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Original Research Article

Independent predictors of hair loss among medical students: a cross-sectional study using the sinclair hair shedding scale in a tertiary medical college in South India

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ABSTRACT

Background: Medical students are highly vulnerable to psychological distress due to demanding academic schedules, which can disrupt hair follicle homeostasis. This study aimed to determine the prevalence of hair loss among female medical students and identify its associated factors.
Methods: A cross-sectional study was conducted among female MBBS students at a tertiary care medical college in Kerala. Data were collected through face-to-face interviews using a pretested semi-structured questionnaire incorporating the Sinclair Hair Shedding Scale to assess hair loss and the Depression Anxiety Stress Scale-21 (DASS-21) to evaluate psychological distress. Multivariable logistic regression was performed to identify independent predictors of excessive hair shedding.
Results: The prevalence of excessive hair shedding was 22.0%. Multivariable logistic regression identified severe to extremely severe stress as the strongest predictor of hair loss (AOR=4.06; 95% CI: 1.79-9.19). Other significant predictors included a positive family history of hair loss (AOR=3.69), being a final-year MBBS student (AOR=3.08), sleeping less than 6 hours per day (AOR=2.57), severe to extremely severe depression (AOR=2.74), severe to extremely severe anxiety (AOR=2.11) and hair care practices.
Conclusions: Excessive hair shedding is a prevalent and multifactorial condition among female medical students, influenced by a combination of psychological, genetic, lifestyle, and hair care factors. Medical colleges should incorporate regular mental health screening, sleep hygiene education, and awareness of appropriate hair care to reduce the risk of excessive hair shedding.

Keywords: Hair loss, Medical students, Anxiety, Stress, Depression, Predictors

INTRODUCTION

Hair loss is one of the most frequently encountered dermatological complaints affecting individuals of all age groups. Although it is often perceived as a cosmetic concern, excessive hair shedding can significantly impair self-esteem, body image, emotional well-being, and overall quality of life irrespective of its severity or pattern.[1] Hair disorders encompass a wide spectrum of conditions, including androgenetic alopecia, alopecia areata, and telogen effluvium, each differing in etiology and clinical presentation.[2] Telogen effluvium, characterized by diffuse hair shedding following physical or psychological stress, is particularly common among

young adults and represents an important cause of reversible hair loss.[1,2] Normal hair growth is a dynamic biological process that occurs through cyclic phases of anagen (growth), catagen (regression), and telogen (resting). Hair follicle stem cells regulate this cycle by periodically transitioning between active and quiescent states to maintain continuous hair regeneration.[3,4] Disturbances in this tightly regulated cycle, particularly prolonged retention of hair follicles in the telogen phase, can result in increased hair shedding and reduced hair density over time.[4] Psychological stress has emerged as an important contributor to hair loss. Chronic stress activates the hypothalamic-pituitary-adrenal axis, resulting in sustained elevation of glucocorticoids, which suppress hair follicle stem cell activation and delay the transition from the telogen to the anagen phase.[3,4] Consequently, persistent stress may lead to progressive hair thinning even in the absence of overt scalp disease. Medical students constitute a population particularly vulnerable to psychological distress because of demanding academic schedules, frequent examinations, and clinical responsibilities, making stress-related hair loss an important concern.[5]

Sleep is another essential factor influencing hair follicle homeostasis. Chronic sleep deprivation and disruption of circadian rhythm can alter endocrine function, increase physiological stress responses, and shorten the anagen phase of the hair cycle.[6] Melatonin, a hormone released in accordance with the circadian rhythm, also plays a role in regulating hair follicle activity. Impaired melatonin secretion due to inadequate or disturbed sleep may adversely affect normal follicular cycling and contribute to excessive hair shedding.[6,7] Hair care practices and environmental factors may further influence hair health. Adequate hydration supports normal scalp physiology and follicular function, whereas dehydration may result in dry, brittle hair and increased shedding.[8] In addition, the quality of water used for hair washing has attracted increasing attention. Hard water containing high concentrations of calcium and magnesium salts may cause mineral deposition on the scalp and hair shaft, leading to increased hair fragility and breakage, although evidence regarding its direct role in hair loss remains limited.[9]

