

Prevalence of Androgenetic Alopecia Among Adults in Sulaimani Governorate (2023): Epidemiology, Pathophysiology, and Clinical Implications

Jwan Jellal Rasheed Shwana¹, PhD candidate;
Burhan Tahir Saeed², PhD;
Fattah Hama Rahim Fattah³, PhD

Abstract

Background: Androgenetic alopecia (AGA) is a common form of hair loss that significantly affects individuals' self-esteem, psychological well-being, and quality of life. This study aimed to investigate the prevalence, epidemiology, pathophysiology, and clinical implications of AGA among adults in Sulaimani Governorate, Iraq.

Methods: A cross-sectional study was conducted in Sulaimani Governorate from September 2022 to December 2023. A stratified sampling method was used to select 1,438 participants aged 18 years and older. Data were collected through a researcher-designed questionnaire and clinical examinations using the Ludwig and Norwood-Hamilton scales. Descriptive statistics, logistic regression, and Pearson's chi-square test were used for data analysis.

Results: The study population consisted of 49.7% males (n=715) and 50.3% females (n=723), with mean ages of 32.23 ± 10.04 and 31.46 ± 11.19 years, respectively. Females exhibited a higher incidence of sudden hair loss (27.5%) compared to males (18.3%). Significant risk factors included a family history of hair loss (OR=1.29, 95% CI: 1.23–1.35, P=0.001) and recent general operations (OR=1.07, 95% CI: 1.01–1.15, P=0.023). Additionally, the use of flat irons/curling irons (OR=1.09, 95% CI: 1.10–1.18, P=0.001) and frequent use (>3 times/week) (OR=1.04, 95% CI: 1.02–1.35, P=0.002) were associated with increased hair loss.

Conclusion: This study provides important insights into the epidemiology and risk factors of AGA in Sulaimani Governorate, Iraq. The findings underscore the need for targeted prevention and treatment strategies that consider the distinct characteristics of the local population. Further research is warranted to investigate the genetic and environmental factors that contribute to AGA in this region.

Please cite this article as: Shwana JJR, Saeed BT, Fattah FHR. Prevalence of Androgenetic Alopecia Among Adults in Sulaimani Governorate (2023): Epidemiology, Pathophysiology, and Clinical Implications. J Health Sci Surveillance Sys. 2025;13(4):402-410. doi: 10.30476/jhss.2024.103259.1934.

Keywords: Androgenetic alopecia, Hair loss, Pattern hair loss, Androgen receptors

¹Sulaimaniyah General Directorate of Health - Research Department, Sulaimaniyah, Iraq

²Department of Nursing, College of Health and Medical Technology, Sulaimani Polytechnic University, Sulaimaniyah, Iraq

³Community Medicine, College of Medicine, University of Sulaimani, Iraq

Correspondence:

Jwan Jellal Rasheed Shwana,
Sulaimaniyah General Directorate of Health - Research Department, Sulaimaniyah, Iraq

Email: Jwanshwana985@gmail.com

Received: 28 July 2025

Revised: 21 August 2025

Accepted: 20 September 2025

Introduction

Alopecia, defined as visible hair loss, is a widespread condition that affects individuals globally and has a profound impact on self-esteem, psychological

well-being, and overall quality of life. Among the different forms of alopecia, androgenetic alopecia (AGA) is the most common type,¹ representing a progressive condition strongly influenced by genetic predisposition and hormonal regulation.²

In men, AGA typically presents with a receding hairline and thinning at the vertex, which may eventually progress to partial or complete baldness. In contrast, women generally experience diffuse thinning over the crown, while the frontal hairline is usually preserved. The psychosocial consequences of AGA can be substantial, particularly for women, as hair plays a crucial role in self-image, social identity, and cultural perceptions of attractiveness.³

Androgenetic alopecia (AGA) is a highly prevalent condition that affects both men and women with varying degrees of severity. It is estimated that by the age of 50, approximately 50% of men and 25% of women experience some degree of AGA.⁴ A strong familial component has been identified, with males being more likely than females to report a family history of alopecia.⁵ While some studies indicate that the overall incidence of AGA does not significantly differ between men and women, others suggest a male predominance.^{6,7} Moreover, the prevalence and severity of AGA vary considerably across ethnic and geographic populations, underscoring the complex interplay between genetic predisposition and environmental influences.⁸ Understanding these variations is crucial for developing region-specific strategies to prevent, detect early, and manage AGA.

