS

Alopecia areata
Biomarkers
Hair loss
Thyroid hormones

ABSTRACT

Alopecia areata is an autoimmune hair loss condition influenced by factors like thyroid dysfunction. The objective of the study was to evaluate the thyroid biomarkers level in patients with alopecia areata compared to healthy control cases. The present study was a cross-sectional study carried out in Erbil Dermatology Teaching Center in Erbil City, Kurdistan region-Iraq during six months from the 1st of January to the 30th of June, 2022. A total of 100 patients with alopecia areata and 100 healthy individuals as controls were included in the study. Data on patients' characteristics, clinical features, and thyroid profiles were collected through questionnaires and blood samples. The samples were analysed using specific laboratory techniques, and statistical analysis was performed using the SPSS program. Statistical tests, including chi-square, Fisher's exact tests, t-tests, and ANOVA, were used to examine relationships and significant differences between variables. A significance level of $p \leq 0.05$ was considered statistically significant. The mean thyroid stimulating hormone was significantly higher among alopecia areata patients as compared to controls (p=0.02). Mean thyroxin hormone was significantly higher among alopecia areata patients as compared to controls. There was a significant association between positive Anti-thyroid peroxidase and alopecia areata (p=0.05). A significant association was observed between positive antithyroglobulin antibody and alopecia areata (p=0.004). This study also identified factors such as social deprivation, urbanization, occupation, and underweight as potential contributors to alopecia areata. These findings highlight the significant role of thyroid dysfunction in the development of alopecia areata.

GRAPHICAL ABSTRACT



* Corresponding author: Dindar Sharif Qurtas
✉ E-mail: dindar.qurtas@hmu.edu.krd

Introduction

Alopecia areata (AA) is a common autoimmune disease affecting hair follicles and nails. This disease causes hair loss in all age groups and the round patches of hair loss appeared in different body parts mainly scalp and face [1, 2]. Globally, the incidence rate of alopecia areata reached to about 20.2/100,000 population/year with life time risk of about 2%, while the AA prevalence is ranging between 0.1-0.2% in regard to location and ethnicity [3]. However, the AA prevalence could reach up to 8.6% in adults with positive family history [4]. It was shown that AA incidence increased with advancing age with high incidence in age group of 25-35 years old. However, more severe cases recorded in paediatric age group 4. No sex differences are reported in regard to AAincidence [5].

The Alopecia Areata is highly related to other autoimmune diseases such as vitiligo, lupus erythematosus, atopic dermatitis, and thyroid disorders. Alopecia areata has been shown to be associated with atopic dermatitis in 39% of cases [5, 6]. The complex pathophysiology of AA involves an autoimmune basis, and its association with other autoimmune diseases supports this etiology. For instance, the presence of lymphocytes around hair follicles and the good response of patients to immunosuppressive treatment also indicate an autoimmune pathogenesis [7]. Moreover, AA diagnosis has been associated with an increased risk of other autoimmune diseases, including systemic autoimmune disorders like ulcerative colitis, type 1 diabetes, thyroid diseases, coeliac disease, and rheumatoid arthritis, as well as dermatological autoimmune conditions such as vitiligo, lupus erythematosus, and scleroderma [8]. The exact etiology of alopecia areata is not fully understood till now, however,

The AA is thought to be an autoimmune disease resulted from combination of genetic factor that play a major role in AA development with predisposition of positive family history and effect of environmental factors that exacerbate the disease. The environmental factors like stress, infection, hormonal changes, diet, and vitamins insufficiency were involved as risk factors. Normally, the hair follicle has immune privilege zone caused by immuosupression mechanisms and lowering antigens activity [9,10]. The immune privilege zone is an immunosuppressive area around the hair bulb, which protects the hair follicle from immunopathogenic injury [11]. This unique feature of hair follicles demonstrates the ability to regenerate itself during each anagen (growth) phase [12]. Several mechanisms collaborate in providing immune protection, including passive and active mechanisms [13]. However, the collapse of this immune privilege zone can be triggered by genetic and environmental factors, leading to autoimmune reactions against hair follicle autoantigens [11]. This collapse results in increased levels of interferons and interleukins, causing infiltration by inflammatory cells and inflammation of the hair follicle, ultimately leading to hair loss [12, 14].

Clinically, the alopecia areata is presented by smooth, sharply lined, round patches of hair loss without atrophy shown at peripheral parts of patches. The disease is either presented as total body hair loss (alopecia universalis) or total scalp hair loss (alopecia totalis). The alopecia areata may also be presented as band-like hair loss in the temporal and occipital scalp (alopecia ophiasis). Other presentations of alopecia areata included some diffuse variants by sporadic or diffuse thinning of hair in the scalp or reticular sites with frequent hair loss and re-growth of hair in the same area [15]. In some cases, hair loss in frontoparietotemporal parts is presented in the ophiasis inversus pattern. Nail abnormalities are reported in 7-66% of AA patients commonly trachyonychia, onychorrhexis, nail thinning, thickening, red spot lunulae, etc [16]. The alopecia areata cases could be clinically presented with thyroid dysfunction features in about 8 to 28% of cases [17], or presented with vitiligo clinical features in about 1.8 to 16% of cases or with atopy clinical features in about 1 to 52% of cases [17, 18].