Several studies have reported a high prevalence of hair loss among university students, particularly those pursuing medical education. Cross-sectional studies from India and Pakistan reported hair loss prevalence ranging from 73.6% to 97.1%, with academic stress, depression, nutritional deficiencies, and dandruff identified as important associated factors.[10-12] Likewise, studies from China and Indonesia demonstrated a significant association between psychological stress and hair loss, with prevalence estimates of 39.2% and 59%, respectively, further emphasizing the need for region-specific evidence using validated assessment tools.[13,14] Hair loss among medical students is likely to be multifactorial, with psychological distress, sleep disturbances, and lifestyle-related factors acting either independently or synergistically. The scientific rationale of the present study is to comprehensively evaluate the independent contribution of psychological, lifestyle, and hair care factors to hair loss using validated assessment tools in a population at high risk of academic stress. Despite growing interest in this area, evidence from South India remains limited, particularly studies employing the Sinclair Hair Shedding Scale and DASS-21. Therefore, the present study was undertaken to determine the prevalence of hair loss among medical students and identify its associated psychological, lifestyle, and hair care factors.

METHODS

Study design, setting and duration

A descriptive cross-sectional study was conducted among undergraduate MBBS students at MES Medical College, Perinthalmanna, Malappuram, Kerala, India, from 5 May 2025 to 30 May 2025.

Study population, sample size and sampling

Inclusion criteria

Female undergraduate MBBS students aged 18–28 years who were willing to participate and provided written informed consent.

Exclusion criteria

Students with a previously diagnosed hair disorder confirmed by a registered dermatologist and those receiving medications known to cause hair loss were excluded.

Sample size

The sample size was calculated using the prevalence of hair loss among female medical students (60.6%) reported by Nitin Joseph et al.[15] The sample size was estimated using the formula $n=4pq/d^2$, where p=60.6%, q=39.4%, and the absolute precision (d) was taken as 8%. The minimum required sample size was calculated to be 150. After accounting for a 10% non-response rate, the required sample size was 165. To improve the precision of the estimates and increase the study power, a total of 200 participants were included in the study.

Sampling

A stratified random sampling technique was employed to ensure adequate representation of students from all years of the MBBS course. The study population was stratified into four strata based on the year of study (first year, second year, third year, and final year). A list of all eligible female students in each academic year was obtained from the institution. From each stratum, 50

participants were selected by simple random sampling using computer-generated random numbers, resulting in a total sample of 200 participants. All enrolled participants completed the interview, and no missing data were recorded for the study variables.

Operational definitions

Hair loss

Hair loss was defined as excessive shedding of scalp hair beyond the normal physiological daily loss of approximately 50-100 hairs.[2]

Wash test (Sinclair hair shedding scale)

Hair shedding was assessed using the Sinclair Hair Shedding Scale. Participants selected the photograph that best represented the amount of hair shed after washing their hair following a 5-day interval without shampooing. Grades 1-4 were considered normal hair shedding, while Grades 5 and 6 were considered excessive hair shedding/hair loss (Figure 1).[16]

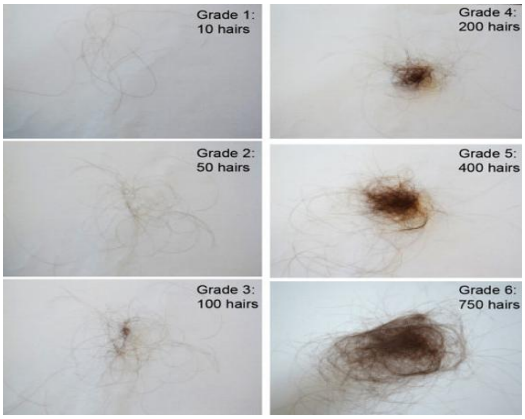


Figure 1: Wash test grading.

Depression, anxiety and stress

Depression, anxiety, and stress were assessed using the Depression Anxiety Stress Scale-21 (DASS-21) and categorized according to the recommended severity classification (Table 1).[17]

Table 1: DASS 21 classification.

Severity	Depression	Anxiety	Stress
Normal	0-5	0-4	0-7
Mild	6-7	5-6	8-9
Moderate	8-10	7-8	10-13
Severe	11-14	9-10	14-17
Extremely severe	≥15	≥11	≥18

Adequate sleep

Adequate sleep was defined as a self-reported sleep duration of at least 6 hours per night.

Consistent sleep schedule

A consistent sleep schedule was defined as maintaining regular bedtime and wake-up times.