The pathophysiology of androgenetic alopecia (AGA) is complex and multifactorial, involving the interaction of genetic susceptibility, hormonal influences, and environmental factors. Among these, androgens—particularly dihydrotestosterone (DHT)—play a central role in the progressive miniaturization of hair follicles in genetically predisposed individuals.⁴ DHT binds to androgen receptors within the dermal papilla cells of hair follicles, triggering molecular changes that shorten the anagen (growth) phase and prolong the telogen (resting) phase of the hair cycle. Over time, this imbalance leads to progressive follicular miniaturization, resulting in thinner, shorter, and less pigmented hair shafts, ultimately culminating in visible hair thinning and patterned hair loss.⁹

Unlike cicatricial alopecia, the pathological process in AGA is characterized by follicular hypoplasia rather than atrophy or complete follicular destruction. Importantly, the dermal papillae—which regulate follicular development and cycling—generally exhibit no consistent structural abnormalities. Genetic predisposition, in combination with androgen production and heightened follicular sensitivity to DHT, constitutes the essential foundation of AGA pathogenesis.¹⁰

While the prevalence of androgenetic alopecia (AGA) has been extensively investigated in diverse populations worldwide, there is a notable paucity of epidemiological data from the Kurdistan region of

Iraq. Given the cultural, genetic, and environmental heterogeneity of this population, understanding the regional epidemiology and associated risk factors of AGA is essential for informing clinical practice and developing targeted prevention and management strategies. Accordingly, this study sought to examine the prevalence, epidemiological characteristics, pathophysiological mechanisms, and clinical implications of AGA among adults in Sulaimani Governorate, Iraq.

Methods

Study Design and Participants

This study employed a community-based analytical cross-sectional design to assess the prevalence and determinants of androgenetic alopecia (AGA) among adults in Sulaimani Governorate between September 15, 2022, and December 14, 2023.

A stratified sampling method was used to ensure representativeness across geographic districts of the governorate. The sample size ($n=1,438$) was calculated assuming a 50% prevalence of AGA, with a precision of 3%, a population size of 2,123,000, a confidence level of 97%, and an alpha value of 0.05. Participants were proportionally selected from each district according to population size, and then randomly chosen within strata to minimize selection bias.

Eligible participants included adult men and women aged 18 years and above who were generally in good health. Individuals with other dermatological conditions affecting the scalp (e.g., alopecia areata, alopecia totalis, alopecia universalis, discoid lupus erythematosus) and those under 18 years of age were excluded from the study.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the research ethics guidelines of the Technical College of Health, Sulaimani Polytechnic University, and the General Directorate of Health, Sulaymaniyah (Approval No: S3214G). Written informed consent was obtained from all participants before data collection. Confidentiality and anonymity were strictly maintained, and participation was entirely voluntary, with the option to withdraw at any stage without consequences.

Data Collection

Data were collected using a researcher-designed questionnaire comprising seven sections: (1) sociodemographic characteristics, (2) medical and health status, (3) hair loss stage and pattern, (4) risk factors, (5) laboratory data, (6) women's health, and (7) response to treatment.

The reliability of the instrument was assessed using Cronbach's alpha, which yielded a coefficient

of 0.81, indicating high internal consistency. Content validity was established by a panel of five experts, who evaluated the questionnaire for clarity, relevance, and alignment with the study objectives. A pilot study involving 75 participants was conducted to evaluate the reliability, validity, clarity, and feasibility of the questionnaire, confirming that it was suitable for the main study.

In addition to the questionnaire, participants underwent a clinical examination to determine the stage of hair loss. The Ludwig scale was applied for female participants, which classifies female pattern hair loss based on the degree of thinning over the crown.¹¹ For male participants, the Norwood-Hamilton scale was used, a standardized tool that categorizes male pattern baldness from minimal recession to advanced baldness.¹²

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (means, standard deviations, and frequencies) were used to summarize demographic and clinical characteristics and to

estimate the prevalence of AGA.

Associations between AGA and categorical variables (demographic, lifestyle, and health-related characteristics) were examined using Pearson's chi-square test, with a significance threshold set at $P < 0.05$. To further explore predictors of AGA, binary logistic regression analysis was conducted, generating odds ratios (ORs) with 95% confidence intervals (CIs) for each independent variable.

Results

A total of 1,438 participants were enrolled, with an almost equal distribution of males (49.7%, $n=715$) and females (50.3%, $n=723$). The mean age was 32.23 ± 10.03 years for males and 31.46 ± 11.18 years for females, with no statistically significant difference ($P=0.169$).

