Systematic Review and Meta-Analysis

Medicine

OPEN

The impact, prevalence, and association of different forms of hair loss among individuals with anxiety disorder

Systematic review and meta-analysis

Almuntsrbellah Almudimeegh, MD[a], Ahmed Hamad Alajlan, MD[b], Abdulelah Ibrahim Alrasheed, MD[b,*], Mansour Ibrahim Alrasheed, MD[c], Abdullah Khalid Alqahtani, MD[d], Reem Bin Idris, MD[b], Muhannad Abdullah Alomar, MD[b], Shaden Ahmad Alobaid, MD[b], Nouf Ali Alotaibi, MD[e]

Abstract

Background: Hair loss is a serious health concern, with individuals having to bear the associated psychological impact of the condition. Alopecia has been linked to emotional and psychological anguish in relationships, career, and personal life.

Objective: This study aimed to elucidate the intricate association, prevalence, and impact of hair loss with anxiety disorders, distinguished from other psychological impacts of alopecia.

Methods: The current review and meta-analysis were performed in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework. A comprehensive search was performed using the Cochrane, PubMed, and Google Scholar electronic databases studies published in English and conducted between January 2014 and September 2024. Statistical analysis was performed using STATA version 16.0 (StataCorp LLC), and the Newcastle-Ottawa Scale and RoB 2 tools were used for critical quality appraisal.

Results: A total of 24 eligible articles were included in the current study, with a cumulative of 5553 patients presenting with 1 or more forms of hair loss. Anxiety disorder was significantly prevalent among patients with alopecia event rate (ER) 0.47 (95% CI: 0.39–0.54). Anxiety severity analysis also showed a significant relationship between anxiety and hair loss, with ERs of 0.35 (95% CI: 0.10–0.60), 0.15 (95% CI: 0.01–0.29), and 0.05 (95% CI: 0.03–0.29), respectively. Statistical significance was also demonstrated by a mean HADS-A score of 7.87 (95% CI: 6.85–8.88). However, considerable heterogeneity was observed in various statistical analyses.

Conclusion: In summary, our study showed that among people with hair loss-related diseases, alopecia was substantially linked to anxiety disorders, with the frequency of anxiety among those affected being noticeably higher.

Abbreviations: AA = alopecia areata, AgA = androgenic alopecia, AM = alopecia monolocularis, AO = alopecia ophiasis, AT = alopecia totalis, AU = alopecia universalis, BAI = Beck anxiety inventory, CCS = case–control study, DASS21 = depression and anxiety stress scale, GADQ = generalized anxiety disorder questionnaire, HADS = hospital anxiety and depression scale, HAM = Hamilton anxiety rating scale, M/F = male/female, NOS = Newcastle–Ottawa scale, RCT = randomized controlled trial, SAS = self-rating anxiety scale, SCARED = screen for child anxiety related disorders, SD = standard deviation, STAI = state-trait anxiety inventory.

Keywords: alopecia, alopecia areata, anxiety disorders, hair loss, mental health

1. Introduction

Hair loss, alias alopecia, can be described as a condition characterized by the partial and/or total loss of hair from various body parts where it is expected to grow.[1] Hair loss affects people of all age groups in both sexes and can be localized, diffuse, transient, or permanent. In the medical field, hair loss is commonly perceived as a comparatively mild dermatologic condition as it pertains to scalp hair body areas.[1,2] Despite being rarely considered a severe medical risk concern for affected individuals, hair loss has been

The authors have no funding and conflicts of interest to disclose.

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

[a] Department of Dermatology, College of Medicine, King Saud University, Riyadh, Saudi Arabia, [b] College of Medicine, King Saud University, Riyadh, Saudi Arabia, [c] Department of Family Medicine and Polyclinic, King Faisal Specialist Hospital & Research Centre, Riyadh, Saudi Arabia, [d] College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia, [e] Department of Family Medicine, King Fahad Medical City, Riyadh, Saudi Arabia.

** Correspondence: Abdulelah Ibrahim Alrasheed, College of Medicine, King Saud University, Riyadh, Saudi Arabia (e-mail: AbdulelahAlrshid@gmail.com).*

How to cite this article: Almudimeegh A, Alajlan AH, Alrasheed AI, Alrasheed MI, Alqahtani AK, Idris RB, Alomar MA, Alobaid SA, Alotaibi NA. The impact, prevalence, and association of different forms of hair loss among individuals with anxiety disorder: Systematic review and meta-analysis. Medicine 2025;104:6(e41457).

Received: 30 September 2024 / Received in final form: 16 January 2025 / Accepted: 17 January 2025

http://dx.doi.org/10.1097/MD.0000000000041457

associated with a devastating psychological impact.[3] For many people, body hair is an instrumental component of aesthetic appearance, boosting their self-image. Therefore, hair loss can prove detrimental to body image, confidence, and self-esteem.[4]

Body image and how people feel about themselves are key factors in self-esteem, particularly among women. Women's perceptions of their beauty play a significant role in their lives. Numerous studies have revealed a positive correlation between self-esteem and physical attractiveness.[3] According to surveys conducted with American women, 78% of them dedicated 1 hour a day to taking care of their appearance, of which makeup, hair treatments, and outfits were predominantly the activities that they spent much time on. Hair and cosmetics appeared to require more time than other appearance-related habits, taking up an average of 55 minutes in a woman's day.[4] Moreover, even though there might not be many physical health effects associated with hair loss, an appearance-related illness might significantly interfere with day-to-day activities.[5,6] Several studies have shown that alopecia can lead to severe mental and psychological distress, which can result in issues with relationships, employment, and personal life.[6,7]

The majority of people with alopecia have been proven to be at a higher risk of developing hair loss-related anxiety disorders and depression projected with social phobia than the general population.[8,9] The presence of indications of anxiety and/or depression ranged from 30% to 68% and affected all age groups according to cross-sectional studies evaluating the psychological burden of adult patients with alopecia areata (AA).[7] When patients with AA were compared to healthy controls, their rates of unemployment and work absenteeism were much greater.[9] Compared to controls, alopecia patients are susceptible to experiencing considerably elevated degrees of displeasure and appearance obsession as it relates to their body image,[8,10] which has resulted in marital issues among 40% of women.[6] Consequently, 35% of the diversity in quality of life has been attributed to the perception of hair loss.[11]

Moreover, in a previous study, individuals with alopecia had a greater lifetime prevalence of psychiatric conditions, including generalized anxiety disorder (39%) and major depressive disorder (39%).[12] Patients with patchy AA were shown to have a higher risk of being diagnosed with generalized anxiety disorder, despite the fact that there was no correlation between major depressive illness and any feature indicating AA history.[12,13] While a number of studies have previously focused on investigating the psychological impacts (depression and anxiety) of 2 types of hair loss, AA and androgenic alopecia (AgA),[7,13–15] few studies have focused on distinguishing the effect of hair loss as a whole on anxiety disorders. As such, this study categorically investigated the association between hair loss and anxiety disorders. Through a systematic review and meta-analysis, we aimed to establish the prevalence and severity of anxiety disorders among individuals with hair loss.

2. Materials and methods

2.1. Design and protocol

The current study adopted a systematic review and meta-analysis design in conformity with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework.[16] It is acknowledged that the study's protocol was not registered.

2.2. Information sources

The Cochrane database, Google Scholar, and PUBMED are among the databases examined. Articles assessing patients affected with 1 or more forms of hair loss and experiencing anxiety disorders were identified through a comprehensive search of electronic medical databases. The study's dependence on a secondary data search from published publications indicated that ethical approval and permits were not necessary.

2.3. Search strategy

A systematically tailored search was steered through 3 electronic databases for potential articles published over the last ten years. The search terms were tailored by combining hair loss-associated terms including "hair loss," OR "alopecia," OR "alopecia areata," OR "androgenic alopecia," OR "loss of hair," OR "alopecia totalis," OR "alopecia universalis," OR "baldness," and the psychological effect terms related to anxiety including "anxiousness," OR "anxiety disorders," OR "anxious feeling," OR "worry," OR "mental health." Manual screening was applied to the reference lists of the included studies for additional articles.

