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The influence of sleep quality and psychological stress on the severity of acne vulgaris

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ABSTRACT

Acne vulgaris is known as one of the most common inflammatory skin diseases. A chronic course and complex etiology characterize it. In recent years, an increasing number of publications have highlighted the role of psychosocial factors, including stress and sleep quality, as potential modulators of sebaceous gland activity, the inflammatory response, and the clinical course of acne. This review summarize the current scientific literature on the association between sleep disorders, psychological stress, and the clinical severity of acne vulgaris. Through searches of PubMed, PubMed Central, and Google Scholar, we identified 29 relevant articles published in the last decade. The research findings primarily support the notion that poor quality of sleep is connected to more severe acne, increased sebum production, and signs of a weakened skin barrier. In adolescents and young adults, increased levels of psychological stress are also associated with more frequent and more severe acne. Many mechanisms are responsible for this condition. The activation of the hypothalamic–pituitary–adrenal axis, elevated cortisol and corticotropin-releasing hormone levels, pro-inflammatory cytokine production, and substance P expression are some examples. Overall, available evidence indicates that assessing and addressing stress and sleep problems may be a valuable adjunct to standard pharmacological treatment of acne vulgaris.

Keywords: Acne vulgaris, sleep quality, psychological stress, psychodermatology, acne severity

1. INTRODUCTION

Acne vulgaris is known as one of the most common skin conditions. This chronic disease affects adults and adolescents. The pathogenesis of acne is known to be a multifactorial process. Disturbances in sebum production regulation, hyperkeratinization of hair follicles, colonization by Cutibacterium acnes, and complex inflammatory mechanisms such as inflammation caused by Th17 cells are the causes of this disease (Reynolds et al., 2024; Melnik, 2023; Vasam et al., 2023). In modern concepts, the importance of the sum of all environmental factors is referred to as "acne exposome". It influences the onset and severity of acne. The definition of

these factors contains sleep disorders, climate, pollution, smoking, psychosocial factors, and nutrition, especially a Western diet (Deng et al., 2024; Ryguła et al., 2024).

According to reviews about skin barrier, its dysfunction, elevated transepidermal water loss, and higher expression of pro-inflammatory cytokines contribute to persistent acne (Deng et al., 2024). Furthermore, diet, stress, and the quality of sleep are all considered to be important modulators of the microbiome composition and influence the gut-brain-skin axis (Ryguła et al., 2024; Borrego-Ruiz and Borrego, 2024). Acne is also a classic psychodermatologic condition. The patients experiencing psychodermatological conditions, including acne, are at a higher risk of developing depression and anxiety, according to a wide-ranging population-based study (Abdi et al., 2025).

The clinical studies among patients with acne confirmed the more frequent presence of depression, anxiety, and stress by using the Depression Anxiety Stress Scale questionnaire with 21 questions (DASS-21). The changes were observed especially in patients with more severe lesions (Rafiq and Mehdi, 2021; Alloboon et al., 2024). The analysis by Misery et al., (2022) was conducted in a large population of patients with four inflammatory skin diseases (adult acne, atopic dermatitis, psoriasis, hidradenitis suppurativa). The work revealed that high levels of subjective stress and poorer quality of life in all studied dermatoses were connected with a significant psychosocial burden of adult acne. The review by Dreno et al., (2018) focused on adult female acne, underlining that, in this group, not only hormonal and metabolic factors but also stress, sleep disorders, and coexisting mood disorders play a key role.

A survey done among adolescents from Montenegro shows that young patients themselves often point to stress as an essential trigger for acne flares, and that the disease reduces their quality of life (Ražnatović Đurović et al., 2021). In recent years, several reviews and original studies discussed the link between psychological stress, sleep quality, and the severity of acne vulgaris. Many reviews describe the correlation between healthy skin and the quality of sleep as bidirectional. At the same time, it was highlighted in a comprehensive review of sleep in dermatologic conditions, as well as a review of sleep disturbances and acne (Samaniego et al., 2025a; Samaniego et al., 2025b). Acne is a model dermatosis driven by the stress-skin axis. Chronic stress increases adrenal androgen production and affects sebaceous gland activity. That leads to the intensification of acne vulgaris (Jović et al., 2017; Gradowicz-Prajsnar, 2023).

According to the prospective observational cohort study, there exists an association between acne severity and academic stress. It was also marked in a systematic review of studies in academic populations (Bouraqqadi et al., 2024; Alzahrani et al., 2025). In this article, we present a narrative review and try to answer the question: how sleep quality and psychological stress influence the severity of acne vulgaris. Our findings focus on the practical meaning of biological mechanisms and clinical studies for everyday dermatological care.