The vast majority of participants were Kurdish (97.6%, $n=1,404$), followed by Arabs (1.9%, $n=28$) and other nationalities (0.4%, $n=6$). Most individuals reported a middle economic status (87.1%, $n=1,253$), while 7.4% ($n=106$) reported low and 5.5% ($n=79$) reported high economic status.

Table 1: Distribution of Socio-demographic variables in the studied population ($n=1438$)

Variable		N	%
Sex	Male	714	49.7
	Female	724	50.3
Address	Sulaimani	498	34.6
	Chamchama	110	7.6
	Darbandikhan	110	7.6
	Ranya	250	17.4
	Saidsadq	120	8.3
	Dukan	100	7.0
	Kalar	250	17.4
Nationality	Kurdish	1404	97.6
	Arabic	28	1.9
	Other	6	0.4
Economic status	Low	106	7.4
	Middle	1253	87.1
	High	79	5.5
Job	Medical staff	115	8.0
	Teacher	131	9.1
	Health worker	204	14.2
	Employee	163	11.3
	Housewife	187	13.0
	Other	635	44.3
Education level	Illiterate	80	5.6
	Primary	162	11.3
	Secondary	287	20.0
	Institute	461	32.1
	University	409	28.4
Marital status	Post graduated	39	2.7
	Married	834	58.0
	Single	593	41.2
	Divorcee	11	0.8
Residency	City center	716	49.8
	Districts	705	49.0
	Rural	17	1.2

Occupational distribution showed that “Other” professions constituted the largest group (44.3%), followed by health workers (14.2%), housewives (13.0%), employees (11.3%), and teachers (9.1%). In terms of education, the highest proportion was institute graduates (32.1%), followed by university degree holders (28.4%), secondary education (20.0%), primary education (11.3%), illiterate (5.6%), and post-graduates (2.7%).

With respect to marital status, 58.0% were married, 41.2% were single, and 0.8% were divorced. Most participants resided in the city center (49.8%), while 49.0% lived in districts and 1.2% in rural areas.

Table 1 presents the distribution of socio-demographic variables in the studied population.

The highest proportion of participants with hair loss was observed in Sulaimani (35.7%), followed by Kalar (19.5%) and Ranya (13.3%). A statistically significant association was found between hair loss and geographic location ($P=0.001$).

Regarding residency, the prevalence of hair loss was higher among participants living in city centers (53.4%) compared to those in districts (45.4%) and rural areas (1.2%), with this difference also reaching statistical significance ($P=0.001$). Logistic regression analysis indicated that living

in urban areas slightly increased the likelihood of experiencing hair loss ($OR=1.15$, 95% CI: 1.11–1.24) (Table 2).

The study identified significant gender differences in the prevalence and pattern of hair loss (Table 3). Females reported a higher incidence of sudden hair loss (27.5%) compared to males (18.3%), with an odds ratio of 1.25, indicating a statistically significant gender disparity.

In males, hair loss predominantly affected the front of the scalp (42%), followed by diffuse thinning (29.6%) and the crown (16.5%). In contrast, females most commonly exhibited diffuse hair loss (78.6%), with fewer cases affecting the front (9.4%) or hairline (5.3%).

Table 4 highlights the significance of family history and recent general operations as risk factors for hair loss in the studied population. A positive family history of hair loss was significantly associated with an increased likelihood of hair loss occurrence ($P=0.001$). Similarly, individuals who had undergone recent general operations exhibited an increased risk of hair loss ($P=0.023$).

A significantly higher proportion of individuals with hair loss (19.6%) reported using flat irons or curling irons compared to those without hair loss (11%).

Table 2: The state of hair loss in the participants according to their address and residency (n=1438)

Variable	Class	Hair loss		OR CI95%	P value**
		Yes	No		
Address	Sulaimani	345 (35.7)*	153 (32.5)	1.12	0.001
	Chamchama	48 (5)	62 (13.2)	0.04-0.18	
	Darbandikhan	71 (7.3)	39 (8.3)		
	Ranya	129 (13.3)	121 (25.7)		
	Saidsadq	99 (10.2)	21 (4.5)		
	Dukan	86 (8.9)	14 (3)		
	Kalar	189 (19.5)	61 (13)		
	Single	398 (41.2)	195 (41.1)		
Residency	Divorcee	8 (0.8)	3 (0.6)		0.001
	City center	516 (53.4)	200 (42.5)	1.15	
	Districts	439 (45.4)	266 (56.5)	1.11-1.24	
	Rural	12 (1.2)	5 (1.1)		
	No	833 (86.1)	392 (83.2)		