Thyroid gland dysfunction disorders affected all body organs and thyroid diseases are also presented clinically by some dermatological manifestations like hair loss [19]. The thyroid hormones have a direct effect on the skin by

protein synthesis stimulation, and oxygen consumption of epidermis, and also play a major role in epidermis thickness and mitosis in addition to significant organization of epidermal homeostasis [20]. The relationship between hair loss and autoimmune thyroid diseases was reported by different literature in regard to the autoimmune etiology of alopecia areata [21]. Both thyroid hormones (Triiodothyronine [T3] and Thyroxin [T4]) are essential in the development of epidermal keratinocytes and dermal fibroblasts, maintenance and stimulation of hair growth in addition to help in secreting sebum [22, 23]. Overt hypothyroidism which is characterized by high thyroid stimulating hormone (TSH) and thyroid anti-bodies is highly related to cases of alopecia areata [24, 25].

The alopecia areata cases in Iraq are common with different etiological and clinical patterns [26]. In Iraq, various studies have been conducted to understand the etiology and clinical patterns of alopecia areata. Some studies have found associations between viral infections, such as cytomegalovirus (CMV), and alopecia areata [27, 28]. Other research has focused on the role of immune cells, such as CD4+, CD39+, and FOXP3+ T regulatory cells, in Iraqi patients with alopecia areata [29]. Dermatoscopic assessments have additionally been carried out to evaluate the features of alopecia areata and their connections with different clinical variations, alterations in the nails, and the extent of the condition [30]. Also, autoimmune disorders are detected in 12.8% of Iraqi patients with alopecia areata [31]. These studies provide insights into the different etiological and clinical patterns of alopecia areata in Iraq.

In Erbil City, the alopecia areata is a common dermatological disease with a family history background and it is related to autoimmune diseases in 11% of cases [32]. However, there is a national scarcity of literature discussing the effect of thyroid hormones on the development of hair loss. This study aims to investigate the levels of thyroid biomarkers in patients with alopecia areata (AA) compared to healthy individuals. By exploring this association, the research seeks to address a knowledge gap in understanding the potential role of thyroid hormones in the AA development. This information could contribute to improved diagnosis and treatment strategies for AA patients, particularly those with thyroid disorders.

Materials and Methods

The present study was a cross-sectional study carried out in Erbil Dermatology Teaching center in Erbil City, Kurdistan region-Iraq during six months from the 1st of January to the 30th of June, 2022. The studied population was patients with alopecia areata. Patients with different age and sex groups in all hairy areas of the body, while the control group was apparently healthy individuals without alopecia areata and hair fall were included. The study ethics were implemented by documented approval of Kurdistan Board and Hospital authority, agreement of patients, in addition to the confidentiality of data and management of complications accordingly.

Inclusion criteria for the evaluation of thyroid biomarkers in patients with alopecia areata included participants of any age and sex with a confirmed diagnosis of alopecia areata. Likewise, patients should not have a history of thyroid disease, use of thyroid drugs, and autoimmune diseases. The exit criteria comprised patients who withdrew their consent to take part in the study, experienced any thyroid disorder throughout the study, underwent any treatment for alopecia areata during the study, and failed to adhere to the study protocol. One hundred patients diagnosed with Alopecia Areata (AA) were carefully chosen based on predefined criteria, while another group of one hundred healthy individuals was also selected to serve as controls. The selection process involved assessing eligibility for inclusion and exclusion criteria to ensure a representative sample for the study.

Information on patients with alopecia areata was collected directly and filled in a prepared questionnaire designed by researchers. The questionnaire included general characteristics of alopecia areata patients (age, sex, marital status, residence, occupation, body mass index, disease duration, and age of patients at disease onset),

clinical characteristics of alopecia areata patients (previous illness, symptoms, associated diseases, previous attack, family history, and treatment), Alopecia areata characteristics (number of patches, erythema, size, the area involved, patterns of involvement, nail involvement and Alopecia areata severity index (AASI) score)) and thyroid profile of alopecia areata patients (Thyroid Stimulating Hormone (TSH), T3, T4, Anti-TPO, and Anti-TGT).

The Alopecia Areata Severity Index (AASI) is a scoring system that evaluates the severity of alopecia areata on the face and scalp. Unlike traditional systems that only consider scalp involvement, the AASI includes an assessment of beard hair, eyebrows, and eyelashes. Each area is individually evaluated and assigned a score from 0 to 100 (0-50 for the upper face). The total AASI score is obtained by adding the scores for the scalp, upper face, and beard. This comprehensive scoring system provides an objective measure for evaluating treatment response and disease progression in alopecia areata [33]. To validate the AASI score, a pilot study was conducted to assess the reliability of scoring system. The study found that the AASI score is a reliable scoring system used to assess the AA severity in research studies [33].

The diagnosis of alopecia areata was made by a dermatologist and hair specialist based on clinical examination and medical history. In addition, dermoscopy and scalp biopsy were used to confirm the diagnosis. The samples were collected by obtaining five milliliters of venous blood from each participant with alopecia areata using plastic disposable syringes. The blood samples were then centrifuged to separate the serum, which contained the target biomarkers. The serum samples were frozen and stored at -20 °C or lower until they were transported to the laboratory for analysis. Thawed samples were subjected to specific laboratory techniques, such as immunoassays, to quantify the levels of thyroid biomarkers (T3, T4, TSH, antithyroglobulin, and anti thyroperoxidase antibodies). Quality control measures were implemented throughout the process to ensure accurate and reliable results.