2. REVIEW METHODS

This article is a narrative review with elements of a systematic search. We have analyzed clinical, cross-sectional, and cohort studies, review articles, mechanistic analyses, and systematic reviews published between January 2015 and October 2025. We searched databases such as PubMed, PubMed Central, and Google Scholar using the English-language keywords. We used combinations of phrases like “acne vulgaris” and “acne severity” combined with “stress”, “psychological stress”, “sleep quality”, “sleep disorders”, and “psychodermatology”. Included studies were about adults and adolescents with acne vulgaris that assessed psychological stress (e.g., Perceived Stress Scale) and/or poor sleep quality (e.g., Pittsburgh Sleep Quality Index - PSQI) in relation to acne severity. We also used systematic reviews and mechanistic studies on acne pathophysiology, the impact of stress, sleep, diet, and microbiome on inflammatory response and other factors increasing acne severity, as well as extensive population-based studies describing the epidemiology of psychodermatologic conditions and the psychological burden of acne. The single case reports and articles that did not meet thematic criteria were excluded, for example, those that did not discuss acne in the context of stress or sleep quality or that focused on dermatologic conditions other than acne vulgaris. This review was guided by the principles of transparent literature selection, thematic coherence, and clarity of presentation, but it is not a formal systematic review. The PRISMA diagram shows the article selection process (Figure 1).

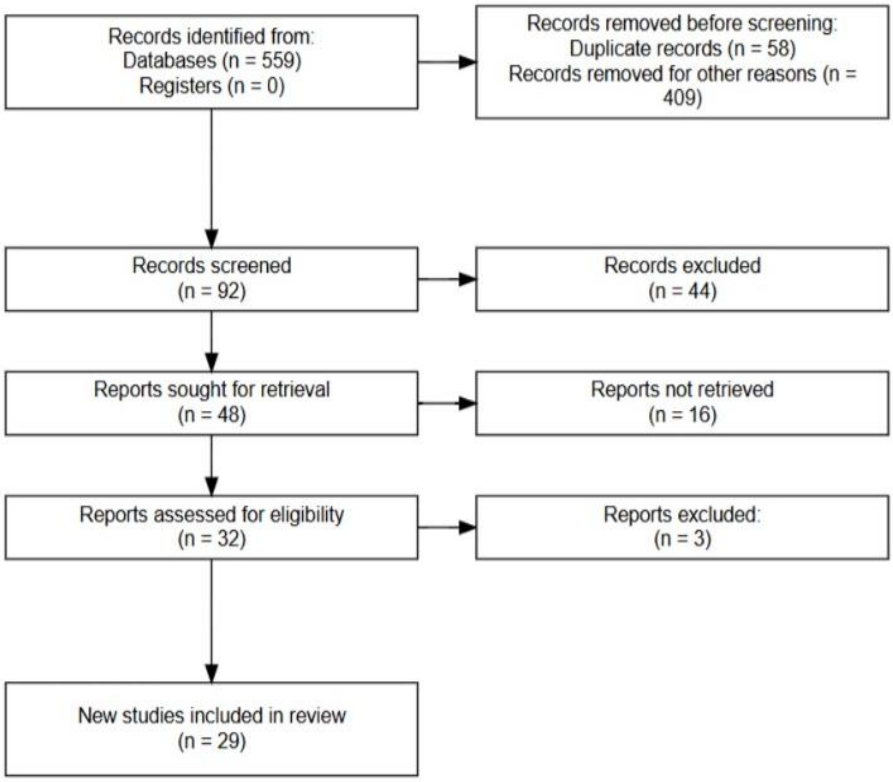

Figure 1. PRISMA flow diagram of study selection.

3. RESULTS

Biological mechanisms linking stress, sleep, and acne vulgaris

Dysfunction of the pilosebaceous unit is the reason for the development of acne. Key mechanisms of this process appear to be excessive sebum production, hyperkeratinization of follicular openings, changes in sebum composition and activation of inflammatory pathways (Reynolds et al., 2024; Melnik, 2023; Vasam et al., 2023). Skin, untreated and isotretinoin-treated, both present changes in gene expression related to immunity, lipid metabolism, oxidative stress, and inflammation (Melnik, 2023). The psychological factors, including stress and poor sleep, are important in contributing to increased transepidermal water loss and microinflammation, gradually weakening the epidermal barrier (Deng et al., 2024). Also, the diet with a high glycemic index and unbalanced dairy intake activates the IGF-1/mTORC1 axis, which, according to dietary studies, promotes sebocyte and keratinocyte proliferation (Ryguła et al., 2024). Reviews of the skin and gut microbiome suggest that stress, sleep, and diet modulate the microbiome composition and influence the immune response and inflammation in the skin via the gut-brain-skin axis (Borrego-Ruiz and Borrego, 2024).