*Frequency (%), P-value chi-Square

Table 3: The state of hair loss in the participants according to sex (n=1438)

Variable		Hair loss		OR (CI95%)	P value*
		Male	Female		
How rapid was the hair loss	Sudden	81 122 (18.3) *	144 (27.5)	1.46 (1.28-1.66)	0.001
	Gradual	362 (81.7)	380 (72.5)		
Which part of your head has hair loss	All over	131 (29.6)	412 (78.6)	1.25 (1.14-1.42)	0.001
	Front	186 (42)	49 (9.4)		
	Hairline	28 (6.3)	28 (5.3)		
	Crown	73 (16.5)	17 (3.2)		
	Back/lower	11 (2.5)	16 (3.1)		
	Other	14 (3.2)	2 (0.4)		

*Frequency (%), P-value chi-Square

Table 4: Distribution of Risk Factor Hair Loss in the Studied Population (n=1438)

Variable	Class	Hair loss		OR CI95%	P value*
		Yes	No		
Weight		69.33±11.456	70.05±10.864	-	0.252
Height		168.16±9.558	168.60±9.354	-	0.404
BMI		24.658±6.745	23.914±8.202	-	0.520
Family history of hair loss	Yes	591(61.1)	86 (18.3)	1.29	0.001
	No	376 (38.9)	385 (81.7)	1.23-.135	
Are you actively dieting	Yes	151 (15.6)	63 (13.4)	-	0.263
	No	816 (84.4)	408 (86.6)	-	
If yes, what type of diet	No	816 (84.4)	408 (86.6)	-	0.248
	Low Carbohydrate	56 (5.8)	32 (6.8)	-	
	Keto	27 (2.8)	9 (1.9)	-	
	Intermittent fasting	17 (1.8)	8 (1.7)	-	
	Other	51 (5.3)	14 (3)	-	
Recent general operation	Yes	126 (13)	42 (8.9)	1.07	0.023
	No	841 (87)	429 (91.1)	1.01-1.15	
If yes, Type of anesthesia	No	841 (87)	429 (91.1)	-	0.070
	General anesthesia	92 (9.5)	32 (6.8)	-	
	Regional anesthesia	34 (3.5)	10 (2.1)	-	

*P value T-test and Chi-square

Table 5: Flat ironing, curling iron, and fingernail normal in people with and without a history of hair loss in the studied population (n=1438)

Variable	Class	Hair loss		OR CI95%	P value*
		Yes	No		
Flat ironing curling iron	Yes	190 (19.6)	52 (11)	1.09	0.001
	No	777 (80.4)	419 (89)	1.10-1.18	
How many times/week	≤ 3	85 (44.7)	14 (27)	1.04	0.002
	> 3	105 (55.3)	38 (73)	1.02-1.35	

* Frequency (%), ** Mean±SD, # P-value chi-square

The odds ratio (OR=1.09, 95% CI: 1.10–1.18, P=0.001) indicates a positive and significant association between the use of these styling tools and hair loss. Among users, a greater percentage of individuals with hair loss (55.3%) used flat irons or curling irons more than three times per week, compared to 27% among those without hair loss. Frequent use (>3 times/week) was also significantly associated with hair loss (OR=1.04, 95% CI: 1.02–1.35, P=0.002). These findings suggest that both the use and frequency of flat irons/curling irons are significant risk factors for hair loss in the studied population.

Among participants, 27.3% of those with hair loss and 25.9% of those without hair loss reported using hair coloring products, most commonly once a week. Henna use was reported by 13.8% of participants with hair loss and 11% without, with the majority applying it on a weekly basis. Hair spray use was similar between groups (11% with hair loss vs. 10.6% without), with an average of 1–3 times per week. Hair gel was used by 26.2% of participants with hair loss and 29.7% without, with most users applying it 1–3 times or more than three times per week. Overall, a higher proportion of individuals with hair loss used hair coloring and gel products than those without, although these differences were not statistically significant (Table 5).

No significant differences were observed between participants with and without hair loss regarding exposure to iron, zinc, or vitamin D. Similarly, the prevalence of oral medication use (15.8% vs. 15.3%) and vitamin or supplement use (23.6% vs. 19.7%) did not differ significantly between the two groups. Among supplement users, a higher proportion of individuals with hair loss reported daily intake (65.7% vs. 48.4%). A trend toward significance was noted for vitamin B12 use, with 10.8% of individuals with hair loss reporting use compared to 4.7% without hair loss (Table 6).