The patient's data were inputted into the SPSS program-26 and analysed statistically. Appropriate tables were created to present the results. Statistical tests such as chi-square and Fisher's exact tests were utilized to examine relationships between variables, while independent sample t-tests and One-way Analysis of Variance (ANOVA) were employed for continuous variables. A significance level of $p \leq 0.05$ was considered statistically significant.

Results and Discussion

In this study, 100 alopecia areata (AA) patients participated with mean age (23.2 years old); 18% of them were in the age of less than 10 years old, 26% of them were in the age group 10-19 years old, 26% of them were in the age group 20-29 years old, 16% of them were in the age group 30-39 years, and 14% of them were in the age of 40 years old and over 40. Male AA patients were more than females (69% vs. 31%). About two-thirds of AA patients were singles, while 34% of them were married. The residents inside Erbil city were represented by 75% of AA patients and outside city in 25% of them. The occupation of AA patients was distributed as followings; child (12%), student (29%), governmental employee (20%), private employee (21%), retired (1%), housewife (8%), and jobless (9%). The mean body mass index of AA patients was (24.3 Kg/m2); 8% of patients were underweight, 33% of patients were overweight and 10% of them were obese. The mean disease duration of AA patients was (5.8 months); 34% of patients had disease duration of less than one month, 58% of them had disease duration of 1-12 months and 8% of them had disease duration of more than 12 months. 40% of patients experienced the onset of AA disease during childhood, while 57% experienced it during adulthood, and the remaining 3% had a late onset of the disease (Table 1).

History of previous illness within the last 3 months was absent in 89% of AA patients, while chronic psychological stress was reported in 8% of AA patients, febrile illness in one patient, and others in two patients.

Table 1: General characteristics of alopecia areata patients

Variable	No.	%
Age mean±SD (23.2±13.2 years)		
<10 years old	18	18.0
10-19 years old	26	26.0
20-29 years old	26	26.0
30-39 years old	16	16.0
≥40 years old	14	14.0
GSex		
Male	69	69.0
Female	31	31.0
Marital status		
Single	66	66.0
Married	34	34.0
Residence		
Inside Erbil	75	75.0
Outside Erbil	25	25.0
Occupation		
Child	12	12.0
Student	29	29.0
Government employee	20	20.0
Private employee	21	21.0
Retired	1	1.0
Housewife	8	8.0
Jobless	9	9.0
Body mass index mean±SD (24.3±4.5 Kg/m^2)		
Underweight	8	8.0
Normal	49	49.0
Overweight	33	33.0
Obese	10	10.0
Disease duration mean±SD (5.8±11.8 months)		
<1 month	34	34.0
1-12 months	58	58.0
>12 months	8	8.0
Age at disease onset		
Childhood onset (1-15 years)	40	40.0
Adulthood onset (16-49 years)	57	57.0
late onset (>50 years)	3	3.0
Total	100	100.0

Table 2: Clinical characteristics of alopecia areata patients

Variable	No.	%
Previous illness		
No	89	89.0
Febrile illness	1	1.0
Chronic psych. Stress	8	8.0
Others	2	2.0
Symptoms		
No	90	90.0
Itching	8	8.0
Pain	2	2.0
Associated diseases		
Negative	72	72.0
Vitiligo	5	5.0
Thyroid	8	8.0
Atopy	15	15.0
Previous attack		
Yes	34	34.0
No	66	66.0
Family history		
Negative	46	46.0
Alopecia areata	6	6.0
Thyroid disease	13	13.0
Rheumatoid arthritis	2	2.0
Diabetes mellitus	19	19.0
Alopecia areata & thyroid disease	3	3.0
Alopecia areata & DM	4	4.0
Thyroid disease & DM	5	5.0
Rheumatoid arthritis & DM	1	1.0
Alopecia areata, thyroid disease &	1	1.0
Treatment		
No	76	76.0
Topical steroids	15	15.0
Topical steroids & salicylic acid	7	7.0
Systemic therapy	2	2.0
Total	100	100.0

Most (90%) of patients had no symptoms, while the main reported AA symptoms were itching (8%) and pain (2%). In 72% of AA patients, there were no associated diseases detected, whereas atopy was observed in 15% of patients, thyroid diseases in 8%, and vitiligo in 5%. Previous AA attack was shown by 34% of studied patients. The family history of AA patients was negative in 46% of patients, while positive family history of diabetes mellitus was shown in (19%) of patients, positive family history of thyroid diseases was indicated in (13%) of patients, positive family history of AA was demonstrated in (6%) of patients, positive family history of thyroid diseases, DM was illustrated in (5%) of patients, etc. Out of the AA patients, treatment information was unavailable for 76% of them, while 24% of the patients underwent treatment. The most commonly administered treatments were topical steroids (15%), a combination of topical steroids and salicylic acid (7%), and systemic therapy (2%) (Table 2).

The mean number of AA patches was (3.5); 39% of them had one patch and 28% of them had five patches and more.