2.4. Eligibility criteria

The articles considered eligible for inclusion in the current study were determined based on the following inclusion criteria (Table 1). No age limit was applied for the participants enrolled in the study. Our inclusion criteria focused on studies that explored the main and common types of hair loss, including alopecia (areata, patchy, totalis, androgenic, universalis, cicatricial, telogen effluvium, ophiasis, traction, trichotillomania, and frontal fibrosing) association with anxiety disorders. Studies were included based on the source of the data, which pertained to primary research papers whose full-text articles were available and published in peer-reviewed journals. Based on relevance, articles exploring anxiety disorders among individuals presenting with 1 or more forms of hair loss and associated conditions. The study design comprised all observational, randomized, and non-randomized studies relevant to the topic of the study. Based on the language and date of publication, studies published in English were conducted between January 2014 and September 2024 (see Table 1).

2.5. Study selection and data extraction

Two independent reviewers screened the titles and abstracts of potential studies based on the eligibility criteria (Table 1). Full-text papers from these potentially relevant studies were then evaluated for inclusion in the current review and meta-analysis based on predetermined inclusion criteria. Disagreements were resolved through conversation or consultation with a third

Table 1

Eligibility criteria for inclusion and exclusion of pertinent studies.

Eligibility items	Inclusion criteria	Exclusion criteria
Sources of information	Primary research articles are available and published in peer-reviewed journals.	Secondary sources include webpages, blogs, magazines, and newspaper articles.
Topic relevance	Studies exploring anxiety disorders among patients with hair loss and other alopecia areata-related conditions	Articles with no association between hair loss and anxiety disorders.
Study designs	All observational studies, randomized, and non-randomized studies relevant to the topic under study.	Case reports, non-referenced conference abstracts, and other reviews.
Publication date	Studies published from January 2014 to September 2024	Studies published before January 2014.
Publication language	Studies published in English to avoid misinterpretations and loss of data.	Studies done in other languages

Table 2

Study characteristics.

Study details		Patient demographics			Hair loss		Anxiety disorders			
Study ID	Design	No.	% of male	Mean age mean (SD)	Type/pattern or severity	% of patients' cases	Anxiety scale	Anxiety score mean (SD)	Categorization (% of patients)	Main findings (prevalence of anxiety in AA patients)
Sellami et al (2014)[13]	CCS	50	48	32.92 (11.81)	AA PA AT	100 80 8	HADS-A	7.9 (3.48)	ns	Anxiety symptoms are highly prevalent among AA patients.
Nadpara et al (2017)[2]	CSS	30	70	30.86 (11.89)	AA AgA	63.3 36.7	HAM-A BPRS	10.3 (6.396) 2.5 (1.17)	Mild (50) Moderate (6.7)	Despite not having a diagnosable anxiety illness, most individuals with mild alopecia had significant anxiety throughout their assessment.
Rajoo et al (2019)[20]	CSS	83	NS	40.95 (13.24)	AA AU PA AT	100 52.8 37.7 9.4	DASS21-A	0.663 (IQR; 0.551–0.763)	Moderate (8) Severe (13.3) Extremely severe (27.71)	Scalp involvement (≥50%) significantly predicts symptomatic anxiety
Altunisik et al (2020)[21]	CCS	27	29.6	8 to 18	AA AU AT Mild AA	100 3.7 14.8 81.5	SCARED	21.6 (13)	Anxiety (51.8)	Out of 27 patients, 14 had an anxiety disorder, compared to 3 in the control group.
Yildiz and Zincir (2023)[14]	CCS	86	66.3	32.94 (10.73)	AA	100	BAI	12.56 (8.76)	Anxiety (19.8)	Anxiety was observed in 19.8% (17) while 7.1% (6) in control group.
Aghaei et al (2014)[22]	CCS	40	44.8	ns	AA	100	BAI	*P*-value = .003	Anxiety (45)	Anxiety was reported by 45% (18) of participants, while 25% (10) in the control group.
Mesinkovska et al (2023)[23]	CSS	547	23.4	44.6 (14.8)	PA AT AU AO AM	30.7 16.5 42.8 6.6 3.5	HADS-A	9 (4.5)	Borderline abnormal (24.3) Abnormal anxiety (37.5)	Most respondents were in the "'abnormal'" (37.5%) or "'borderline abnormal'" (24.3%) categories of the anxiety domain.
Marahatta et al (2020)[24]	CSS	75	53.3	29.4 (9.9)	AA	100	BAI	5 (IQR; 0–11)	Low anxiety (89) Moderate (8)	Anxiety prevalence was 73.3%, with a median anxiety score of 5 (IQR; 0.0–11.0). However, no patients had acute anxiety.
Mesinkovska et al (2020)[25]	CSS	216	18	46.9	Severe AA 1/3 (scalp) >1/3 (scalp) Eyebrows Eyelashes Nasal	77 (166) 22 78 74 68 50	ns	ns	Anxiety (47)	85% of respondents reported at least 1 comorbidity, with anxiety/depression being the most frequent (47%)
Gilding et al (2022)[26]	CSS	129	13	44.2 (15.6)	AT AU AA (scalp)	17 60 43	HADS-A	9.0 (5.0)	Borderline abnormal (25) Abnormal anxiety (35) of 106 participants	Among 15 caregivers, 9 (60%) reported alopecia-related anxiety in their children A total of 40 individuals (34.8%) had abnormal anxiety levels
Vélez-Muñiz et al (2019)[27]	CSS	126	44	3 to 68 years	PA TA AU AO	92.9 3.2 1.6 1.6	HADS-A	ns	Anxiety (46.8) Borderline abnormal (19.1)	46.8% (62) of individuals experienced clinically significant symptoms, with 19.1% having borderline anxiety.
Alzubaidy et al (2023)[28]	CSS	211	54	30 to 44	AA	100	ns	ns	Anxiety (47.9)	Anxiety (47.9%) and depression (36) were the most often reported psychological symptoms.
Piraccini et al (2023)[29]	RCT	676	38.9	37.7 (13.1)	Scalp	100	HADS-A	26.4	Borderline/abnormal (32.5)	Patients with significant regrowth moved from HADS ≥ 8 to ≤ 8 (anxiety: 46.8% vs 26.4%).

(*Continued*)

Table 2

(*Continued*)