Table 7 suggests that hair loss in women may be associated with specific fertility and reproductive health factors, including difficulty conceiving and menopausal status. Women with hair loss reported a significantly higher rate of difficulty conceiving (19.1%) compared to those without hair loss (11.5%), with an odds ratio (OR) of 0.11, suggesting a lower likelihood of conception difficulties in women without hair loss. The prevalence of menopause was higher among women without hair loss (21%) than those with hair loss (13%), with an OR of 1.13. Rates of hysterectomy and ovary removal were slightly higher in women with hair loss, but these differences were not statistically significant.

Table 6: Distribution of chemical exposure in people with and without a history of hair loss in the studied population (n=1438)

Variable	Class	Hair loss		P value*
		Yes N (%)	No N (%)	
Hair coloured	Yes	264 (27.3)	122 (25.9)	0.574
	No	703 (72.7)	349 (74.1)	
Hair coloured per week	No	703 (72.7)	349 (74.1)	0.348
	One	13 (13.1)	10 (15.9)	
	Two	3 (3)	0	
Hana	Yes	133 (13.8)	52 (11)	0.149
	No	834 (86.2)	419 (89)	
Hana per week	No	834 (86.2)	419 (89)	0.912
	One	2 (0.8)	4 (1.6)	
Hair Spray	Yes	106 (11)	50 (10.6)	0.843
	No	861 (89)	421 (89.4)	
Spray per week	No	861 (89)	421 (89.4)	0.205
	1-3	31 (8.7)	30 (9.8)	
	3 <	13 (2.3)	2 (0.8)	
Gel	Yes	253 (26.2)	140 (29.7)	0.155
	No	714 (73.8)	331 (70.3)	
Gel per week	No	714 (73.8)	331 (70.3)	0.133
	1-3	101 (10.5)	44 (9.4)	
	3 <	152 (15.7)	96 (20.3)	

*P-value chi-Square

Table 7: Distribution of Chemical exposure in people with and without a history of hair loss, the population of Sulaimani City

Variable	Class	Hair loss		P value**
		Yes	No	
Oral medication	Yes	153 (15.8)	72 (15.3)	0.527
	No	814 (84.2)	399 (84.7)	
Vitamins and natural supplements	Yes	228 (23.6)	93 (19.7)	0.101
	No	739 (76.4)	378 (80.3)	
Dosage of vitamins and natural supplements	Daily	150 (65.7)	45 (48.4)	0.647
	Weekly	50 (22)	30 (32.3)	
	Monthly	28 (12.3)	18 (19.3)	
Iron	Yes	57 (5.9)	20 (4.3)	0.705
	No	910 (94.1)	451 (95.7)	
Zinc	Yes	60 (6.3)	25 (5.4)	0.777
	No	907 (93.7)	446 (94.6)	
Vitamin D	Yes	147 (15.3)	63 (13.4)	0.751
	No	820 (84.7)	408 (86.6)	
Vitamin B12	Yes	104 (10.8)	22 (4.7)	0.06
	No	863 (89.2)	449 (95.3)	

*Frequency, **P-value chi-Square

Similarly, estrogen replacement therapy was marginally more common among women without hair loss (2.5%) compared to those with hair loss (1.9%), with no significant difference observed.

Discussion

The study's findings on the epidemiology and assessment of hair loss among adults in Sulaimani Governorate, Iraq, provide valuable insights. The participants' demographic characteristics, including a diverse and representative sample with a nearly equal distribution of males and females, allow for a comprehensive understanding of the population affected by hair loss.

In contrast to the study by Kacar et al., which primarily examined perceived stigma and its relationship with demographic variables,¹³ our findings emphasize the direct correlation between demographic factors and the prevalence of hair loss. While stigma is a significant psychological outcome of AGA, understanding the demographic determinants—such as residency, gender, age, and family history—is crucial for elucidating the epidemiological patterns of hair loss in the population.

The significant associations observed between hair loss and certain demographic variables, such as address, residency, and occupation, are consistent with findings from other regions. For instance, a study

conducted by Wang et al. in China reported that urban residency was associated with a higher prevalence of androgenetic alopecia (AGA) compared to rural areas, suggesting that environmental factors, such as pollution, stress, and lifestyle differences, may contribute to the increased risk of hair loss in urban populations.¹⁴ Similarly, the higher prevalence of AGA in urban areas within the Sulaimani Governorate could be attributed to these same factors.