Table 3: Alopecia areata characteristics

Variable	No.	%
Number of patches mean±SD (3.5±3)		
1 patch	39	39.0
2-4 patch	33	33.0
≥5 patches	28	28.0
Erythema		
Yes	3	3.0
Scale		
Yes	2	2.0
Size mean±SD (3.7±2.9 mm)		
<5 cm	83	83.0
5-9 cm	10	10.0
≥10 cm	7	7.0
Area involved		
Vertex	10	10.0
Occipital	22	22.0
Frontal	6	6.0
Temporal	6	6.0
Beard area	29	29.0
Eye brow	5	5.0
Eye lashes	5	5.0
Vertex & occipital	2	2.0
Vertex & frontal	1	1.0
Vertex & beard area	2	2.0
Occipital & temporal	2	2.0
Different areas	10	10.0
Patterns of involvement		
Patchy	87	87.0
Ophiasis	1	1.0
Sapho	1	1.0
Patchy & sapho	5	5.0
Patchy & totalis	1	1.0
Patchy, ophiasis & sapho	3	3.0
Patchy, ophiasis, totalis & beard area	2	2.0
Nail involvement		
No	87	87.0
Pitting	9	9.0
Biting	3	3.0
Ridging	1	1.0
AASI score		
0	1	1.0
<25%	73	73.0
25-49%	8	8.0
50-74%	9	9.0
75-99%	5	5.0
100%	4	4.0
Total	100	100.0

Table 4: Thyroid profile of alopecia areata patients

Variable	Mean	SD
TSH (mIU/L)	8.23	22.28
T3 (ng/dl)	2.8	0.95
T4 (ng/dl)	126.5	41.62
Anti-TPO (IU/L)	26.35	72.66
Anti-TGT (IU/L)	53.35	140.09
Total	100	100.0

Erythema was indicated by 3 AA patients and scale was shown by 2 AA patients. The mean size of the patch was (3.7 mm); 7% of them had a patch size of 10mm and more. The common areas involved by AA were beard area (29%), occipital (22%), vertex (10%), different areas (10%), frontal (6%), temporal (6%), etc. The common pattern of involvement was patchy (87%), followed by; patchy and sapho (5%), patchy, ophiasis & sapho (3%), patchy, ophiasis, totalis & beard area (2%), etc. Nail involvement was absent in 87% of AA patients, while 13% of them had nail involvement; 9% pitting, 3% biting and 1% ridging. AASI score was 0 in one AA patient, less than 25% in 73% of AA patients, 25-49% in 8% of AA patients, 50-74% in 9% of AA patients, 75-99% in 5% of AA patients and 100% in 4% of them (Table 3).

The mean TSH of AA patients was 8.23 mIU/L, while the mean T3 of them was 2.8 ng/dl, and the mean T4 of AA patients was 126.5 ng/dl. The mean of anti-TPO for AA patients was (26.35 IU/L) and the anti-TGT mean (53.35 IU/L) (Table 4).

No significant differences were observed between AA patients and controls regarding age (p=0.96) and sex (p=0.65). There was a significant association between single-status and AA patients (p=0.002). A significant association was observed between inside city residences and AA patients (p=0.01). A significant association was observed between alopecia areata (AA) disease and employment status, particularly among individuals working in both private and governmental sectors (p=0.03). There was a highly significant association between underweight and AA disease (p<0.001) (Table 5 and Figure 1).

The mean TSH was significantly higher among AA patients as compared to controls (p=0.02). Mean T3 was not statistically different between the two study groups. Mean T4 was significantly higher among AA patients as compared to controls. There was a significant association between positive anti-TPO and alopecia areata (p=0.05). A significant association was observed between positive anti-TGT and alopecia areata (p=0.004) (Table 6 and Figure 2).

Table 5: Distribution of general characteristics according to study groups

Variable	Study groups				P-value
	Alopecia areata		Control		
	No.	%	No.	%	
Age					0.96 NS
<10 years	18	18.0	16	16.0	
10-19 years	26	26.0	27	27.0	
20-29 years	26	26.0	26	26.0	
30-39 years	16	16.0	19	19.0	
≥40 years	14	14.0	12	12.0	
GSex					0.65 NS

Male	69	69.0	66	66.0	
Female	31	31.0	34	34.0	
Marital status					
Single	66	66.0	44	44.0	**0.002** S
Married	34	34.0	56	56.0	
Residence					
Inside Erbil	75	75.0	58	58.0	**0.01** S
Outside Erbil	25	25.0	42	42.0	
Occupation					
Child	12	12.0	9	9.0	
Student	29	29.0	37	37.0	
Gov. employee	20	20.0	12	12.0	**0.03** S
Private employee	21	21.0	10	10.0	
Retired	1	1.0	3	3.0	
Housewife	8	8.0	20	20.0	
Jobless	9	9.0	9	9.0	
Body mass index					
Underweight	8	8.0	0	-	
Normal	49	49.0	34	34.0	**<0.001** S
Overweight	33	33.0	58	58.0	
Obese	10	10.0	8	8.0	

NS=Not significant, S=Significant.

