The Interconnected Pathways of Sleep, Mental Health, and Acne Vulgaris: A Comprehensive Review

Nicole Jacobs

Abstract

This comprehensive review explores the intricate and interconnected relationship between sleep quality, mental health, and the pathogenesis and severity of *Acne vulgaris*. The essay synthesizes evidence demonstrating that sleep deprivation acts as a significant physiological and psychological stressor, primarily by activating the hypothalamic-pituitary-adrenal (HPA) axis. This activation leads to increased production of inflammatory mediators, cortisol, and stress-related adrenal androgens, which subsequently exacerbate acne lesions and compromise the skin barrier function.

Furthermore, the review details how compromised sleep quality, quantity, and conditions like insomnia create a cyclical relationship. Poor mental health, such as depression, anxiety, and chronic stress, worsens skin conditions, which in turn intensifies psychological distress and further disrupts healthy sleep patterns. This dynamic can even reduce the efficacy of acne treatments, such as laser therapies. Empirical studies are cited throughout to emphasize that psychological well-being and sufficient, quality sleep are critical, often overlooked factors that should be integral to the holistic prevention and management of *Acne vulgaris*.

Sleep and Acne Pathogenesis

Sleep is a form of rest that allows the human body to recharge and is important in restoring physical and cognitive functi on through energy conservation, recovery, and brain maintenance. Sleep is vital for storing memories, improving learning capabilities and aiding in fighting off illnesses. Beyond its affect on cognition, sleep has already been linked to affecting the quality of skin and the aging of skin.

More recently, there has been an increase in the body of evidence regarding sleep and acne severity. Evidence indicates that sleep deprivation acts as a physiological stressor and causes an increase in stress, leading to a rise in the production of cortisol and stress related adrenal androgens. A comprehensive review by Chen et al. explores the connection between emotional health, sleep, and acne vulgaris. The review delves into how neurological mediators such as neuropeptides, the hypothalamic-pituitary-adrenal axis, and the sympatho-adrenal-medullary axis influence skin health directly through immune responses, increasing inflammation. Specifically, increased levels of have been linked skin conditions such as acne and psoriasis.Furthermore, the review paper details how stress, induced by a lack of sleep, can damage the skin barrier and wound healing capabilities. The brain is able to support the integrity of the skin through its regenerative properties given sufficient sleep. Although stress has also been shown to cause an increase in sebum production which causes pores to clog and in turn produce acne, there is evidence to suggest that sebum can also play a dual role in skin health with those who receive better sleep quality and have a moderate level of sebum that the antimicrobial benefits can potentially reduce the risk of acne.

Sleep Quality

A study conducted by Schrom et al. at the University Hospitals Cleveland Medical Center that tested the relationship between sleep quality and acne severity within adults. The researchers started off by recruiting 40 adult patients with acne and assessed their level of acne severity, sleep quality, quality of life and depressive symptoms throughout the trial. An important result of this study is that self-reported acne severity scores directly correspond with depression symptoms and poorer quality of life (DLQI: $r = 0.44677$, $p = 0.0039$; PHQ-2: $r = 0.33512$, $p = 0.0345$). In another study published in the Khyber Medical University Journal, with the objective to test the correlation between acne, academic stress and sleep quality, they used 150 acne-prone undergraduate students and used the Perceived Stress Scale, Sleep Quality Scale and Comprehensive Acne Severity Scale to collect data during times where students had exams and when they did not. At the end of the trials the researchers found that during the exam period there was a significant rise in acne severity ($p<0.01$) and stress levels ($p<0.01$), showing a positive correlation between academic stress and the intensity of acne. Furthermore, the data also showed that there was a positive correlation between stress levels ($r=0.95$, $P<0.01$) and sleep quality ($r=0.95< P<0.01$). Hench, showing a possible indirect link between sleep quality and acne.

Sleep Quantity & Insomnia

Beyond quality of sleep, the amount of sleep and timing of sleep has also been shown to impact the severity of acne vulgaris. In a study done by Dashti et al. that tested sleep quantity and

regularity on different types of conditions, one of which being acne, they found that the larger the difference between sleep timing and duration on weekdays and weekends is strongly associated with higher levels of acne. This study also found that sleeping too much is linked to a higher chance of mental health issues such as anxiety, depression and PTSD, further establishing the connection between sleep, mental health, and acne severity. Additionally, several studies have explored the relationship between insomnia and acne vulgaris. A study performed by Güler et al. found that insomnia is a big source of distress and frequently found within patients with acne. Thus, causing the increased stress from acne to negatively affect the sleeping patterns of individuals and which in turn cause acne severity to worsen, creating a cycle.Additionally, in a study conducted by Pärna E et al, they found that their results confirm the significance of insomnia in patients with acne along with psoriasis and eczema. Their results showed that when comparing their whole group of patients and the control group, the patients had significantly higher rates of depression, general anxiety, social anxiety, fatigue, agoraphobia and insomnia, with the results for insomnia being ($Z(174)=4.10$, $p<0.001$).Which further establishes the link between insomnia and acne. Another important factor to consider is that lack of sleep has also been found to decreased the effectiveness of acne treatments. One example of this being Ultrapulse fractional CO2 lasers meant to treat acne scars. In the study completed by Hua et al. they found that patients who had better sleep quality had lower PSQI scores (Pittsburgh Sleep Quality Index) showed greater improvement in this acne scare compared to those with higher PSQI scores. Thus, indicating that people who receive less sleep are at risk of lessening the effectiveness of their acne treatments.