The rate of hair loss also varied significantly between the sexes, with a higher proportion of women experiencing sudden hair loss than men. This variable increased the odds of hair loss by 3% (OR=1.03), highlighting the importance of a tailored approach to hair loss management that accounts for the rapidity and pattern of the condition. Similar findings were reported by Can et al., who observed sex-specific differences in chemotherapy-induced alopecia,¹⁵ noting lower psychological well-being among women compared to men regardless of hair loss severity. Lolli et al. further emphasized that women are more likely to experience diffuse thinning over the crown, whereas men typically present with a receding hairline and vertex balding.¹⁶ This gender-specific pattern of hair loss was also evident in our study, with females exhibiting a higher incidence of diffuse hair loss compared to males.

Additionally, the observed association between family history and the prevalence of hair loss highlights the genetic predisposition underlying AGA. Lee et al. (2023) emphasized the critical role of family history in the development of male pattern hair loss, particularly when AGA is present on both the paternal and maternal sides.¹⁷ Consistent with these findings, our study revealed that individuals with a family history of hair loss were significantly more likely to experience hair loss themselves.

The study identified a significant association between the use of flat irons and curling irons and an increased risk of hair loss. Individuals with a history of hair loss were more likely to have used these heat styling tools, and frequent use (more than three times per week) was also significantly associated with an increased risk of hair loss. These findings suggest that excessive heat exposure from styling tools may negatively affect hair health, causing cuticle damage, protein loss, and weakening of the hair shaft, ultimately leading to breakage and hair loss. Hatsbach de Paula et al. reported that prolonged heat exposure from hair straighteners can cause internal hair damage, particularly in textured hair.¹⁸ However, Olsen et al. found no significant correlation between hair straightener use and extensive central hair loss.¹⁹ Moreover, no association was observed between the age at which hair straightening was first initiated and the pattern of hair loss when comparing individuals

with no hair loss (pattern 0) to those with probable central centrifugal cicatricial alopecia (CCCA) patterns 3 and 5.

Based on the data from this study, no significant association was observed between hair loss and the use of hair coloring products, henna, hair spray, or hair gel ($p>0.05$). The frequency of use of these products was similar between individuals with and without hair loss. It is essential to note that this study focused solely on the presence or absence of hair loss, rather than its severity or specific types. In contrast, Jusuf reported that hair coloring can damage hair and cause scalp problems,²⁰ finding a significant relationship between hair coloring, hair damage, and scalp issues.

The results indicate a significant difference in Vitamin B12 supplementation between individuals with and without a history of hair loss, with 10.8% of those with hair loss reporting use of Vitamin B12 supplements. This finding suggests that Vitamin B12 deficiency may contribute to hair loss in this population, although further research is needed to establish a causal relationship and clarify the underlying mechanisms. Assessing Vitamin B12 status and considering supplementation may be valuable in managing hair loss conditions. Trends observed in the intake of other nutrients also warrant further investigation.

In contrast, Almohanna et al. found no significant differences in folate and Vitamin B12 levels between patients with hair loss and control subjects.²¹ Additionally, Devjani et al. (2023) reported reduced Vitamin B12 levels in females with AGA treated with ethinyl estradiol and cyproterone acetate.²² This deficiency led to Vitamin B12-related anxiety, prompting some patients to discontinue treatment. Daily supplementation with 200 µg of Vitamin B12 corrected the deficiency; however, this reduction in Vitamin B12 levels did not adversely affect hair shedding or growth.

The results indicate significant differences in the prevalence of fertility issues and menopausal status between women with and without a history of hair loss. Women with hair loss were more likely to report difficulties in becoming pregnant, whereas women without hair loss were more likely to be menopausal. These findings suggest that reproductive and hormonal factors may play a role in the development of hair loss. The observed associations warrant further investigation to clarify the underlying mechanisms and their potential implications for the management of hair loss. Exploring these relationships in larger, longitudinal studies could provide valuable insights into the interplay between reproductive health and hair loss.

In contrast, Rinaldi et al. reported that hair loss

during menopause may present as diffuse thinning or widening of the parting.¹⁴ It is important to note that not all women experience significant hair loss during menopause, and the severity of hair loss can vary considerably among individuals.

Strengths and Limitations

One of the major strengths of this study is its large sample size of 1,438 participants, which is representative of the adult population in Sulaimani Governorate. This enhances the generalizability of the findings to the broader population in the region. The study employed a robust data collection method, combining a detailed, researcher-designed questionnaire with clinical examinations using established scales (Ludwig for females and Norwood-Hamilton for males). This comprehensive approach enabled a thorough assessment of the prevalence and risk factors associated with androgenetic alopecia (AGA).