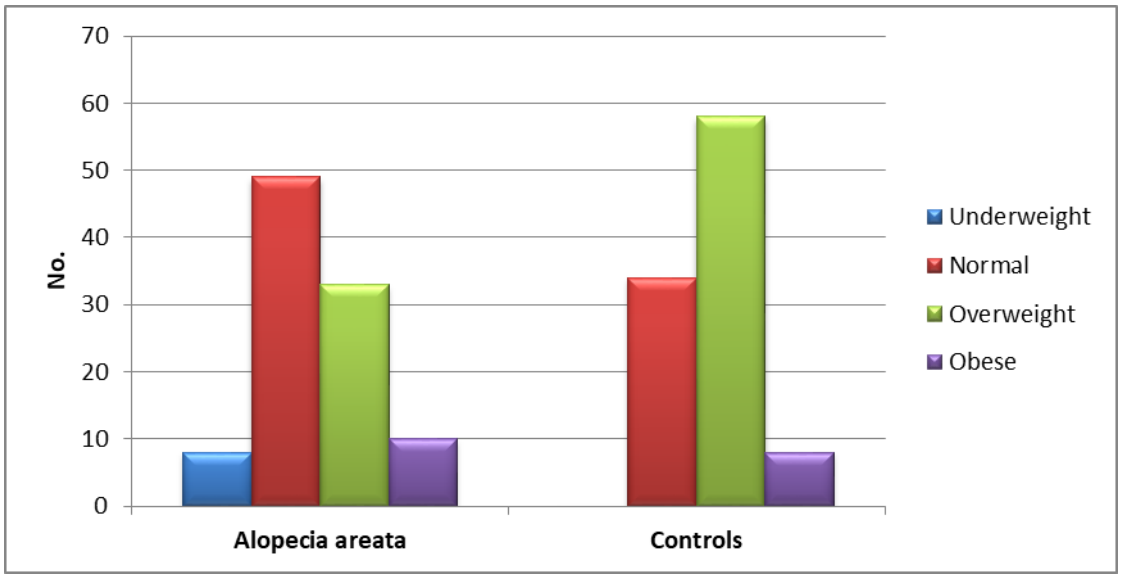


Figure 1: BMI distribution according to study groups

Table 6: Distribution of thyroid profile according to study groups

Variable	Study groups				P-value
	Alopecia areata		Control		
TSH					0.02 S
Mean±SD (mIU/L)	8.23±22.28		3.04±3.55		
T3					0.16 NS
Mean±SD (ng/dl)	2.8±0.95		14.09±81.5		
T4					<0.001 S
Mean±SD (ng/dl)	126.5±41.62		98.98±35.99		
Anti-TPO					0.05 S
Above Normal	8	8.0	2	2.0	
Normal	92	92.0	98	98.0	
Anti-TGT					0.004 S
Above Normal	8	8.0	0	-	
Normal	92	92.0	100	100.0	

NS=Not significant, S=Significant.

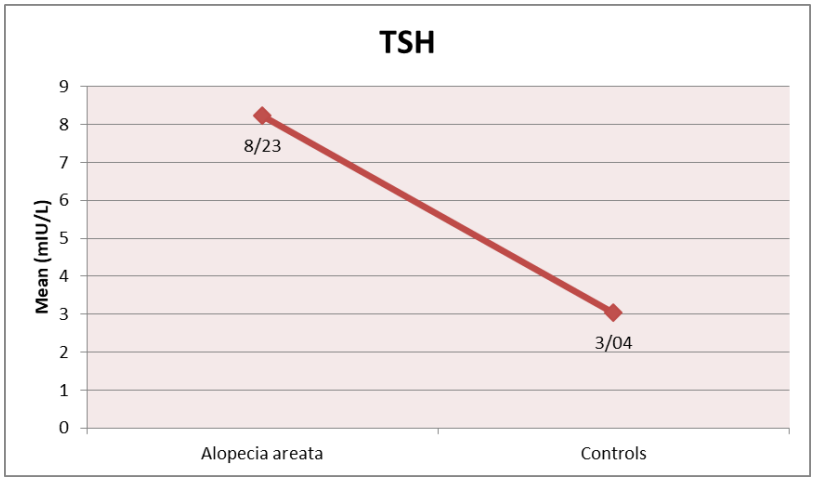


Figure 2: TSH level distribution according to study groups.

No significant relationship between the AA severity and thyroid profile measures of AA patients was observed (p>0.05) (Table 7).

Although the long history of alopecia areata and its publicity all over the world, the etiology and mechanisms of this disease are limited. In general, the pathogenesis and clinical spectrum of alopecia areata are variations between different communities [16].

Mesinkovska *et al.* (2020) conducted a cross-sectional study in the USA. They proved that psychosocial burden is high in patients with alopecia areata and there is a significant relationship between single status and AA disease, which is similar to our study [34].

Harries *et al.* [35] conducted a population-based cohort study in the UK. They found that there is a significant relationship between the high incidence rate of alopecia areata and urban residence. Gorrell *et al.* [36], and Falkai *et al.* [37], also found that urbanization is associated with unhealthy diet, high stress, and other environmental factors that exacerbate alopecia areata. This result is consistent with the present study.

Table 7: Distribution of thyroid profile according to severity of AA

Variable	AA severity			P-value
	Mild	Moderate	Severe	
TSH				0.69 NS
Mean±SD (mIU/L)	7.78±21.6	6.96±17.8	14.31±31.5	
T3				0.51 NS
Mean±SD (ng/dl)	2.86±0.95	2.61±0.87	2.6±1.1	
T4				0.26 NS
Mean±SD (ng/dl)	130.4±40.8	113.2±36.5	119.0±54.6	
Anti-TPO				0.37 NS
Mean±SD (IU/L)	30.1±79.4	8.32±3.3	7.6±3.4	
Anti-TGT				0.33 NS
Mean±SD (IU/L)	61.08±152.9	17.3±18.6	14.9±6.7	

NS=Not significant.