Study details		Patient demographics			Hair loss		Anxiety disorders			
Study ID	Design	No.	% of male	Mean age mean (SD)	Type/pattern or severity	% of patients' cases	Anxiety scale	Anxiety score mean (SD)	Categorization (% of patients)	Main findings (prevalence of anxiety in AA patients)
Bewley et al (2024)[30]	CSS	747	44.7	43.8 (7.1)	AA Scalp Eyebrow Eyelash Beard Body	100 73.2 46.9 48.7 61.5 73.2	ns	ns	Anxiety (26.1)	Anxiety was noted at all levels of present scalp hair loss severity. It was widespread among persons with < 50% scalp hair loss (34.0%).
Kim et al (2016)[31]	CSS	543	40	39.4 (32–46)	AA	100	ns	ns	Anxiety (17.30)	Of 543 adults with alopecia, 84 (17.3%) reported anxiety.
Baghestani et al (2015)[32]	CCS	68	ns	35.4 (7.6)	AA	100	HAM-A	12.76 (7.21)	Anxiety (47)	Anxiety was reported by 44.9% of males and 52.7% of women in the case group, compared to 16.3% and 42.1% in the control group, respectively.
Yu et al (2023)[33]	CSS	192	61.5	>18	AgA	100	HADS-A	6.12 (3.51)	Borderline/abnormal (28.13)	28.13% of patients had borderline/abnormal scores, which indicated an anxiety problem.
Edson-Heredia et al (2022)[34]	CSS	587	38	43.7 (15.4)	Scalp Eyebrow Eyelash Facal Body	98.8 19.7 10 1.8 5.7	HADS-A	All-6.21 (4.61) Mild 4.56 (3.87) Moderate 5.78 (4.7) Severe 7.62 (4.35)	Anxiety 50% of 286	The severity of alopecia areata was linked to increased anxiety.
Vañó-Galván et al (2020)[35]	CSS	2083	56	34 (11)	Mild AA Moderate AA Severe AA	299 936 848	HADS-S	ns	Anxiety 495 (23.76) Borderline abnormal (24.73) Abnormal (17.87)	The number of individuals with borderline abnormal or abnormal HADS scores for anxiety rose as the severity of AA increased.
Montgomery et al (2017)[9]	CSS	338	2.7	13 to 65	AA AU AT AgA	33.7 31.4 17.5 2.4	GADQ	ns	Anxiety (35.5) Mild (14.5) Moderate (13.5) Severe (15)	There were clinically significant levels of social anxiety (47.5%) and anxiety (35.5%).
Cakirca et al (2019)[36]	CCS	33	75.8	26.33 (6.08)	AA	100	HADS-A	9.45 (3.40)	Anxiety (36.4)	Anxiety and depression scores were higher among AA patients than in the control group.
Miniksar et al (2022)[37]	CCS	68	51.48	14.81 (2.42)	AA Mild AA Severe AA	47.06 78.13 7	STAI	State 33.75 (10.1) Trait 42.03 (11.25)	ns	There were no significant differences in anxiety levels between the 2 groups.
Yu et al (2016)[38]	CSS	342	54.7	30.43 (7.8)	AA AgA	38 62	SAS	AA = 40.69 (8.19) AgA = 40.44 (9.21)	Anxiety (18.9)	40 (18.9%) patients had an SAS score above 50, indicating anxiety.
Titeca et al (2020)[39]	CCS	115	23	41.6	AA AgA	32.2 17	HADS-A	7.9 (5.5)	ns	Patients had a considerably higher HADS mean anxiety score (7.9) than controls (5.6).

AA = alopecia areata, AgA = androgenic alopecia, AM = alopecia monolocularis, AO = alopecia ophiasis, AT = alopecia totalis, AT = alopecia totalis, defined by loss of hair on scalp as well as eyebrows and eyelashes, AU = alopecia universalis, AU = alopecia universalis, defined by loss of hair on areas of the body other than the head, BAI = Beck anxiety inventory, CCS = case–control study, CSS = cross-sectional study, DASS21 = depression and anxiety stress scale, GADQ = generalized anxiety disorder questionnaire, HADS = hospital anxiety and depression scale, HAM = Hamilton anxiety rating scale, M/F = male/female, RCT = randomized controlled trial, SAS = self-rating anxiety scale, SCARED = screen for child anxiety related disorders, SD = standard deviation, STAI = state-trait anxiety inventory.

reviewer. Relevant information, including study details (authors, date, and design), patient demographics (size, mean age, and sex), hair loss manifestations (alopecia areata, androgenic, totalis, and universalis), and anxiety disorders (manifestations and severity), were gathered and organized into a study characteristics table (Table 2).

2.6. Critical quality appraisal

All observational studies included in the current analysis were assessed for bias using the Newcastle–Ottawa Scale (NOS).[17] It is critical to uncover any potential risk-of-bias in participant selection, comparability, or reporting of exposure and results.[18] RoB 2.0 was used for RCT.[19]

2.7. Statistical data analysis

Stata Statistical Software version 16 (STATA v16.0, StataCorp LLC) was used to perform the various meta-analyses with each outcome represented by a random-effect model and pooled event rate (ER) or ORs with corresponding 95% confidence intervals. The *Q*-test and *I*-squared statistic were used to examine heterogeneity; values $I^2 > 70\%$ indicated considerable heterogeneity. Statistical significance was reached at *P*-value < .05 ($P < .05$).

2.8. Ethical approval

There was no need for ethical committee approval because our study design is based on publicly accessible literature and online data that are recognized to pose no risks.

3. Results

3.1. Search results

A total of 1275 studies were identified through database searches (677 from Google Scholar, 57 from Cochrane, and 541 from PubMed). Five hundred sixty-two articles were eliminated before screening (129 duplicates, 298 ineligible owing to automated tools, and 135 for other reasons). After title and abstract screening, 237 studies were excluded. Four hundred seventy-six studies were designated for full-text retrieval; however, 283 full-texts were not found. The full-texts of 193 successfully retrieved publications were evaluated for eligibility based on the preset inclusion criteria. One hundred sixty-nine articles were excluded because they did not meet the specified eligibility criteria. Data from the remaining 24 relevant studies were gathered for review and meta-analysis (Fig. 1).

3.2. Characteristics of included studies

All 24 included studies with the number of enrolled patients with alopecia ranging from 27 to 747 recruited an overall of 5553 patients. The majority of participants were female (56.8%). The ages of the patients ranged from 3 to 68 years, with a mean age of 34.81 (95% CI: 29.43–40.17) years. Of the total sample recruited, 99.4% reported having at least 1 form of hair loss, with AA being the most common hair loss condition observed among the patients. Of this, 42. 73% reported having experienced anxiety disorders, most of which presented as mild to moderate anxiety cases. Furthermore,

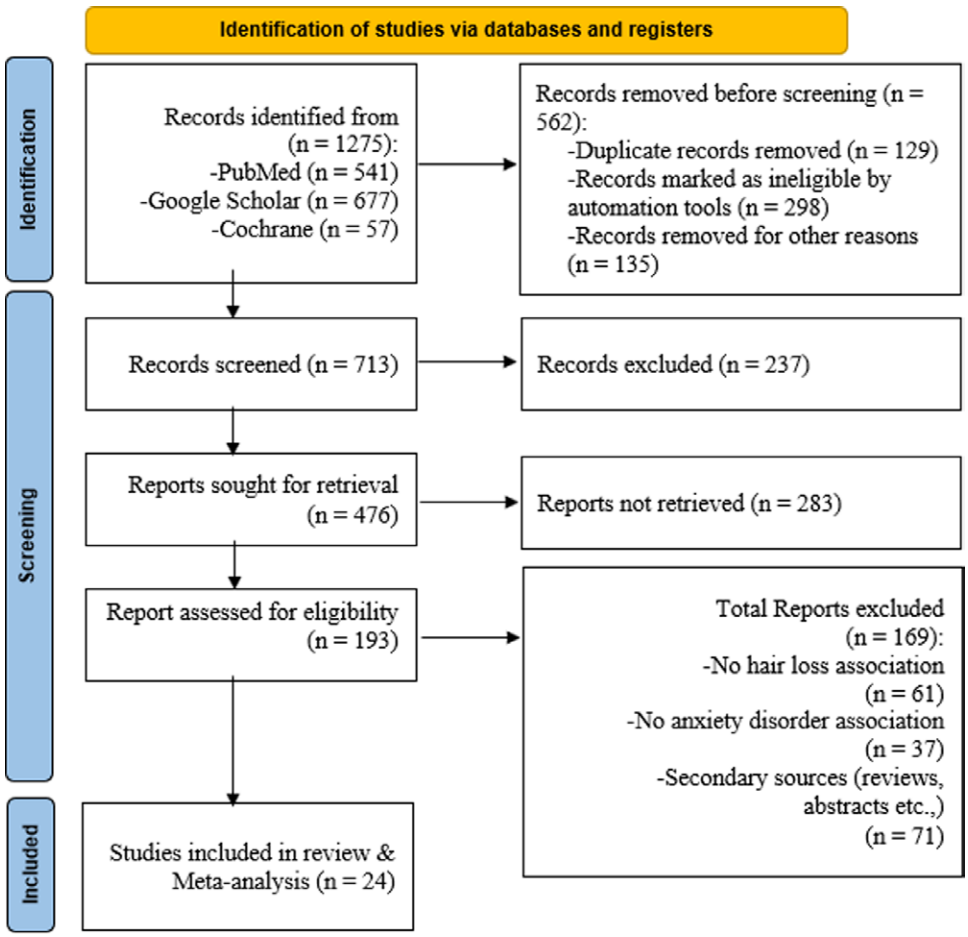

Figure 1. PRISMA-led study identification and inclusion. PRISMA = preferred reporting items for systematic reviews and meta-analyses.

other studies have reported cases of borderline abnormal and abnormal anxiety among patients[2,9,13,14,20–39] (Table 2).