Additionally, the study addresses a significant gap in the literature by focusing on the prevalence and determinants of AGA in the Kurdistan region of Iraq, a population that has been underrepresented in prior research. The findings provide valuable data that can inform region-specific health strategies and interventions.

However, the cross-sectional design limits the ability to draw causal inferences between the identified risk factors and the development of AGA. Longitudinal studies are needed to establish temporal relationships and causality. Some data, particularly lifestyle factors and family history, were self-reported, which may introduce recall bias or social desirability bias. Future research could benefit from incorporating more objective measures where feasible.

While family history was identified as a significant risk factor, this study did not explore specific genetic markers or molecular mechanisms underlying AGA. Future research could address these genetic aspects, potentially through genomic or molecular studies. Finally, the findings are specific to Sulaimani Governorate and may not be directly generalizable to regions with different environmental, cultural, or genetic contexts. Comparative studies across diverse populations would help validate and expand these findings.

Conclusion

This study provides important insights into the epidemiology and risk factors of androgenetic alopecia (AGA) among adults in the Sulaimani Governorate, Iraq. The findings underscore the need for tailored prevention and treatment strategies that consider the unique demographic, lifestyle, and clinical characteristics of

the local population. Further research is warranted to investigate the underlying genetic and environmental factors contributing to AGA in this region.

Authors' Contribution

Jwan Jellal Rasheed Shwana is the corresponding author and led the research, with Burhan Tahir Saeed and Fattah Hama Rahim Fattah contributing as co-authors.

Acknowledgement

The authors gratefully acknowledge the support and assistance provided by the Sulaimaniyah General Directorate of Health's Research Department, which facilitated the data collection process and logistical arrangements. Special thanks are extended to the Department of Nursing, College of Health and Medical Technology at Sulaimani Polytechnic University for their academic and technical support throughout the study. Additionally, the authors appreciate the guidance and contributions from the College of Medicine, University of Sulaimani, which enriched the research design and analysis. The authors also thank all participants for their voluntary involvement and cooperation, without which this study would not have been possible.

Funding

The research received no financial support for the study, authorship, or publication of the article.

Data Availability

The dataset used in this study is available from the corresponding author upon reasonable request. Data are not publicly available to ensure the confidentiality of participants' information.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in the study.

References

- 1 Wolff H, Fischer TW, Blume-Peytavi U. The Diagnosis and Treatment of Hair and Scalp Diseases. *Dtsch Arztebl Int.* 2016; 113(21):377-86. doi: 10.3238/arztebl.2016.0377. PubMed PMID: 27504707; PubMed Central PMCID: PMC4908932.
- 2 He H, Xie B, Xie L. Male pattern baldness and incidence of prostate cancer: A systematic review and meta-analysis. *Medicine (Baltimore).* 2018; 97(28):e11379. doi: 10.1097/MD.00000000000011379. PubMed PMID: 29995779; PubMed Central PMCID: PMC6076190.