Kim *et al.* [38], did a study in South Korea, and reported that longer work duration is related to high probability of developing alopecia areata in men. This result is consistent with the present study.

Our study also found a highly significant association between underweight and AA disease. This finding parallels the results of study conducted by Almohanna *et al.* (2019), in Saudi Arabia. They showed that underweight along with vitamin and mineral deficiencies were associated with the risk of developing alopecia areata [39].

The interesting finding in the present study was the significant increase in mean TSH among alopecia areata patients, as compared to controls. This finding is consistent with the results of Bakry *et al.* [40], who did a case-control study in Egypt on 50 patients with AA and 50 healthy controls; they found a significant increase in TSH level as compared to controls. Another study was conducted by Thomas and Kadyan [41], in India, that significantly prevalent hypothyroidism in patients with alopecia areata, as compared to controls. However, our study found no significant difference in T3 level between AA cases and controls. This finding coincides with the results of Odum et al (2018) [42], retrospective study in Nigeria which reported no significant difference in T3 level between AA cases and controls, but they showed an obvious relationship between thyroid dysfunction and alopecia areata. Our study found that mean T4 was significantly higher among AA patients as compared to controls. This finding is parallel to reports of Grymowicz *et al.* [43], a study in Poland which stated that hormonal disturbances especially in TSH and T4 lead to hair loss. Our study findings regarding TSH and T4 hormones effects on developing alopecia areata are consistent with the results of Almohanna *et al,* [40], case-control study in Iraq which found a significant differences in TSH and T4 hormones levels between AA cases and controls.

Rahnama *et al.* (2014), conducted a study in Iran; they observed a high level of positive Anti-TPO in patients with alopecia areata, which is consistent with the results of the present study [22]. On the other hand, according to the study conducted by Park *et al.* (2019), in South Korea, there is a significant relationship between positive anti-thyroglobulin antibodies and alopecia areata, which is in line with the present study [44]. Autoimmunity significantly contributes to the AA occurrence, and in instances where alopecia areata is accompanied by autoimmune thyroid diseases, both immune mechanisms play a substantial part in the onset of hair loss. T-cell-mediated immunity, similar to other autoimmune

disorders, assumes a crucial function in this process [45, 46].

Conclusion

In conclusion, the thyroid dysfunctions play a major role in development of alopecia areata. The alopecia areata is highly related to thyroid autoimmunity disorders. The alopecia areata is more likely to be related to social deprivation, urbanization, occupation, and underweight. This study recommended the screening of thyroid hormones during the assessment of cases with alopecia areata.

Acknowledgements

The authors would like to present their gratitude and thank for the staff of Erbil Dermatology Teaching Centre.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

ORCID

Chiman Yousif Younis
https://orcid.org/0000-0001-5175-8653
Dindar Sharif Qurtas
https://orcid.org/0000-0002-2537-520X
Raza Hassan Muhammed
https://orcid.org/0000-0003-3276-4729

References

[1]. Alessandrini A., Bruni F., Piraccini B.M., Starace M., Common causes of hair loss–clinical manifestations, trichoscopy and therapy, *Journal of the European Academy of Dermatology and Venereology*, 2021, **35**:629 [Crossref], [Google Scholar], [Publisher]
[2]. Pratt C.H., King L.E., Messenger A.G., Christiano A.M., Sundberg J.P., Alopecia areata. *Nat Rev Dis Primers*, 2017, **3**:17011 [Crossref], [Google Scholar], [Publisher]
[3]. Schwartz R.A., Janniger C.K., Alopecia areata, *Cutis*, 1997, **59**:238 [Google Scholar], [Publisher]
[4]. Otlewska A., O.A., Szpotowicz G., Alopecia areata, *Paediatrics and Family Medicine*, 2019, **15**:358 [Crossref], [Google Scholar], [Publisher]
[5]. Mirzoyev S.A., Schrum A.G., Davis M.D., Torgerson R.R., Lifetime incidence risk of Alopecia Areata estimated at 2.1 percent by Rochester Epidemiology Project, 1990–2009, *J Invest Dermatol*, 2014, **134**:1141 [Crossref], [Google Scholar], [Publisher]
[6]. Abdullah A., Alopecia areata update, *Dermatologic clinics*, 2013, **31**:93 [Crossref], [Google Scholar], [Publisher]
[7]. Burhan E., Muazzez Çiğdem O., Yalçın T.z.n., Alopecia Areata, in *Hair and Scalp Disorders*, K. Zekayi and S. Server, Editors. 2017, IntechOpen: Rijeka. p. Ch. 7 [Crossref], [Publisher]
[8]. Laitinen I., Jokelainen J., Tasanen K., Huilaja L., Comorbidities of Alopecia Areata in Finland between 1987 and 2016, *Acta Derm Venereol*, 2020, **100**:adv00063 [Crossref], [Google Scholar], [Publisher]
[9]. Paus R., Bertolini M., The Role of Hair Follicle Immune Privilege Collapse in Alopecia Areata: Status and Perspectives, *Journal of Investigative Dermatology Symposium Proceedings*, 2013, **16**:S25 [Crossref], [Google Scholar], [Publisher]
[10]. Paus R., Langan E.A., Vidali S., Ramot Y., Andersen B., Neuroendocrinology of the hair follicle: principles and clinical perspectives, *Trends in Molecular Medicine*, 2014, **20**:559 [Crossref], [Google Scholar], [Publisher]
[11]. Ito T., Recent Advances in the Pathogenesis of Autoimmune Hair Loss Disease Alopecia Areata, *Clinical and Developmental Immunology*, 2013, **2013**:348546 [Crossref], [Google Scholar], [Publisher]
[12]. Żeberkiewicz M., Rudnicka L., Malejczyk J., Immunology of alopecia areata, *Cent Eur J Immunol*, 2020, **45**:325 [Crossref], [Google Scholar], [Publisher]