3.3. Quality appraisal

The NOS was utilized for the critical quality appraisal of 23 of the enrolled studies based on their design. The 3 domains included comparability, selection, and outcome for the cross-sectional study (n = 15) and outcomes for case-controlled studies (n = 8). Four articles were found to be of moderate quality, the remaining were of high quality, and no study was of poor quality (Fig. 2). The Cochrane risk-of-bias tool (RoB 2) for randomized controlled trials (RCTs) was used to evaluate the quality of the included RCTs. Based on the responses to the collection of signaling questions, RoB2.0 can use an algorithm to produce a suggested judgment regarding the risk-of-bias. The evaluation was predicated on 5 predetermined categories of bias that addressed the different facets of trial design, execution, and documentation. The judgment was classified as having a "LOW," "SOME CONCERNS," or "HIGH" risk-of-bias based on these domains. Based on the 5 dimensions of judgment shown in Figure 3. The overall RCTs had a low risk-of-bias.

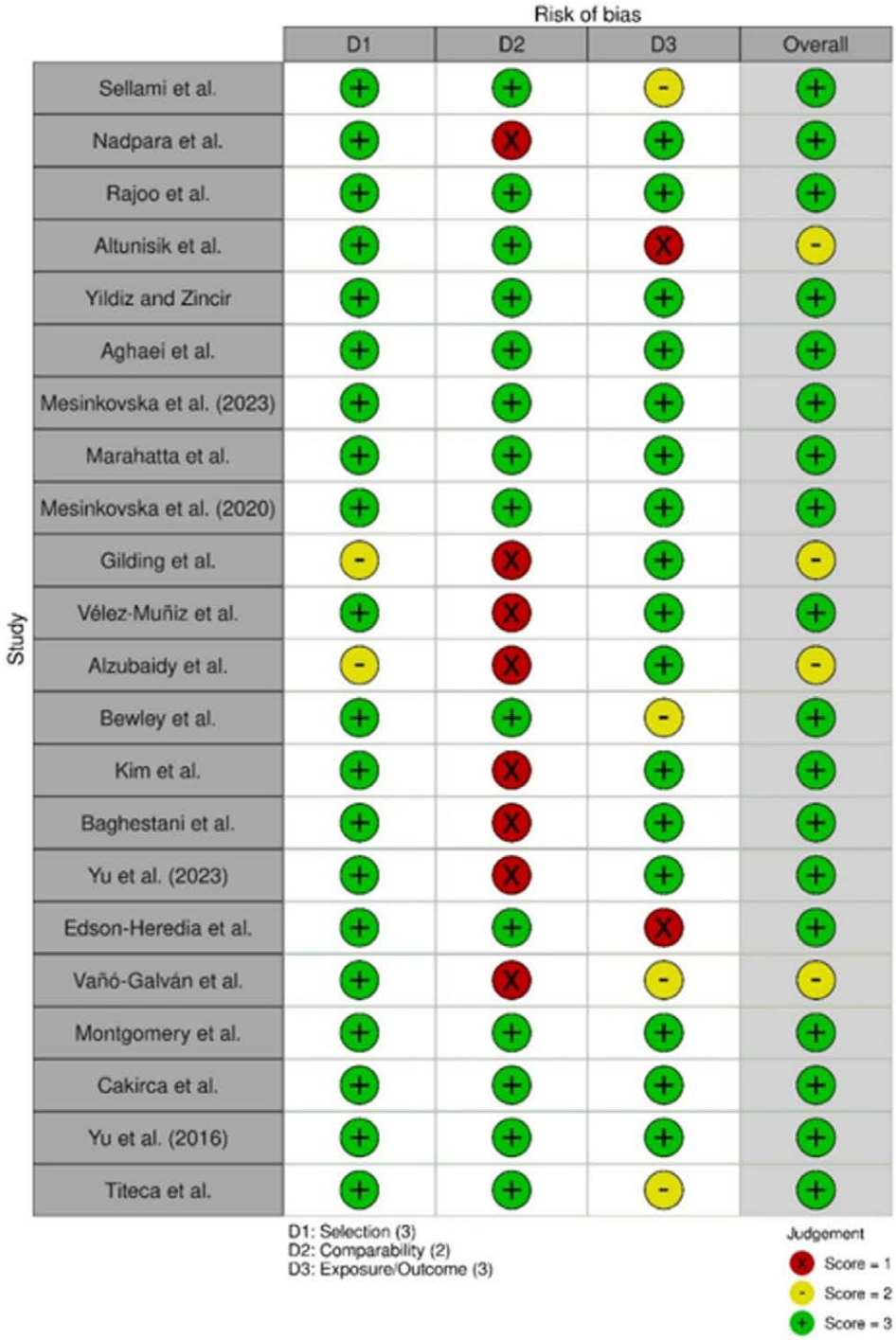

Figure 2. Critical appraisal based on NOS for cross-sectional and case-controlled study. NOS = Newcastle–Ottawa Scale.

3.4. Meta-analysis

3.4.1. Association between hair loss and anxiety incidences. Twenty-three studies were used to perform a meta-analysis to investigate the association between hair loss and anxiety disorders. The analysis revealed that the prevalence of anxiety was significantly associated with hair loss, accounted for by a pooled ER of 0.47 (95% CI: 0.39–0.54) (Fig. 4).

3.5. Hair loss and severity of anxiety incidences

A subgroup meta-analysis was performed on 4 studies reporting the severity of anxiety (mild, moderate, and severe). The analysis showed that mild, moderate, and severe anxiety cases were significantly associated with hair loss, with ER of 0.35 (95% CI: 0.10–0.60), 0.15 (95% CI: 0.01–0.29), and 0.05 (95% CI: 0.03–0.29), respectively (Fig. 5). In addition, a subgroup analysis was conducted in 6 studies reporting anxiety incidence (borderline abnormal and abnormal anxiety) using the HADS-A scale. The research shows that borderline abnormal and abnormal anxiety occurrences were significantly linked with hair loss with an ER of 0.17 (95% CI: 0.12–0.23) and 0.23 (95% CI: 0.16–0.31), respectively (HADS-A) (Fig. 6).

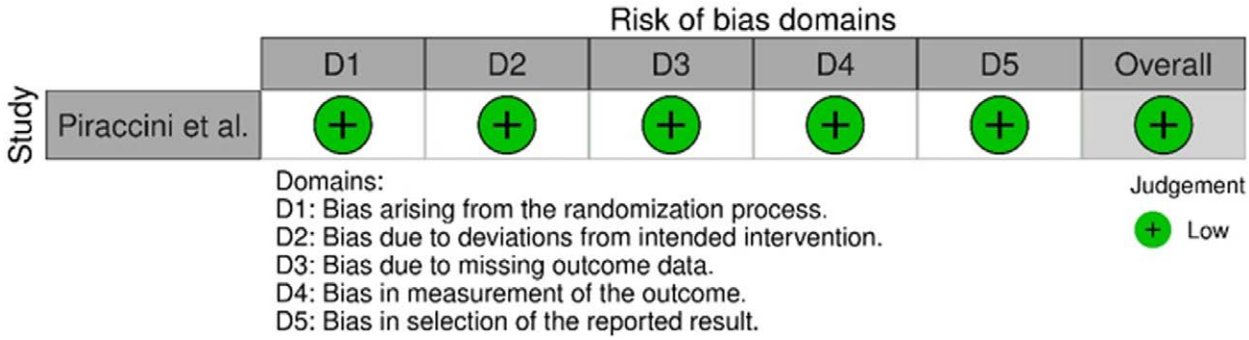

Figure 3. ROB 2.0 for RCT. RCT = randomized controlled trial.