Method of data collection and data analysis

Data were collected through face-to-face interviews using a pretested, semi-structured questionnaire after obtaining written informed consent from the participants. The questionnaire was reviewed and validated for content validity by experts from the Department of Community Medicine and Dermatology prior to data collection.

The questionnaire comprised four sections. Section A included socio-demographic and clinical characteristics. Section B assessed hair loss using the Wash test (Sinclair hair shedding scale) and included questions on hair characteristics.[16] Section C assessed psychological distress using the validated Depression anxiety stress scale-21 (DASS-21).[17]

Section D collected information on sleep characteristics, source of water used for hair washing, hair washing practices, and other potential determinants of hair loss. A pilot study was conducted among 10% of the study participants, and necessary modifications were made to the questionnaire before the final data collection. Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0. Categorical variables were summarized as frequencies and percentages, while continuous variables were expressed as mean±standard deviation (SD) or median (interquartile range), as appropriate. The association between hair loss and categorical variables was assessed using the Chi-square test or Fisher's exact test, wherever applicable.

Variables with a $p<0.20$ in the bivariate analysis were included in a multivariable binary logistic regression model to identify independent predictors of hair loss. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated. A $p<0.05$ was considered statistically significant.

Ethical considerations

The study was carried out in accordance with the ethical principles outlined in the Declaration of Helsinki. Prior to the initiation of the study, ethical clearance was obtained from the Institutional Ethics Committee of MES Medical College, Kerala (Approval No. IEC/MES/UGCM12/2025). Written informed consent was obtained from all participants before data collection. Participants were informed about the purpose of the study, and confidentiality and anonymity of the information provided were ensured. Participation was entirely voluntary, and participants were free to decline or withdraw from the study at any point without any repercussions.

RESULTS

Baseline characteristics of the study participants

A total of 200 female MBBS students participated in the study. The mean age of the participants was 22.02±1.28 years. More than half (52.0%) were aged 21–22 years, while 36.5% were aged ≥23 years. The majority were third-year students (59.0%), hostel residents (82.0%), from urban areas (60.5%), belonged to the upper socioeconomic status (77.5%), and were in the regular batch (81.5%). A family history of hair loss was reported by 31.0% of participants, whereas 8.5% had a history of chronic medical illness (Table 2).

The Prevalence of hair loss

Based on the Sinclair Hair Shedding Scale, 44 (22.0%) participants had excessive hair shedding classified as hair loss (Grades 5-6), while 156 (78.0%) had normal hair shedding (Grades 1-4). Grade 2 was the most frequently reported category (25.5%), followed by Grade 4 (23.0%), Grade 3 (18.0%), Grade 5 (13.0%), Grade 1 (11.5%) and Grade 6 (9.0%) (Table 3) (Figure 2).

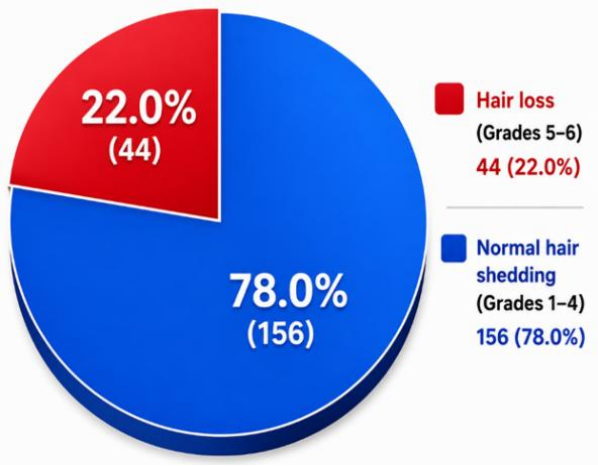


Figure 2: Prevalence of hair loss among the study participants (n=200).

Hair care practices, sleep characteristics and psychological profile of the study participants

Most participants washed their hair 2-3 times per week (50.5%), used hair oil regularly (47.0%), and used shampoo occasionally (56.5%). Nearly two-thirds (65.0%) had never used heat styling tools, while 63.0% reported sharing combs. Tap water was the most common source of water used for hair washing (51.5%), and the majority (62.5%) reported sleeping for less than 6 hours per night, with 54.5% having an inconsistent sleep schedule. Based on the DASS-21, 40.0%, 34.0%, and 57.5% of participants had normal levels of depression, anxiety, and stress, respectively (Table 4).