[13]. Bertolini M., McElwee K., Gilhar A., Bulfone-Paus S., Paus R., Hair follicle immune privilege and its collapse in alopecia areata, *Experimental Dermatology*, 2020, **29**:703 [Crossref], [Google Scholar], [Publisher]
[14]. Suchonwanit P., Kositkuljorn C., Pomsoong C., Alopecia areata: an autoimmune disease of multiple players, *ImmunoTargets and Therapy*, 2021, **10**:299 [Google Scholar], [Publisher]
[15]. Darwin E., Hirt P.A., Fertig R., Doliner B., Delcanto G., Jimenez J.J., Alopecia Areata: Review of Epidemiology, Clinical Features, Pathogenesis, and New Treatment Options, *Int J Trichology*, 2018, **10**:51 [Crossref], [Google Scholar], [Publisher]
[16]. Gandhi V., Baruah M.C., Bhattacharaya S.N., Nail changes in alopecia areata: incidence and pattern, *Indian Journal of Dermatology, Venereology and Leprology*, 2003, **69**:114 [Google Scholar], [Publisher]
[17]. Goh C., Finkel M., Christos P.J., Sinha A.A., Profile of 513 patients with alopecia areata: associations of disease subtypes with atopy, autoimmune disease and positive family history. *Journal of the European Academy of Dermatology and Venereology*, 2006, **20**:1055 [Crossref], [Google Scholar], [Publisher]
[18]. Hordinsky M., Ericson M., Autoimmunity: Alopecia Areata, *Journal of Investigative Dermatology Symposium Proceedings*, 2004, **9**:73 [Crossref], [Google Scholar], [Publisher]
[19]. Lee S., Lee Y.B., Kim B.J., Lee W.S., Screening of thyroid function and autoantibodies in patients with alopecia areata: A systematic review and meta-analysis, *Journal of the American Academy of Dermatology*, 2019, **80**:1410 [Crossref], [Google Scholar], [Publisher]
[20]. Wilhelm S.M., Wang T.S., Ruan D.T., Lee J.A., Asa S.L., Duh Q.Y., Doherty G.M., Herrera M.F., Pasieka J.L., Perrier N.D., Silverberg S.J., The American Association of Endocrine Surgeons guidelines for definitive management of primary hyperparathyroidism, *JAMA surgery*, 2016, **151**:959 [Crossref], [Google Scholar], [Publisher]
[21]. Seyrafi H., Akhiani M., Abbasi H., Mirpour S., Gholamrezanezhad A., Evaluation of the profile of alopecia areata and the prevalence of thyroid function test abnormalities and serum autoantibodies in Iranian patients, *BMC Dermatology*, 2005, **5**:11 [Crossref], [Google Scholar], [Publisher]
[22]. Rahnama Z., Farajzadeh S., Mohamamdi S., Masoudi M.A., Prevalence of thyroid disorders in patients with alopecia areata, *Journal of Pakistan Association of Dermatologists*, 2014, **24**:246 [Google Scholar], [Publisher]
[23]. Safer J.D., Crawford T.M., Fraser L.M., Hoa M., Ray S., Chen T.C., Persons K., Holick M.F., Thyroid hormone action on skin: diverging effects of topical versus intraperitoneal administration, *Thyroid*, 2003, **13**:159 [Crossref], [Google Scholar], [Publisher]
[24]. Leonhardt J.M., H.W., Thyroid disease and the skin, *Dermatologic clinics*, 2002, **20**:473 [Crossref], [Google Scholar], [Publisher]
[25]. Vincent M., Yogiraj K., A Descriptive Study of Alopecia Patterns and their Relation to Thyroid Dysfunction, *International journal of trichology*, 2013, **5**:57 [Crossref], [Google Scholar], [Publisher]
[26]. Nayaf M.S., A.A., Abdalla M.A., Alopecia areata and serum vitamin D in Iraqi patients: A Case-Control Study, *Prensa Med Argent*, 2020, **106**:287 [Crossref], [Google Scholar], [Publisher]
[27]. Goh C., Finkel M., Christos P.J., Sinha A.A. Profile of 513 patients with alopecia areata: associations of disease subtypes with atopy, autoimmune disease and positive family history, *Journal of the European Academy of Dermatology and Venereology*, 2006, **20**:1055 [Crossref], [Google Scholar], [Publisher]
[28]. Kawen A.A., Association Between Cytomegalovirus Infection and Alopecia Areata In Thi Qar Province. Iraq, *University of Thi-Qar Journal*, 2017, **12**:268 [Google Scholar], [Publisher]
[29]. Rhadi O.K., Fahad H.M., Evaluation of CD4+, CD39+, FOXP3+Tregulatory cells in Iraqi Alopecia areata patients by ELISA, *Journal of Pharmaceutical Negative Results*, 2022, **10**:247 [Crossref], [Google Scholar], [Publisher]
[30]. Al Chalabi Q.S., Al harbawi A., Al Salman H.N., Dermatoscopic evaluation of alopecia areata, *Annals of the College of Medicine, Mosul*, 2021, **43**:144 [Crossref], [Google Scholar]
[31]. Al Zubaidy A.J., The Clinical Spectrum of Alopecia Areata in IRAQ, *European Journal of*