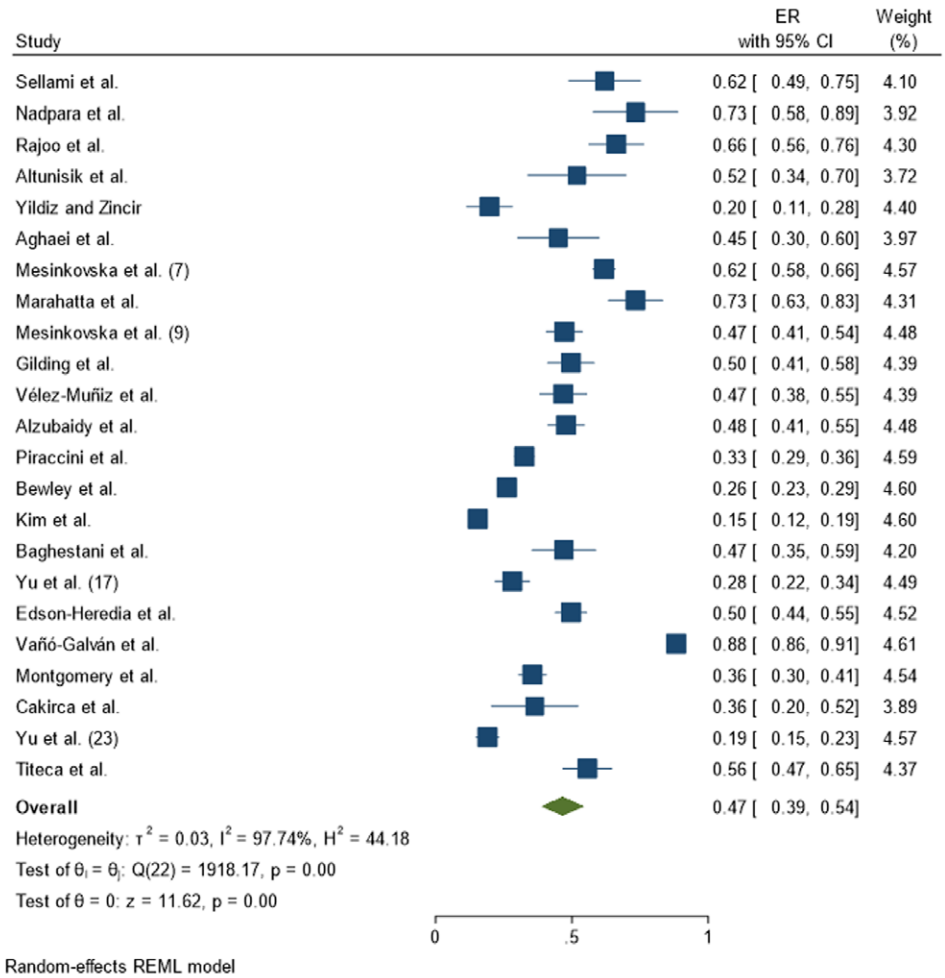

Figure 4. Forest plot showing the association of hair loss with the prevalence of anxiety disorders. ER of anxiety among patients reporting hair loss conditions. ER = event rate.

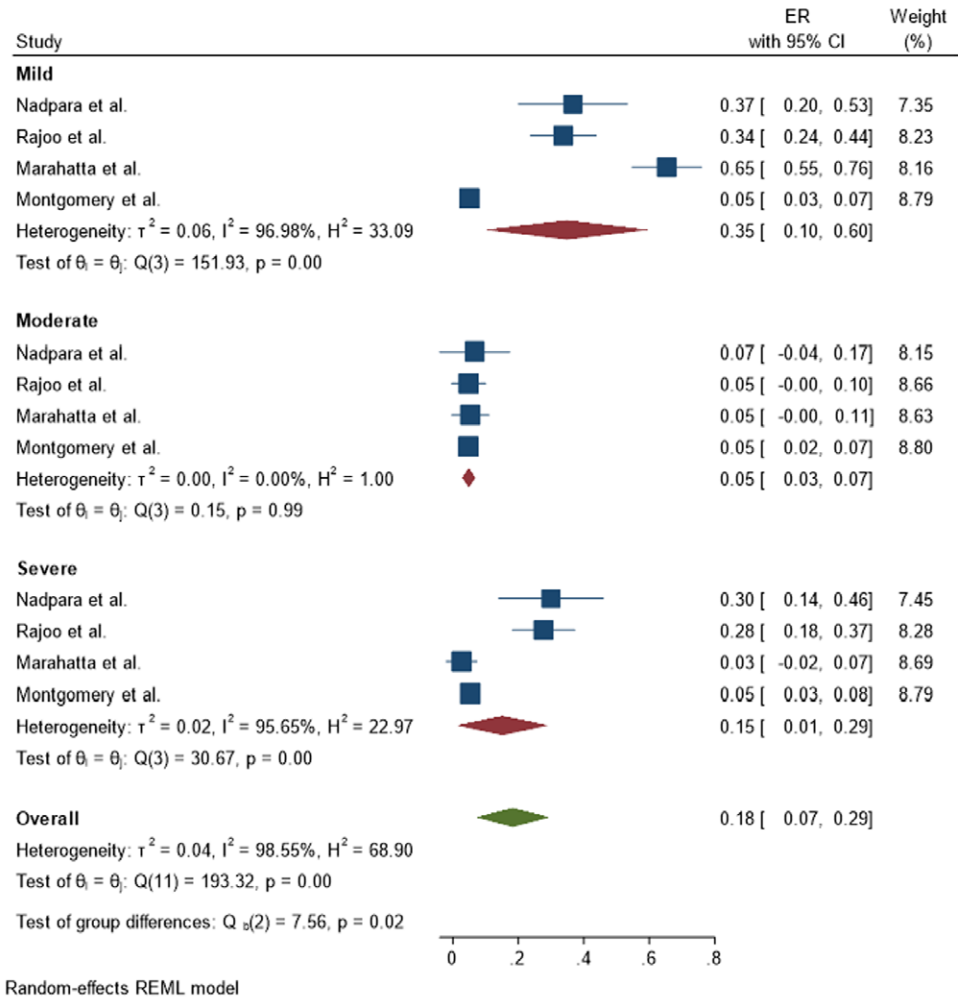

Figure 5. Subgroup meta-analysis investigating the association of mild, moderate, and severe anxiety to hair loss.

3.6. Mean anxiety HADS-A scores in patients with hair loss

The mean anxiety scores based on the HADS-A scale among patients with alopecia were reported in 7 of the included studies. The mean HADS-A score was 7.87 (95% CI: 6.85–8.88), which was statistically significant (Fig. 7).

3.7. Heterogeneity

Based on the *Q*-test ($P = .00$) and $I^2 > 70\%$ observed across various analyses, the level of in-study variance was significantly high ($P = .00$) (Fig. 8).