Narrative reviews describe the implications of the hypothalamic-pituitary-adrenal (HPA) axis and local skin neuroendocrine systems in the pathogenesis of acne. Receptors for corticotropin-releasing hormone (CRH) and several neuropeptides, including substance P, are found in keratinocytes, as well as on sebocytes. Activating these pathways by psychological stress can lead to increased sebum production, sebocyte proliferation, upregulation of pro-inflammatory cytokines and recruitment of inflammatory cells (Jović et al., 2017; Gradowicz-Prajsnar, 2023). A clinical study on substance P showed that in patients with acne vulgaris, a higher number of stressful life events was associated with elevated concentrations of this neuropeptide and a more severe form of the disease, confirming the involvement of the "stress-neuropeptides-acne" axis (Rokowska-Waluch et al., 2016).

The impact of deprivation and fragmentation of sleep on immune and hormonal homeostasis is described in a comprehensive review of sleep in dermatologic conditions and a review of sleep disorders in acne. Large production of pro-inflammatory cytokines (IL-6, TNF-α) and elevated cortisol levels are the consequences of sleep loss. Moreover, decreased concentration of melatonin, a hormone with protective effects on the epidermal barrier, has been observed (Samaniego et al., 2025a; Samaniego et al., 2025b). These mechanisms appear to promote inflammation and barrier dysfunction in acne.

Psychological stress and acne severity

Several cross-sectional studies have looked at the link between stress intensity and acne severity. An Indonesian study using The Social Readjustment Rating Scale, by Holmes and Rahe, and Acne Grading based on Lehmann Criteria, found a clearly positive correlation between the total stress score and clinically assessed acne severity - patients with higher stress levels were more likely to have moderate and severe forms of the disease (Sutrisno et al., 2020). In a study of pharmacy students assessed using the Global Acne Severity Scale and the Perceived Stress Scale, students with higher levels of stress more often had acne and more often presented more severe forms. However, female gender, family history, dietary habits, and sleep patterns also had an impact (Ab Hadi et al., 2015).

According to a prospective cohort study on medical students, stressful periods (like exams) can lead to acne getting worse. Assessing lesion severity according to the Leeds Classification (revisited by Cunliffe) increased in step with higher scores on the 10-item Perceived Stress Scale (Bouraqqadi et al., 2024). Also, a systematic review by Alzahrani et al., including 11 studies which involved 3063 medical students from Middle Eastern countries, confirmed that higher levels of stress are connected with higher frequency or severity of acne. This material suggests a vital role of academic stress in shaping the course of the disease. The authors also support the idea of the bidirectional character - stress worsens acne, and acne, in turn, increases the burden of stress (Alzahrani et al., 2025).

Table 1. Summary of main evidence on psychological stress, sleep quality and acne vulgaris

Clinical factor	Main evidence	Typical measures	Impact on acne
Psychological stress	Higher perceived stress is linked with higher prevalence and severity of acne, especially in students and young adults. The relationship is bidirectional, because acne itself increases psychological stress.	Perceived Stress Scale (PSS), DASS-21, stress questionnaires	Worsens acne severity and maintains a vicious cycle between acne and psychological stress.
Sleep quality	Patients with acne more often report poorer sleep quality, insomnia and daytime sleepiness, which is linked to worse quality of life and, in some studies, to more severe acne.	Pittsburgh Sleep Quality Index (PSQI), sleep questionnaires	Poor sleep may intensify acne activity and worsen psychological comorbidities.