- 3 Anastassakis K, Anastassakis K. The Psychological Effects of AGA/FPHL2022. 283-99 p.
- 4 Varothai S, Bergfeld WF. Androgenetic alopecia: an evidence-based treatment update. *Am J Clin Dermatol*. 2014; 15(3):217-30. doi: 10.1007/s40257-014-0077-5. PubMed PMID: 24848508.
- 5 Kavak A, Yeşildal N, Parlak AH, Gökdemir G, Aydoğan I, Anul H, et al. Alopecia areata in Turkey: demographic and clinical features. *J Eur Acad Dermatol Venereol*. 2008; 22(8):977-81. doi: 10.1111/j.1468-3083.2008.02699.x. PubMed PMID: 18384559.
- 6 Kim BJ, Kim JY, Eun HC, Kwon OS, Kim MN, Ro BI. Androgenetic alopecia in adolescents: a report of 43 cases. *J Dermatol*. 2006; 33(10):696-9. doi: 10.1111/j.1346-8138.2006.00161.x. PubMed PMID: 17040499.
- 7 Xu F, Sheng YY, Mu ZL, Lou W, Zhou J, Ren YT, et al. Prevalence and types of androgenetic alopecia in Shanghai, China: a community-based study. *Br J Dermatol*. 2009; 160(3):629-32. doi: 10.1111/j.1365-2133.2008.08909.x. PubMed PMID: 19016703.
- 8 Abdin R, Zhang Y, Jimenez JJ. Treatment of Androgenetic Alopecia Using PRP to Target Dysregulated Mechanisms and Pathways. *Front Med (Lausanne)*. 2022; 9:843127. doi: 10.3389/fmed.2022.843127. PubMed PMID: 35372424; PubMed Central PMCID: PMC8965895.
- 9 Swerdloff RS, Dudley RE, Page ST, Wang C, Salameh WA. Dihydrotestosterone: Biochemistry, Physiology, and Clinical Implications of Elevated Blood Levels. *Endocr Rev*. 2017; 38(3):220-254. doi: 10.1210/er.2016-1067. PubMed PMID: 28472278; PubMed Central PMCID: PMC6459338.
- 10 Miranda BH, Charlesworth MR, Tobin DJ, Sharpe DT, Randall VA. Androgens trigger different growth responses in genetically identical human hair follicles in organ culture that reflect their epigenetic diversity in life. *FASEB J*. 2018; 32(2):795-806. doi: 10.1096/fj.201700260RR. PubMed PMID: 29046359; PubMed Central PMCID: PMC5928870.
- 11 Ludwig E. Classification of the types of androgenetic alopecia (common baldness) occurring in the female sex. *Br J Dermatol*. 1977; 97(3):247-54. doi: 10.1111/j.1365-2133.1977.tb15179.x. PubMed PMID: 921894.
- 12 Norwood OT. Male pattern baldness: classification and incidence. *South Med J*. 1975; 68(11):1359-65. doi: 10.1097/00007611-197511000-00009. PubMed PMID: 1188424.
- 13 Kacar SD, Soyucok E, Bagcioglu E, Ozuguz P, Coskun KS, Asik AH, et al. The Perceived Stigma in Patients with Alopecia and Mental Disorder: A Comparative Study. *Int J Trichology*. 2016; 8(3):135-40. doi: 10.4103/0974-7753.189005. PubMed PMID: 27625566; PubMed Central PMCID: PMC5007920.
- 14 Wang TL, Zhou C, Shen YW, Wang XY, Ding XL, Tian S, et al. Prevalence of androgenetic alopecia in China: a community-based study in six cities. *Br J Dermatol*. 2010; 162(4):843-7. doi: 10.1111/j.1365-2133.2010.09640.x. PubMed PMID: 20105167.
- 15 Can G, Demir M, Erol O, Aydinler A. A comparison of men and women's experiences of chemotherapy-induced alopecia. *Eur J Oncol Nurs*. 2013; 17(3):255-60. doi: 10.1016/j.ejon.2012.06.003. PubMed PMID: 22901547.
- 16 Lolli F, Pallotti F, Rossi A, Fortuna MC, Caro G, Lenzi A, et al. Androgenetic alopecia: a review. *Endocrine*. 2017; 57(1):9-17. doi: 10.1007/s12020-017-1280-y. PubMed PMID: 28349362.
- 17 Lee SH, Kang H, Lee WS. Association between Family History and Male Androgenetic Alopecia with Female Pattern Hair Loss. *Ann Dermatol*. 2023; 35(5):348-354. doi: 10.5021/ad.22.221. PubMed PMID: 37830416; PubMed Central PMCID: PMC10579574.
- 18 Hatsbach de Paula JN, Basílio FMA, Mulinari-Brenner FA. Effects of chemical straighteners on the hair shaft and scalp. *An Bras Dermatol*. 2022; 97(2):193-203. doi: 10.1016/j.abd.2021.02.010. PubMed PMID: 35058079; PubMed Central PMCID: PMC9073307.
- 19 Olsen EA, Callender V, McMichael A, Sperling L, Anstrom KJ, Shapiro J, et al. Central hair loss in African American women: incidence and potential risk factors. *J Am Acad Dermatol*. 2011; 64(2):245-52. doi: 10.1016/j.jaad.2009.11.693. PubMed PMID: 21075478.
- 20 Jusuf NK. The Relationship between Types of Hair Coloring with Hair Damages and Scalp Problems in Medical Students of University Sumatera Utara, Indonesia. *International Archives of Medicine*. 2016; 9. doi: 10.3823/1940.
- 21 Almohanna HM, Ahmed AA, Tsatalis JP, Tosti A. The Role of Vitamins and Minerals in Hair Loss: A Review. *Dermatol Ther (Heidelb)*. 2019; 9(1):51-70. doi: 10.1007/s13555-018-0278-6. PubMed PMID: 30547302; PubMed Central PMCID: PMC6380979.
- 22 Devjani S, Ezemma O, Kelley KJ, Stratton E, Senna M. Androgenetic Alopecia: Therapy Update. *Drugs*. 2023; 83(8):701-715. doi: 10.1007/s40265-023-01880-x. PubMed PMID: 37166619; PubMed Central PMCID: PMC10173235.