Association between baseline characteristics and excessive hair shedding

Among the socio-demographic characteristics, hair loss was significantly associated with age, year of study, residential status, type of batch, family history of hair loss, and history of chronic medical illness. The prevalence of hair loss increased with age, from 4.3% among participants aged ≤20 years to 34.2% among those aged ≥23 years (p=0.003). Similarly, the proportion increased across the years of study, ranging from 5.6% in first-year students to 54.3% in final-year students (p<0.001). Participants residing in apartments had a higher prevalence of hair loss (47.8%) compared to hostel residents (17.7%) and day scholars (30.8%) (p=0.005). Hair loss was also more common among irregular batch students than regular batch students (43.2% vs. 17.2%; p<0.001), among those with a family history of hair loss than those without (38.7% vs. 11.7%; p<0.001), and among participants with a history of chronic medical illness than those without (58.8% vs. 18.6%; p<0.001). No, statistically significant association was observed between hair loss and place of residence or socioeconomic status (p>0.05) (Table 5).

Association between hair loss and hair care practices, sleep characteristics and psychological factors among the study participants

Participants washing their hair ≤2 times/week had a higher prevalence of hair loss (44.4%) compared to those washing 2-3 times/week (23.8%) and >3 times/week (14.8%) (p=0.012). Hair loss was also more common among participants using heat styling tools (31.4% vs. 16.9%, p=0.013), sharing combs (27.8% vs. 12.2%, p=0.016), sleeping <6 hours/day (28.8% vs. 10.7%, p=0.005), and having an inconsistent sleep schedule (29.4% vs. 13.2%, p=0.009). The prevalence of hair loss increased with increasing severity of depression (10.0% to 60.9%), anxiety (8.8% to 51.7%), and stress (10.4% to 87.5%) (all p<0.001). No, statistically significant association was observed between hair loss and hair oil use (p=0.769), shampoo use (p=0.914) or the primary source of water used for hair washing (p=0.910) (Table 6).

Multivariable logistic regression analysis of factors associated with excessive hair shedding

Multivariable logistic regression analysis showed that age ≥23 years (AOR=2.36), being in the final year of MBBS (AOR=3.08), irregular academic batch (AOR=2.41), family history of hair loss (AOR=3.69), hair washing ≤2 times/week (AOR=2.21), use of heat styling tools (AOR=2.14), sharing of combs (AOR=2.03), sleeping <6 hours/day (AOR=2.57), severe/extremely severe depression (AOR=2.74), severe/extremely severe anxiety (AOR=2.11) and severe/extremely severe stress (AOR=4.06) were identified as independent predictors of excessive hair shedding. Among these, severe/extremely severe stress showed the strongest association with excessive hair shedding, followed by a family history of hair loss and being in the final year of MBBS (Table 7).

Table 2: Baseline characteristics of the study participants (n=200).

Variables	Frequency (N)	Percentage (%)
Age (years)		
≤20	23	11.5
21–22	104	52.0
≥23	73	36.5
Year of study		
First year	18	9.0
Second year	29	14.5
Third year	118	59.0
Final year	35	17.5
Residential status		
Hostel	164	82.0
Apartment	23	11.5
Day scholar	13	6.5
Place of residence		
Urban	121	60.5
Rural	79	39.5
Socioeconomic status		
Upper socioeconomic status	154	77.5
Lower socioeconomic status	46	22.5
Type of batch		
Regular	163	81.5
Irregular	37	18.5
Family history of hair loss		
Yes	62	31.0
No	111	55.5
Not sure	27	13.5
History of chronic medical illness		
Yes	17	8.5
No	183	91.5

Table 3: Distribution of hair shedding according to the Sinclair hair shedding scale (n=200).

Variables	Frequency (N)	Percentage (%)
Grade 1	23	11.5
Grade 2	51	25.5
Grade 3	36	18.0
Grade 4	46	23.0
Grade 5	26	13.0
Grade 6	18	9.0

Table 4: Hair care practices, sleep characteristics, and psychological characteristics of the study participants (n=200).

Variables	Frequency (N)	Percentage (%)
Hair washing frequency		
≤2 times/week	18	9.0

Continued.