Sleep quality and acne severity

In a recent review of sleep in dermatologic conditions, including acne vulgaris, patients with inflammatory dermatoses report poorer sleep quality more often. Other common disturbances reported by patients are insomnia and greater daytime sleepiness than in the general population. This sleep disturbances connected with acne are associated with poorer quality of life (Samaniego et al., 2025a). Also, a comprehensive review of the sleep and acne relationship confirmed that patients with acne vulgaris seem to have poor sleep quality, which correlates with lower quality of life and more frequent depressive symptoms (Samaniego et al., 2025b). Adult patients with acne and worse quality of sleep, assessed using the Pittsburgh Sleep Quality Index (PSQI), reported higher Dermatology Life Quality Index (DLQI) scores and more frequent depressive symptoms. However, the association with increased acne severity, assessed using the Global Acne Grading Scale (GAGS), was less clear due to this research (Schrom et al., 2019). Students with poorer sleep quality more often reported acne, according to cross-sectional studies (Adinegoro et al., 2024; Primawati et al., 2022). Indonesian studies confirmed these outcomes. Students with PSQI > 5 report a more severe form of acne than those with good sleep (Rajagukguk, 2024; Harlim, 2020). Among acne suffering patients, poor quality of sleep is associated with more severe lesions or more frequent flare-ups.

The study on acne in women has shown that poorer quality of sleep is associated with a different sebum secretion profile, measured using a Sebumeter (SM815; Courage and Khazaka; Cologne, Germany), suggesting the interaction of hormonal, metabolic, and psychological mechanisms (Bilgiç et al., 2016). In many studies, dysregulated sebum secretion was marked as one of the crucial factors in acne pathogenesis. It supports a link between the quality of sleep and the severity of acne.

Integration of stress, sleep, and other lifestyle factors

Sleep disturbances and stress coexist with other lifestyle factors. In many studies, they are described as causes of increased severity of acne vulgaris. As a reason for acne intensification, the review of dietary patterns presents activation of the IGF-1/mTORC1 pathway, and microbiome changes, which are results of a Western-style diet, and a high-glycemic index diet (Ryguła et al., 2024). At the same time, chronic stress and sleep deprivation impact the same hormonal and inflammatory pathways, as well as epidermal barrier function (Deng et al., 2024; Ryguła et al., 2024). The simultaneous assessment of metabolic biomarkers, skin biophysical parameters, and lifestyle, including stress and sleep quality, in patients with acne and healthy individuals is an element of the cross-sectional study protocol by Kim et al., (2017). The Korean study analyzed the correlations between human biomarkers and various factors. The researchers used the Korean Acne Grading System (KAGS) to identify acne severity in a specific population. Some of the factors, including stress levels and sleep patterns, were examined using the Pearson correlation test (Kim et al., 2017). Taken together, many studies show that poorer quality of sleep and high stress levels are essential factors leading to worse acne. The table 1 presents the summary of the results.

4. DISCUSSION

In this narrative review, we summarise the available evidence. Psychological stress and sleep disorders are significant modulators of the course of acne vulgaris. Psychological stress activates the HPA axis and local neuroendocrine systems in the skin. The latter leads to upregulated inflammatory pathways and the recruitment of inflammatory cells (Melnik, 2023; Deng et al., 2024; Jović et al., 2017). Also, many studies confirmed that a large number of stressful events in life increases substance P levels and leads to more severe acne (Gradowicz-Prajsnar, 2023; Rokowska-Waluch et al., 2016). There exists evidence that decreased melatonin levels and sleep disturbances can create a dysfunctional skin barrier, increased cortisol levels, and inflammation (Samaniego et al., 2025a; Samaniego et al., 2025b). These factors, interacting with diet, the microbiome, and other components of the exposome, create a complex environment conducive to disease prolongation.

Cross-sectional and cohort studies confirmed a positive correlation between stress levels and acne. It was noticeable especially in college and young adult populations (Ab Hadi et al.,2015; Sutrisno et al., 2020; Bouraqqadi et al., 2024; Alzahrani et al., 2025). According to studies on sleep, patients with acne more often report poorer sleep quality than those without the condition. Reduced sleep quality, insomnia and daytime sleepiness, accompanied by inflammatory dermatoses, are associated with poorer quality of life and more frequent depressive symptoms (Samaniego et al., 2025a; Samaniego et al., 2025b). The study by Schrom et al. demonstrates that adult patients with acne and poorer sleep quality, measured by PSQI, have higher DLQI scores and more frequently report depressive symptoms. On the other hand, the relationship between PSQI and clinical acne severity, assessed by the GAGS scale, was uncertain (Schrom et al., 2019).

A cross-sectional study's summary regarding student populations confirms that individuals with poorer sleep quality tend to report acne more often. Students with PSQI > 5 also have a tendency to develop more severe forms of acne in contrast to those with good sleep quality (Adinegoro et al., 2024; Primawati et al., 2022; Rajagukguk, 2024; Harlim, 2020). The important point is that the relationships discussed in this review have a bidirectional character. Acne (especially a severe one) can significantly reduce self-esteem, promote anxiety and depression. It is associated with a higher risk of mental disorders (Abdi et al., 2025; Sieradocha, 2024). In patients with acne, exceptionally moderate to severe cases, scales such as DASS-21 and stress questionnaires confirm the high prevalence of depression, anxiety, and stress (Rafiq and Mehdi, 2021; Alloboon et al., 2024).