4. Discussion

The main aim of our study was to evaluate the psychological impact of alopecia on hair loss and anxiety disorders. The review and analysis were based on 24 articles that reported anxiety incidences in a cumulative of 5553 patients who experienced at least 1 type of alopecia. Our findings demonstrated that the prevalence of anxiety disorders among patients with different forms of hair loss was significant, 0.47 (95% CI: 0.39–0.54). These findings imply that alopecia is strongly associated with the incidence of anxiety disorders, with a statistically significant relationship between the 2. The severity analysis also concurs with these findings, showing a significant rate of mild, moderate, and severe anxiety among patients with alopecia: 0.17 (95% CI: 0.12–0.23) and 0.23 (95% CI: 0.16–0.31), respectively. Furthermore, the mean anxiety scores based on the HADS-A, as reported and analyzed in 6 of the included studies, showed that anxiety was significantly present among patients with hair loss. These findings reinforce the outcomes of the related analyses on borderline and abnormal anxieties, which were significantly prevalent among alopecia patients: 0.17 (95% CI: 0.12–0.23) and 0.23 (95% CI: 0.16–0.31), respectively.

Our results are consistent with those of earlier meta-analyses and systematic reviews that found comparable relationships between hair loss and anxiety disorders. According to a recent study, patients with alopecia were highly associated with higher incidences of undefined anxiety disorders (17% vs 7.3%) than the general population.[40] In line with this, the anxiety-associated symptoms were significantly higher in alopecia patients than the control, with a mean of 34% (95% CI: 22%–47%) of people who reported having anxious symptoms.[41] Similarly, another meta-analysis exploring the relationship between AA and anxiety showed a positive correlation between alopecia and anxiety with a pooled OR 2.5 (95% CI: 1.54–4.06).[42] The mechanism by which hair loss and its psychological impacts on anxiety and depression are related has been attributed to hormonal stimulations. It has been contentious that stressful conditions generally manifested as psychological stress triggering a hormone called the hypothalamic-pituitary-adrenal axis (HPA) that is associated with hair follicles, which consequentially increases the secretion of corticotropic releasing hormone (CRH).[43] CRH stimulates mast cell production and degranulation. This mechanism causes neurogenic inflammation, which

breaks down the immune privilege of hair follicles and causes them to break down prematurely.[44]

Furthermore, a prior study on the implication of COVID-19 on hair loss contends that the negative psychological impact associated with the restrictions from the pandemic played a significant role in exacerbating stress and anxiety.[45] During the pandemic, COVID-19-induced mild to severe effluvium was the most common form of hair loss reported, with other types

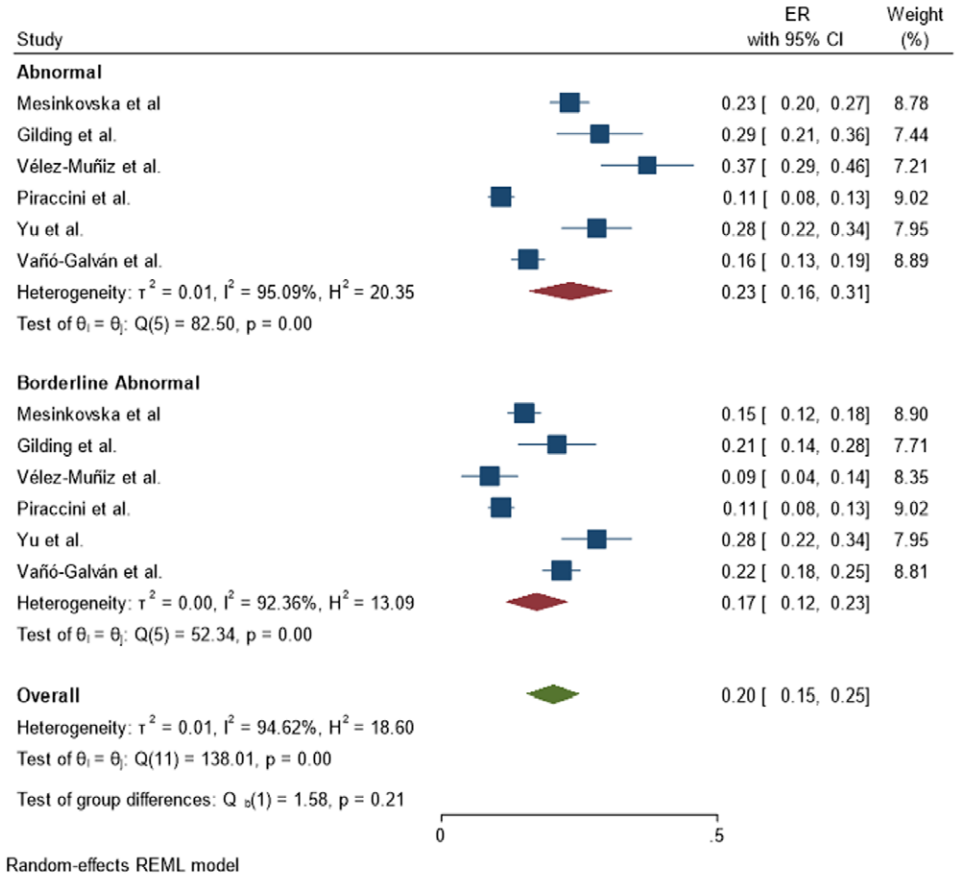

Figure 6. Subgroup meta-analysis investigating the association of borderline abnormal and abnormal anxiety to hair loss (HADS-A). HADS-A = hospital anxiety and depression scale.

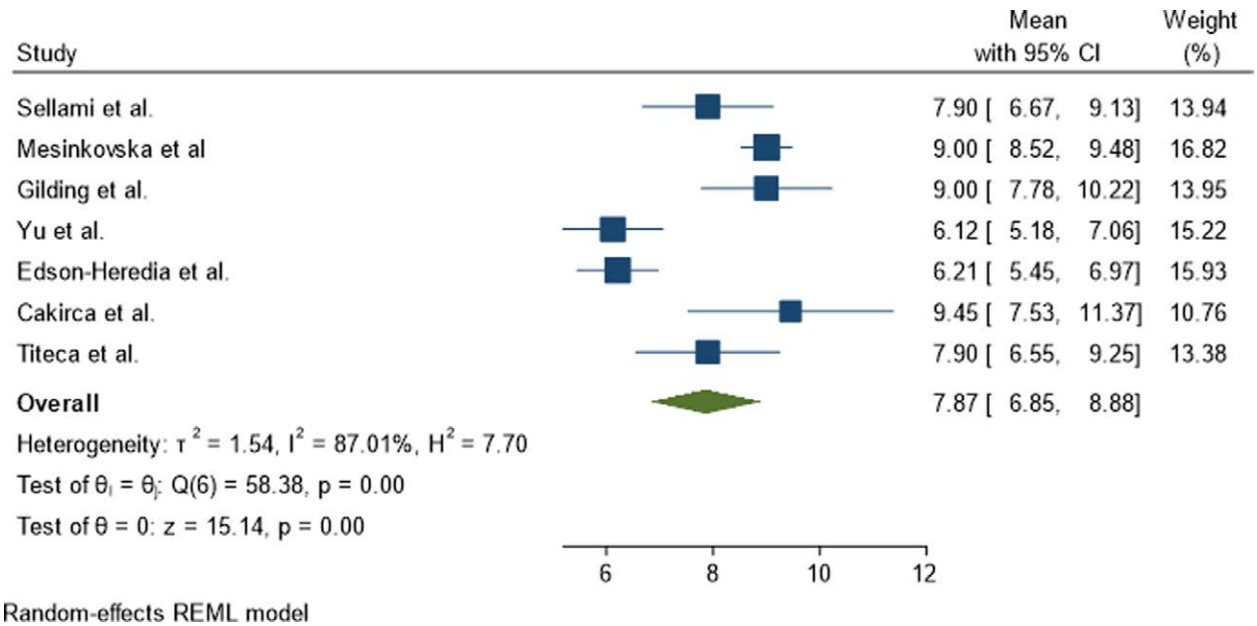

Figure 7. Mean anxiety scores (HADS-A) among patients reporting alopecia-associated hair loss conditions. HADS-A = hospital anxiety and depression scale.