Biomedical and Pharmaceutical Sciences, 2018, **5**:623 [Crossref], [Google Scholar], [Publisher]
[32]. Almously I.M., Behnan B.A., Alopacia areata among patients attending the department of dermatology and venereology in Rizgary Teaching Hospital in Erbil, *Zanco Journal of Medical Sciences*, 2013, **17**:294 [Crossref], [Google Scholar], [Publisher]
[33]. Majid I., Sameem F., Sultan J., Aleem S., Alopecia areata severity index (AASI): A reliable scoring system to assess the severity of alopecia areata on face and scalp—a pilot study, *Journal of Cosmetic Dermatology*, 2021, **20**:2565 [Crossref], [Google Scholar], [Publisher]
[34]. Mesinkovska N., King B., Mirmirani P., Ko J. Cassella J., Burden of Illness in Alopecia Areata: A Cross-Sectional Online Survey Study, *Journal of Investigative Dermatology Symposium Proceedings*, 2020, **20**:S62 [Crossref], [Google Scholar], [Publisher]
[35]. Harries M., Macbeth A.E., Holmes S., Chiu W.S., Gallardo W.R., Nijher M., de Lusignan S., Tziotzios C., Messenger A.G., The epidemiology of alopecia areata: a population-based cohort study in UK primary care, *British Journal of Dermatology*, 2022, **186**:257 [Crossref], [Google Scholar], [Publisher]
[36]. Gorrell S., Trainor C., Le Grange D., The impact of urbanization on risk for eating disorders, *Current opinion in psychiatry*, 2019, **32**:242 [Crossref], [Google Scholar], [Publisher]
[37]. Falkai P., M.-L.A., Urbanisierung und psychische Gesundheit, *Die Psychiatrie*, 2016, **13**:60 [Crossref], [Google Scholar], [Publisher]
[38]. Kim H., Suh B.S., Lee W.C., Jeong H.S., Son K.H., Nam M.W., Kim H.C., The association between long working hours and marital status change: middle-aged and educated Korean in 2014–2015, aoem, 2019, **31**:e3 [Crossref], [Google Scholar], [Publisher]
[39]. Almohanna H.M., Ahmed A.A., Tsatalis J.P., Tosti A., The Role of Vitamins and Minerals in Hair Loss: A Review, *Dermatology and Therapy*, 2019, **9**:51 [Crossref], [Google Scholar], [Publisher]
[40]. Bakry O.A., Basha M.A., El Shafiee M.K., Shehata W.A., Thyroid disorders associated with alopecia areata in Egyptian patients, *Indian journal of dermatology*, 2014, **59**:49 [Crossref], [Google Scholar], [Publisher]
[41]. Thomas E.A., Kadyan R.S., Alopecia areata and autoimmunity: a clinical study, *Indian Journal of Dermatology,* 2008, **53**:70 [Crossref], [Google Scholar], [Publisher]
[42]. Odum E.P., Amadi C., Otike-Odibi B.I., Evaluation of thyroid function status in patients with alopecia areata, *International Journal of Research*, 2018, **4**:277 [Crossref], [Google Scholar], [Publisher]
[43]. Grymowicz M., et al., Hormonal Effects on Hair Follicles, *International Journal of Molecular Sciences*, 2020, **21**:5342 [Crossref], [Google Scholar], [Publisher]
[44]. Park S.M., Oh Y.J., Lew B.L., Sim W.Y., The association among thyroid dysfunction, thyroid autoimmunity, and clinical features of alopecia areata: A retrospective study, *Journal of the American Academy of Dermatology*, 2019, **81**:602 [Crossref], [Google Scholar], [Publisher]
[45]. Chanprapaph K., Mahasaksiri T., Kositkuljorn C., Leerunyakul K., Suchonwanit P., Prevalence and Risk Factors Associated with the Occurrence of Autoimmune Diseases in Patients with Alopecia Areata, *Journal of Inflammation Research,* 2021, **14**:4881 [Crossref], [Google Scholar], [Publisher]
[46]. Kinoshita-Ise M., Martinez-Cabriales S.A., Alhusayen R., Chronological association between alopecia areata and autoimmune thyroid diseases: A systematic review and meta-analysis, *The Journal of Dermatology*, 2019, **46**:702 [Crossref], [Google Scholar], [Publisher]

HOW TO CITE THIS ARTICLE
Chiman Yousif Younis, Dindar Sharif Qurtas, Araz Hassan Muhammed. Evaluation of Thyroid Biomarkers in Patients with Alopecia Areata. *J. Med. Chem. Sci.*, 2023, 6(10) 2480-2493
DOI: https://doi.org/10.26655/JMCHEMSCI.2023.10.22
URL: https://www.jmchemsci.com/article_172159.html