Evidence of the interaction between stress, sleep, and other lifestyle factors indicates that a holistic approach to testing acne patients should be considered. The exposome factors provoke disruption of skin barrier function. Then inflammation intensifies and the composition of the skin and gut microbiome changes (Deng et al., 2024; Borrego-Ruiz and Borrego, 2024). The acne course improvement may depend on stress-coping strategies and normalization of sleep patterns. Evaluation of these interventions appears to be an integral part of acne treatment (Ryguła et al., 2024; Samaniego et al., 2025; Kim et al., 2017). From the perspective of clinical practice, the review result supports: routine assessment of stress and sleep in dermatological interviews, use of simple screening

questionnaires (PSS, PSQI, short depression and anxiety scales) among patients with moderate to severe acne. A key role in treatment is early recognition of depression and anxiety symptoms, or chronic stress (Abdi et al., 2025; Dreno et al., 2018; Samaniego et al., 2025a; Samaniego et al., 2025b). The main treatment options for acne vulgaris remain pharmacotherapy and skin care.

A multidisciplinary approach can improve the treatment (Reynolds et al., 2024; Borrego-Ruiz and Borrego, 2024; Dreno et al., 2018). As a result, effective acne treatment should also include sleep education, stress-reduction techniques, and lifestyle modifications. This review has several limitations, including the inability to infer causality, because most available studies are cross-sectional. Also, the study populations are mainly limited to medical students or related disciplines. It is harder to generalize the results to other age groups and populations. To measure stress, sleep, and acne severity, researchers mostly used heterogeneous tools. This article has limitations, such as the inability to compare studies and conduct quantitative analyses. This article is a narrative review and is based on a broad set of clinical, population-based, and mechanistic studies, allowing for a coherent, qualitative synthesis of the available knowledge. The summary of the work is presented in Table 2.

Table 2. Summary of key findings and implications

Area	Summary of evidence	Interpretation and implications
Psychological stress	Higher stress levels are consistently associated with increased acne prevalence and severity, particularly in adolescents and young adults. Stressful life events correlate with substance P elevation and inflammatory activity.	Psychological stress acts as an important modulator of acne through neuroendocrine and inflammatory pathways, and acne itself may increase stress, forming a bidirectional relationship.
Sleep disturbances	Patients with acne frequently report poor sleep quality, insomnia, and daytime sleepiness. Poor sleep is linked to reduced quality of life and depressive symptoms; its association with acne severity is less consistent.	Sleep disturbances contribute to acne through hormonal imbalance, impaired skin barrier function, and inflammation, while also worsening psychosocial outcomes.
Exposome interactions	Stress and sleep disturbances interact with diet, microbiome alterations, and environmental factors, promoting barrier dysfunction and inflammation.	Interactions of all acne exposome factors contribute to acne through intensifying their mutual influence on its exacerbation.
Clinical relevance	Screening tools such as PSQI, PSS, and brief mental health scales are commonly used in studies and applicable in clinical practice.	Routine assessment of stress and sleep, alongside standard pharmacotherapy, may improve disease control and patients' quality of life.
Research limitations	Most studies are cross-sectional, include student populations, and use heterogeneous assessment tools.	Well-designed interventional studies are needed to clarify causality and evaluate stress- and sleep-targeted interventions in acne management.

5. CONCLUSION

In conclusion, available data suggest that psychological stress and poor sleep quality are relevant modulators of the course of acne vulgaris. The high levels of stress, sleep disturbances, and comorbid psychological disorders are common in acne patients. It correlates with disease severity and poorer quality of life. This relationship appears to be bidirectional: acne provokes stress and sleep disturbances, which in turn may promote disease intensification. The results of our review highlight that acne treatment should combine standard pharmacology with the assessment and targeted modification of psychological and lifestyle factors. The routine evaluation of stress levels and sleep quality, patient education, psychological support, and a multidisciplinary approach are necessary to improve treatment outcomes and patients' quality of life. Future research should focus on carefully designed studies, with outcomes measured using standardised tools and clearly defined patient populations.

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Informed consent

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Ethical approval

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Conflict of interest

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability

All data associated with this study will be available based on reasonable request to the corresponding author.

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