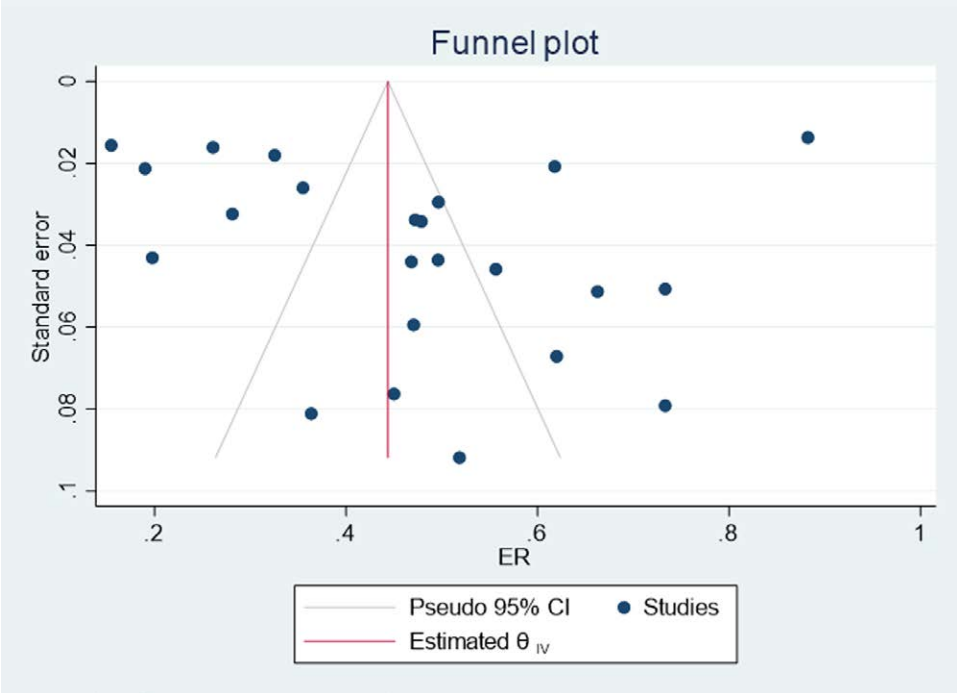

Figure 8. Funnel plot showing the heterogeneity.

such as trichotillomania and AA also observed.[46,47] Rivetti and Barruscotti reiterated that the high prevalence of anxiety and other psychological implications during the COVID-19 led to the release of neuropeptides, neurotransmitters, and the hormones associated with promoting the development of the hair cycle in anagen through to the telogen phase. As a result, the COVID-19 virus significantly disrupted stress and physiological factors, leading to elevated incidence of hair loss-associated conditions such as AA, effluvium, and AgA.[48] According to Limburg et al, the high incidences of alopecia could also be explained by the fact that the COVID-19 virus affects the action of the serine 2 gene (TMPRSS2),[49] the transmembrane protease gene that plays a critical role in androgenic pathways, thus aggravating hair loss.[50,51]

The current study boosts its strength as it narrows down on anxiety disorders, distinguishing it from other psychological impacts of hair loss to elucidate the intricate relationship between the 2. We used a relatively large sample size of patients presenting with different types of hair loss. Anxiety was also analyzed based on different scales of severity. Nonetheless, our study had several limitations. We relied on observational studies, which are prone to bias, unlike randomized controlled studies. In addition, we were unable to conduct an analysis of anxiety severity for different scales of measurement other than the HADS-A due to missing information on other scales reported in the included studies. Another limitation concerns sex-specific anxiety prevalence, which could not be investigated because the studies did not report distinguished cases of anxiety for both sexes.

Furthermore, the considerable heterogeneity in the analysis can be attributed to varying sample sizes, different tools of anxiety measurement, varying severity of anxiety, and in-study variability. Moreover, the between-study variabilities observed across various statistical analyses can be attributed to the fact that different hair-loss conditions may have varied psychological impacts on an individual. As a result, this may result in varying magnitudes of anxiety experienced by an individual as alluded to a specific type of hair loss. Similarly, the current study was focused on hair loss as a whole—not distinct types, leading to heterogeneity since different hair-loss types have varied clinical presentations and pathomechanisms. It is also worth noting that the majority of the studies' central objectives were not entirely focused on investigating anxiety and hair loss; thus, only information relevant to our objective was extracted.

5. Conclusion

Our study demonstrated that alopecia was significantly associated with anxiety disorders among individuals experiencing hair loss-related conditions, with the prevalence of anxiety among the affected patients proving to be notably heightened. Moreover, the severity analysis indicated a significantly robust association between alopecia with mild, moderate, severe, and abnormal anxiety severity levels. Therefore, to address the substantial psychological burden associated with alopecia, these findings highlight the necessity of thorough psychological evaluations and therapies for people experiencing hair loss.

Author contributions

Conceptualization: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani.
Data curation: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani.
Formal analysis: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani.
Funding acquisition: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.
Investigation: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

Methodology: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

Project administration: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

Resources: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

Software: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani.

Supervision: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani.

Validation: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani.

Visualization: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

Writing – original draft: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

Writing – review & editing: Almuntsrbellah Almudimeegh, Ahmed Hamad Alajlan, Abdulelah Ibrahim Alrasheed, Mansour Ibrahim Alrasheed, Abdullah Khalid Alqahtani, Reem Bin Idris, Muhannad Abdullah Alomar, Shaden Ahmad Alobaid, Nouf Ali Alotaibi.

References

[1] Al Aboud AM, Syed HA, Zito PM. Alopecia. In: StatPearls. StatPearls Publishing; 2024. http://www.ncbi.nlm.nih.gov/books/NBK538178/. Accessed May 29, 2024.

[2] Nadpara J, Tadke R, Faye A, et al. Study of anxiety in patients with moderate alopecia. Ann Indian Psychiatry. 2017;1:29.

[3] Moattari CR, Jafferany M. Psychological aspects of hair disorders: consideration for dermatologists, cosmetologists, aesthetic, and plastic surgeons. Skin Appendage Disord. 2022;8:186–94.

[4] Tucker P. Bald is beautiful?: the psychosocial impact of alopecia areata. J Health Psychol. 2009;14:142–51.

[5] Rumsey N, Harcourt D. Body image and disfigurement: issues and interventions. Body Image. 2004;1:83–97.

[6] Hunt N, McHale S. The psychological impact of alopecia. BMJ. 2005;331:951–3.

[7] Aukerman EL, Jafferany M. The psychological consequences of androgenetic alopecia: a systematic review. J Cosmet Dermatol. 2023;22:89–95.

[8] Ruiz-Doblado S, Carrizosa A, García-Hernández MJ. Alopecia areata: psychiatric comorbidity and adjustment to illness. Int J Dermatol. 2003;42:434–7.

[9] Montgomery K, White C, Thompson A. A mixed methods survey of social anxiety, anxiety, depression and wig use in alopecia. BMJ Open. 2017;7:e015468.

[10] Cash TF, Price VH, Savin RC. Psychological effects of androgenetic alopecia on women: comparisons with balding men and with female control subjects. J Am Acad Dermatol. 1993;29:568–75.

[11] Chiang YZ, Bundy C, Griffiths CEM, Paus R, Harries MJ. The role of beliefs: lessons from a pilot study on illness perception, psychological distress and quality of life in patients with primary cicatricial alopecia. Br J Dermatol. 2015;172:130–7.

[12] Colón EA, Popkin MK, Callies AL, Dessert NJ, Hordinsky MK. Lifetime prevalence of psychiatric disorders in patients with alopecia areata. Compr Psychiatry. 1991;32:245–51.

[13] Sellami R, Masmoudi J, Ouali U, et al. The relationship between alopecia areata and alexithymia, anxiety and depression: a case-control study. Indian J Dermatol. 2014;59:421.

[14] Yildiz H, Zincir S. Anxiety and depression in patients with alopecia areata in Eskisehir, Turkey. Clin Cosmet Investig Dermatol. 2023;16:2443–50.