Variables	Frequency (N)	Percentage (%)
2–3 times/week	101	50.5
>3 times/week	81	40.5
Hair oil use		
Regular	94	47.0
Occasional	63	31.5
Never	43	21.5
Shampoo use		
Regular	64	32.0
Occasional	113	56.5
Never	23	11.5
Use of heat styling tools		
Yes	70	35.0
No	130	65.0
Sharing of combs		
Yes	126	63.0
No	74	37.0
Primary source of water used for hair washing		
Tap water	103	51.5
Groundwater/Borewell	54	27.0
Filtered/Other	43	21.5
Sleep duration		
<6 hours	125	62.5
≥6 hours	75	37.5
Sleep schedule		
Consistent	91	45.5
Inconsistent	109	54.5
Depression (DASS-21)		
Normal	80	40.0
Mild	29	14.5
Moderate	41	20.5
Severe	27	13.5
Extremely severe	23	11.5
Anxiety (DASS-21)		
Normal	68	34.0
Mild	19	9.5
Moderate	50	25.0
Severe	34	17.0
Extremely severe	29	14.5
Stress (DASS-21)		
Normal	115	57.5
Mild	25	12.5
Moderate	27	13.5
Severe	25	12.5
Extremely severe	8	4.0

Table 5: Association between baseline characteristics and excessive hair shedding (n=200).

Variables	Excessive hair shedding N (%)	Normal hair shedding N (%)	χ^2	p value
Age (years)			11.89	0.003
≤20	01 (4.3)	22 (95.7)		
21–22	18 (17.3)	86 (82.7)		
≥23	25 (34.2)	48 (65.8)		
Year of study			28.73	<0.001
First year	01 (5.6)	17 (94.4)		

Continued.

Variables	Excessive hair shedding N (%)	Normal hair shedding N (%)	χ^2	p value
Second year	2 (6.9)	27 (93.1)		
Third year	22 (18.6)	96 (81.4)		
Final year	19 (54.3)	16 (45.7)		
Residential status			11.30	0.003
Hostel	29 (17.7)	135 (82.3)		
Apartment	11 (47.8)	12 (52.2)		
Day scholar	4 (30.8)	9 (69.2)		
Place of residence			0.63	0.427
Urban	25 (20.7)	96 (79.3)		
Rural	19 (24.1)	60 (75.9)		
Socioeconomic status			0.51	0.475
Upper socioeconomic status	33 (21.4)	121 (78.6)		
Lower socioeconomic status	11 (23.9)	35 (76.1)		
Type of batch			11.94	<0.001
Regular	28 (17.2)	135 (82.8)		
Irregular	16 (43.2)	21 (56.8)		
Family history of hair loss			17.18	<0.001
Yes	24 (38.7)	38 (61.3)		
No	13 (11.7)	98 (88.3)		
Not sure	7 (25.9)	20 (74.1)		
History of chronic medical illness			14.68	<0.001
Yes	10 (58.8)	7 (41.2)		
No	34 (18.6)	149 (81.4)		

Table 6: Association between hair loss and hair care practices, sleep characteristics, and psychological factors among the study participants (n=200).

Variables	Hair loss N (%)	No hair loss N (%)	χ^2	
Hair washing frequency			7.92	
≤2 times/week (n=18)	8 (44.4)	10 (55.6)		
2–3 times/week (n=101)	24 (23.8)	77 (76.2)		
>3 times/week (n=81)	12 (14.8)	69 (85.2)		
Hair oil use			0.53	
Regular (n=94)	20 (21.3)	74 (78.7)		
Occasional (n=63)	13 (20.6)	50 (79.4)		
Never (n=43)	11 (25.6)	32 (74.4)		
Shampoo use			0.18	
Regular (n=64)	15 (23.4)	49 (76.6)		
Occasional (n=113)	24 (21.2)	89 (78.8)		
Never (n=23)	5 (21.7)	18 (78.3)		
Use of heat styling tools			5.57	
Yes (n=70)	22 (31.4)	48 (68.6)		
No (n=130)	22 (16.9)	108 (83.1)		
Sharing of combs			6.62	
Yes (n=126)	35 (27.8)	91 (72.2)		
No (n=74)	9 (12.2)	65 (87.8)		
Primary source of water			0.19	
Tap water (n=103)	22 (21.4)	81 (78.6)		
Groundwater/borewell (n=54)	13 (24.1)	41 (75.9)		
Filtered/other (n=43)	9 (20.9)	34 (79.1)		
Sleep duration			8.98	
<6 hours (n=125)	36 (28.8)	89 (71.2)		
≥6 hours (n=75)	8 (10.7)	67 (89.3)		

Continued.