[15] van Dalen M, Muller KS, Kasperkovitz-Oosterloo JM, Okkerse JME, Pasmans SGMA. Anxiety, depression, and quality of life in children and adults with alopecia areata: a systematic review and meta-analysis. Front Med. 2022;9:1054898.

[16] Moher D, Shamseer L, Clarke M, et al; PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Syst Rev. 2015;4:1.

[17] Lo CKL, Mertz D, Loeb M. Newcastle–Ottawa Scale: comparing reviewers' to authors' assessments. BMC Med Res Methodol. 2014;14:45.

[18] Wells G, Shea B, O'Connell D, et al. The Newcastle–Ottawa Scale (NOS) for assessing the quality of non-randomized studies in meta-analysis| Ottawa Hospital Research Institute. https://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed May 27, 2024.

[19] RoB 2: a revised Cochrane risk-of-bias tool for randomized trials | Cochrane Bias. https://methods.cochrane.org/bias/resources/rob-2-revised-cochrane-risk-bias-tool-randomized-trials. Accessed April 4, 2023.

[20] Rajoo Y, Wong J, Cooper G, et al. The relationship between physical activity levels and symptoms of depression, anxiety and stress in individuals with alopecia areata. BMC Psychol. 2019;7:48.

[21] Altunisik N, Ucuz I, Turkmen D. Psychiatric basics of alopecia areata in pediatric patients: evaluation of emotion dysregulation, somatization. J Cosmet Dermatol. 2022;21:770–5.

[22] Aghaei S, Saki N, Daneshmand E, Kardeh B. Prevalence of psychological disorders in patients with alopecia areata in comparison with normal subjects. Int Sch Res Not. 2014;2014:e304370.

[23] Mesinkovska N, Craiglow B, Ball SG, et al. The invisible impact of a visible disease: psychosocial impact of alopecia areata. Dermatol Ther. 2023;13:1503–15.

[24] Marahatta S, Agrawal S, Adhikari BR. Psychological impact of alopecia areata. Dermatol Res Pract. 2020;2020:1–5.

[25] Mesinkovska N, King B, Mirmirani P, Ko J, Cassella J. Burden of illness in alopecia areata: a cross-sectional online survey study. J Investig Dermatol Symp Proc. 2020;20:S62–8.

[26] Gilding AJ, Ho N, Pope E, Sibbald C. The burden of disease in alopecia areata: Canadian online survey of patients and caregivers. JMIR Dermatol. 2022;5:e39167.

[27] Vélez-Muñiz RC, Peralta-Pedrero ML, Cruz F J-S, Morales-Sánchez MA. Psychological profile and quality of life of patients with alopecia areata. Skin Appendage Disord. 2019;5:293–8.

[28] Alzubaidy BA, Banjar TA, Almaghrabi MA, et al. Evaluation of the awareness, beliefs, and psychological impact of patients with alopecia areata in Makkah City, Saudi Arabia. Adv Med. 2023;2023:1–7.

[29] Piraccini BM, Ohyama M, Craiglow B, et al. Scalp hair regrowth is associated with improvements in health-related quality of life and psychological symptoms in patients with severe alopecia areata: results from two randomized controlled trials. J Dermatolog Treat. 2023;34:2227299.

[30] Bewley A, Figueras-Nart I, Zhang J, et al. Patient-reported burden of severe alopecia areata: first results from the multinational alopecia areata unmet need survey. Clin Cosmetic Investigational Dermatol. 2024;17:751–61.

[31] Kim AB, Cheng BT, Hassan S. Association of mental health outcomes and lower patient satisfaction among adults with alopecia: a cross-sectional population-based study. JAAD Int. 2022;8:82–8.

[32] Baghestani S, Zare S, Seddigh SH. Severity of depression and anxiety in patients with alopecia areata in Bandar Abbas, Iran. Dermatol Rep. 2015;7:6063.

[33] Yu L, Moorthy S, Peng L, et al. Evaluation of anxiety and depression in patients with androgenetic alopecia in Shanghai: a cross-sectional study. Dermatol Ther. 2023;2023:1–9.

[34] Edson-Heredia E, Aranishi T, Isaka Y, Anderson P, Marwaha S, Piercy J. Patient and physician perspectives on alopecia areata: a real-world assessment of severity and burden in Japan. J Dermatol. 2022;49:575–83.

[35] Vañó-Galván S, Blume-Peytavi U, Farrant P, et al. Physician- and patient-reported severity and quality of life impact of alopecia

areata: results from a real-world survey in five European countries. Dermatol Ther. 2023;13:3121–35.
[36] Cakirca G, Manav V, Celik H, Saracoglu G, Yetkin EN. Effects of anxiety and depression symptoms on oxidative stress in patients with alopecia areata. Adv Dermatol Allergol Dermatol Alergol. 2019;37:412–6.
[37] Miniksar DY, Çölgeçen E, Cansız MA. An evaluation of anxiety disorder and emotion regulation difficulty in children and adolescents with alopecia areata. Indian J Dermatol. 2022;67:313.
[38] Yu NL, Tan H, Song ZQ, Yang XC. Illness perception in patients with androgenetic alopecia and alopecia areata in China. J Psychosom Res. 2016;86:1–6.
[39] Titeca G, Goudetsidis L, Francq B, et al. 'The psychosocial burden of alopecia areata and androgenetica': a cross-sectional multicentre study among dermatological out-patients in 13 European countries. J Eur Acad Dermatol Venereol. 2020;34:406–11.
[40] Stein DJ, Scott KM, de Jonge P, Kessler RC. Epidemiology of anxiety disorders: from surveys to nosology and back. Dialogues Clin Neurosci. 2017;19:127–36.
[41] Lauron S, Plasse C, Vaysset M, et al. Prevalence and odds of depressive and anxiety disorders and symptoms in children and adults with alopecia areata. JAMA Dermatol. 2023;159:281–8.
[42] Okhovat JP, Marks DH, Manatis-Lornell A, Hagigeorges D, Locascio JJ, Senna MM. Association between alopecia areata, anxiety, and depression: a systematic review and meta-analysis. J Am Acad Dermatol. 2023;88:1040–50.
[43] Novak MA, Hamel AF, Coleman K, et al. Hair loss and hypothalamic–pituitary–adrenocortical axis activity in captive rhesus macaques (Macaca mulatta). J Am Assoc Lab Anim Sci. 2014;53:261–6.
[44] Azzawi S, Penzi LR, Senna MM. Immune privilege collapse and alopecia development: is stress a factor. Skin Appendage Disord. 2018;4:236–44.
[45] Rivetti N, Barruscotti S. Management of telogen effluvium during the COVID-19 emergency: psychological implications. Dermatol Ther. 2020;33:e13648.
[46] FIvenson D. COVID-19: association with rapidly progressive forms of alopecia areata. Int J Dermatol. 2021;60:127.
[47] Rizzetto G, Diotallevi F, Campanati A, et al. Telogen effluvium related to post severe Sars-Cov-2 infection: clinical aspects and our management experience. Dermatol Ther. 2021;34:e14547.
[48] Grover C, Khurana A. Telogen effluvium. Indian J Dermatol Venereol Leprol. 2013;79:591–603.
[49] Limburg H, Harbig A, Bestle D, et al. TMPRSS2 is the major activating protease of influenza A virus in primary human airway cells and influenza B Virus in human type II pneumocytes. J Virol. 2019;93:e00649–19.
[50] Lucas JM, Heinlein C, Kim T, et al. The androgen-regulated protease TMPRSS2 activates a proteolytic cascade involving components of the tumor microenvironment and promotes prostate cancer metastasis. Cancer Discov. 2014;4:1310–25.
[51] Tolouian R, Tolouian A, Ardalan M. Blocking serine protease (TMPRSS2) by Bromhexine; looking at potential treatment to prevent COVID-19 infection. Marshall J Med. 2020;6:11.