Variables	Hair loss N (%)	No hair loss N (%)	χ^2
Sleep schedule			7.55
Consistent (n=91)	12 (13.2)	79 (86.8)	
Inconsistent (n=109)	32 (29.4)	77 (70.6)	
Depression (DASS-21)			31.80
Normal (n=80)	8 (10.0)	72 (90.0)	
Mild (n=29)	4 (13.8)	25 (86.2)	
Moderate (n=41)	8 (19.5)	33 (80.5)	
Severe (n=27)	10 (37.0)	17 (63.0)	
Extremely severe (n=23)	14 (60.9)	9 (39.1)	
Anxiety (DASS-21)			25.50
Normal (n=68)	6 (8.8)	62 (91.2)	
Mild (n=19)	2 (10.5)	17 (89.5)	
Moderate (n=50)	10 (20.0)	40 (80.0)	
Severe (n=34)	11 (32.4)	23 (67.6)	
Extremely severe (n=29)	15 (51.7)	14 (48.3)	
Stress (DASS-21)			39.78
Normal (n=115)	12 (10.4)	103 (89.6)	
Mild (n=25)	5 (20.0)	20 (80.0)	
Moderate (n=27)	8 (29.6)	19 (70.4)	
Severe (n=25)	12 (48.0)	13 (52.0)	
Extremely severe (n=8)	7 (87.5)	1 (12.5)	

Table 7: Multivariable logistic regression analysis of factors independently associated with excessive hair shedding among the study participants.

Variables	AOR	95% CI	P value
Age ≥23 years (vs. ≤20 years)	2.36	1.12–4.98	0.024
Final year MBBS (vs. First year)	3.08	1.35–7.01	0.008
Irregular batch (vs. Regular)	2.41	1.15–5.07	0.020
Family history of hair loss (Yes vs. No)	3.69	1.81–7.53	<0.001
Hair washing ≤2 times/week (vs. >3 times/week)	2.21	1.06–4.62	0.035
Use of heat styling tools (Yes vs. No)	2.14	1.08–4.26	0.029
Sharing of combs (Yes vs. No)	2.03	1.01–4.09	0.047
Sleep duration <6 hours (vs. ≥6 hours)	2.57	1.19–5.54	0.016
Severe/Extremely severe depression*	2.74	1.28–5.89	0.010
Severe/Extremely severe anxiety*	2.11	1.03–4.31	0.041
Severe/Extremely severe stress*	4.06	1.79–9.19	<0.001

*Reference category: Normal to moderate depression/anxiety/stress.

DISCUSSION

The present study among 200 female medical students demonstrated that 22.0% of participants had excessive hair shedding (Grades 5-6), while 78.0% had physiological hair shedding (Grades 1-4) as assessed by the Sinclair Hair Shedding Scale. Excessive hair shedding was significantly associated with older age, final-year MBBS status, chronic morbidity, family history of hair loss, shorter sleep duration (<6 hours), and hair care practices including infrequent hair washing, use of heat styling tools, and sharing combs. Severe-to-extremely severe stress, anxiety, and depression, assessed using the DASS-21 scale, were also significantly associated with excessive hair shedding. Multivariable logistic regression identified severe-to-extremely severe stress as the strongest independent predictor, followed by a positive

family history of hair loss and being a final-year MBBS student.

The observed prevalence of 22.0% (Grades 5-6 on the Sinclair Hair Shedding Scale) among the study population (Figure 2) is considerably lower when compared with prior epidemiological literature evaluating hair loss among medical and other undergraduate students, such as studies by Kadiyala et al (33.3%) and Shi et al (39.2%).[11,13] Similarly, Penumaka et al reported a much higher prevalence of hair loss (97.1%) among medical students in Andhra Pradesh, India, which is likely attributable to the use of self-reported hair loss instead of the objectively assessed Sinclair Hair Shedding Scale used in the present study.[10] International studies have reported variable prevalence estimates. Fatima et al from Pakistan demonstrated a high proportion of stress-related moderate and extreme hair loss (60.6%) among medical students, while Shi et al reported that hair loss among Chinese university students was 39.2%.[12,13] Variations in prevalence across studies are expected because of differences in the assessment tools used, including self-reported hair loss, clinical diagnosis, and validated scales such as the Sinclair Hair Shedding Scale, as well as differences in participant characteristics, ethnicity, environmental exposures, nutritional status, and academic workload.

Our study demonstrated a strong and statistically significant association between psychological factors and excessive hair shedding among medical students. Students with severe or extremely severe stress had the highest prevalence of excessive hair shedding, followed by those with extremely severe depression and extremely severe anxiety. Our findings show that as stress, anxiety, and depression levels shift from normal to highly severe categories, the chance of hair loss increases dramatically and linearly. This pattern is consistent with earlier research on stress-induced suppression of hair development by Peters et al and Hadshiew et al.[16,17] Furthermore, multivariable logistic regression confirmed that severe stress (AOR: 4.06; 95% CI: 1.79–9.19), severe depression (AOR: 2.74; 95% CI: 1.28–5.89), and severe anxiety (AOR: 2.11; 95% CI: 1.03–4.31) remained independent predictors of excessive hair shedding after adjusting for potential confounders. These findings are consistent with those reported by Fatima et al, Mufti et al and Shi et al.[12-14] Trueb et al reported that psychogenic stress and anxiety disrupt the tightly regulated hair follicle cycle by activating systemic neuroendocrine pathways that adversely affect normal follicular function.[18]

Similarly, Asghar et al described that, under normal physiological conditions, hair follicles undergo a coordinated cycle comprising the anagen, catagen, and telogen phases, and disruption of this cycle may result in excessive hair shedding.[19] However, by blocking the activation factor GAS6, elevated sustained levels of corticosterone directly drive hair follicle stem cells into a prolonged quiescent state, according to groundbreaking research by Choi et al reports by Bryant and Lau.[3-5] Additionally, Lee et al showed that corticotropin-releasing hormone (CRH), a major mediator of the stress response, inhibits hair growth by inducing oxidative stress and cellular senescence in human hair follicle cells, thereby contributing to stress-induced hair loss.[20]

Beyond psychological factors, sleep duration was also an important factor associated with hair follicle health in the present study. Although relatively few epidemiological studies have specifically examined sleep duration and hair shedding among medical students, recent investigations have consistently reported that poor sleep quality and reduced sleep duration are associated with an increased risk of hair loss. A total of 62.5% of the participants reported sleeping for less than 6 hours per night, and this was significantly associated with hair loss ($p=0.002$). This finding is consistent with the systematic review by Boghosian et al which described the relationship between sleep deprivation and clinical alopecia.[21] Similarly, Minokawa et al found that patients with sleep disorders showed an increased risk of alopecia areata with a hazard ratio of 1.651, and this tendency was especially observed in younger age groups (<45 years).[22] Sleep deprivation may contribute to hair loss by disrupting the autonomic nervous system and increasing the production of pro-inflammatory cytokines, which can affect the normal functioning of hair follicles, as proposed by Wright et al.[7] Moreover, modern chronobiological studies by Liu et al have shown that human hair follicles contain fully functional intrinsic peripheral circadian clocks.[6] Also, Plikus et al demonstrated that the circadian clock plays a key role in regulating hair follicle regeneration and hair matrix cell proliferation, suggesting that disruption of normal circadian rhythms, such as may occur with inadequate sleep, could adversely affect hair growth.[23]

Baseline characteristics indicated that genetic predisposition played a more important role than sociodemographic factors in hair loss among the participants. While residential locality ($p=0.427$) and socioeconomic status ($p=0.475$) were not significantly associated with hair loss, a positive family history showed a strong association ($p<0.001$). This finding is consistent with Rook's Textbook of Dermatology (Griffiths et al), which describes genetic susceptibility as an important determinant of hair disorders, with environmental and physiological factors potentially triggering hair loss in genetically predisposed individuals.[2]

Although most participants were hostel residents (82.0%), neither residential status nor the primary source of water (tap water vs. borewell; $p=0.910$) was significantly associated with hair loss. Nevertheless, lifestyle changes associated with hostel living, including alterations in diet, hygiene practices, and environmental exposures, may indirectly influence hair health, as

suggested by previous studies conducted by Almohanna et al and Minokawa et al.[24,22]

Moreover, hair care practices were also found to be significantly associated with hair loss in the present study. Participants who washed their hair two or fewer times per week experienced significantly greater hair loss than those who washed more frequently (p=0.019). This finding is supported by Kester, who reported that infrequent hair washing promotes the accumulation of sebum, sweat, and dead skin cells on the scalp, creating conditions that may contribute to scalp irritation and hair shedding.[9] The use of heat styling tools (p=0.018) and sharing combs (p=0.010) were also significantly associated with hair loss. This finding is supported by Phillips st al which states that repeated exposure to heat can damage the hair cuticle and weaken the hair shaft, increasing hair breakage.[25]

In the final multivariable logistic regression model, several key variables remained strong independent predictors of excessive hair shedding, even after adjusting for confounding factors. Age ≥23 years was independently associated with an increased risk of excessive hair shedding (AOR=2.36, 95% CI: 1.12-4.98, p=0.024). This aligns with academic progression, as final-year MBBS students demonstrated a three-fold higher risk of excessive shedding compared to first-year students (AOR=3.08, 95% CI: 1.35–7.01, p=0.008). These findings align with observations by Joseph et al regarding the prevalence of skin and hair conditions within medical college environments.[15] Genetic predisposition also remained a powerful endogenous factor, with a positive family history increasing the odds of excessive shedding more than threefold (AOR=3.69, 95% CI: 1.81–7.53, p<0.001), a foundational tenet well-documented in standard dermatological literature (Griffiths et al).[2]

Among hair care practices, infrequent hair washing (AOR=2.21, 95% CI: 1.06–4.62, p=0.035), use of heat styling tools (AOR=2.14, 95% CI: 1.08–4.26, p=0.029), and sharing combs (AOR=2.03, 95% CI: 1.01–4.09, p=0.047) remained significant independent predictors of excessive hair shedding. Psychological factors demonstrated some of the strongest independent associations with hair shedding. Severe-to-extremely severe depression (AOR=2.74, 95% CI: 1.28–5.89, p=0.010), anxiety (AOR=2.11, 95% CI: 1.03–4.31, p=0.041), and stress (AOR=4.06, 95% CI: 1.79–9.19, p<0.001) were all significant predictors. These findings are consistent with studies by Mufti et al and Fatima et al which reported that psychological distress is independently associated with diffuse hair loss among students and young adults.[14,12] These insights highlight the multifactorial nature of hair loss among medical students and emphasize the importance of addressing both psychological well-being and modifiable lifestyle practices to reduce excessive hair shedding.

Limitations

The present study has certain limitations. As it employed a cross-sectional design, causal relationships between the identified factors and quality of life could not be established. Also, the results cannot be extrapolated to male medical students or peers from non-medical universities because the sample was limited to female undergraduate medical students at a single private institution in Malappuram, Kerala.

CONCLUSION

The present study demonstrated a considerable burden of excessive hair shedding among undergraduate female MBBS students, with a prevalence of 22.0% as assessed using the Sinclair Hair Shedding Scale. The findings indicate that hair loss in this population is a multifactorial condition influenced by a complex interplay of genetic predisposition, psychological distress, lifestyle behaviours, academic factors, and hair care practices. Multivariable logistic regression analysis identified severe to extremely severe stress as the strongest independent predictor of excessive hair shedding (AOR=4.06), followed by a positive family history of hair loss (AOR=3.69) and being in the final year of the MBBS course (AOR=3.08).

In addition, sleeping for less than six hours per night, belonging to an irregular academic batch, frequent use of heat styling tools, sharing combs, and washing hair two or fewer times per week were independently associated with an increased likelihood of excessive hair shedding. These findings underscore the significant influence of psychological well-being and modifiable lifestyle behaviours on hair health and suggest that excessive hair shedding among female medical students extends beyond a cosmetic concern. The demanding academic environment of medical education, characterized by prolonged study hours, sleep deprivation, and high levels of stress, appears to substantially contribute to this problem. Based on these findings, a comprehensive and multidisciplinary approach is recommended to address both the physical and psychological determinants of hair loss.

Recommendations

Medical colleges should strengthen student wellness initiatives. Periodic mental health screening using validated tools may facilitate early identification and timely intervention for students experiencing psychological distress. Health education programmes should promote adequate sleep hygiene, encouraging students to obtain at least six hours of sleep each night, while also emphasizing healthy lifestyle practices and hair care behaviours, including avoiding the sharing of combs, minimizing the use of heat styling devices, and maintaining regular hair washing practices. Furthermore, multicentric longitudinal studies involving diverse

populations are recommended to establish causal relationships.

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