Mental Health and Acne Pathogenesis

Mental health plays a significant role in skin health and has been increasingly recognized as a contributing factor in the development and severity of acne. Acne vulgaris, once thought to be primarily influenced by hormonal and environmental factors, is now understood to also be deeply intertwined with psychological well-being. Emotional distress, particularly in the form of depression, anxiety, and chronic stress, activates physiological responses in the body that directly affect the skin's barrier function, immune responses, and sebaceous activity. The brain and skin share a close embryological origin and are linked through the neuro-immuno-cutaneous-endocrine (NICE) system, which allows emotional and mental states to influence dermatological outcomes. This connection has been the focus of growing research, which increasingly supports the view that mental health should be considered in both the prevention and treatment of acne.

Chronic psychological stress is another key factor that contributes to acne through both hormonal and inflammatory pathways. Stress activates the HPA axis, leading to increased cortisol and adrenal androgen release, both of which are known to stimulate sebaceous glands and promote inflammation. In a comprehensive review by Arck et al., stress was found to disrupt skin homeostasis through immune dysregulation and impaired wound healing, both of which are critical in acne management. Another review by Chen et al. also highlights how neurological mediators such as neuropeptides, substance P, and catecholamines influence the skin via increased inflammation and sebum production. These stress-induced biochemical changes can worsen existing acne and delay the healing of acne lesions. Moreover, studies on academic stress, such as the one published in the Khyber Medical University Journal, show that during high-stress periods (e.g., exams), students reported a significant increase in acne severity

($p<0.01$) and stress levels ($p<0.01$), reinforcing the relationship between psychological stress and acne flare-ups.

Mental Health Disorders

Depression, in particular, has a strong association with acne severity. It triggers dysregulation in the hypothalamic-pituitary-adrenal (HPA) axis, resulting in increased production of cortisol and pro-inflammatory mediators, both of which contribute to the pathogenesis of acne. Elevated cortisol levels promote sebum production and disrupt the skin's immune balance, which leads to an increase in clogged pores and inflammatory lesions. In a study conducted by Schrom et al. at the University Hospitals Cleveland Medical Center, 40 adult patients with acne were assessed for acne severity, sleep quality, depressive symptoms, and overall quality of life. The results revealed that higher self-reported acne severity scores had a significant correlation with depression symptoms (PHQ-2: $r = 0.33512$, $p = 0.0345$) and decreased quality of life (DLQI: $r = 0.44677$, $p = 0.0039$).These findings support the idea that depression may not only be a consequence of acne but also a potential driver of its worsening, creating a self-perpetuating cycle. Additionally, a large longitudinal study published in the British Journal of Dermatology found that individuals with acne had a 63% higher risk of depression in the first year following diagnosis. Depression can also impair healthy lifestyle habits such as hygiene, nutrition, and medication adherence, all of which further influence acne outcomes.

Beyond depression and general stress, several other mental health conditions have also been linked to acne, either directly or indirectly. Generalized anxiety disorder (GAD), social anxiety, obsessive-compulsive disorder (OCD), and post-traumatic stress disorder (PTSD) are all

associated with increased inflammation, dysregulated cortisol patterns, and behavioral changes that may influence acne. In particular, OCD and anxiety-related skin-picking behaviors can physically aggravate acne lesions, leading to increased scarring and delayed healing. Additionally, those suffering from body dysmorphic disorder (BDD)—a condition where individuals obsess over perceived flaws in their appearance—may excessively touch or pick at their skin, further aggravating acne. This behavioral link between mental health and acne indicates that psychological disorders can influence not just the biological pathways of acne but also how individuals interact with their skin, often to their own detriment.(can be used as a transition sentence between the hormonal/skin picking sentences)

Implications for Treatment

The growing body of evidence linking mental health to acne severity underscores the importance of holistic treatment strategies. Addressing mental health through psychotherapy, stress management, and in some cases, pharmacological intervention may improve acne outcomes alongside traditional dermatological therapies. For example, incorporating cognitive behavioral therapy (CBT) or mindfulness-based interventions into acne treatment plans has shown promise in improving both psychological well-being and skin condition. Recognizing and treating comorbid conditions such as depression and anxiety may help break the cyclical relationship between emotional distress and acne flares. Ultimately, dermatological care that considers the mental health of patients is likely to be more effective and sustainable in managing chronic acne.

Diet

Diet is increasingly recognized as a significant factor in acne pathogenesis, influencing the skin through hormonal and inflammatory pathways. A primary dietary link to acne is through high

glycemic load (GL) foods, which cause rapid spikes in blood sugar and insulin levels. This triggers a hormonal cascade, with increased insulin and insulin-like growth factor 1 (IGF-1) stimulating the sebaceous glands to produce more sebum, leading to clogged pores and inflammation. A randomized controlled trial conducted in Korea with 32 patients aged 20–27 demonstrated that those following a low-glycemic diet for 10 weeks experienced a significant reduction in acne severity, even without weight changes. Further skin biopsies revealed that the low-GL group had reduced sebaceous gland size and decreased inflammatory cells. In addition to high-GL foods, dairy consumption has been associated with acne in many studies, particularly skim milk. A large retrospective study involving 47,355 adult women found that those who consumed two or more glasses of skim milk per day during their teenage years were 44% more likely to have acne. While milk contains hormones and growth factors that can increase insulin and IGF-1 levels, the link is inconsistent across all dairy products, as some studies find no association with cheese or yogurt. For instance, a meta-analysis showed a positive association between milk intake and acne, but no significant link was found for yogurt or cheese. Conversely, some dietary components can help, with studies showing benefits from omega-3 fatty acids, found in fish and certain oils, which help reduce inflammation. A case series involving five male patients showed that their acne, unresponsive to conventional treatments, resolved completely after they discontinued whey protein supplementation. These studies collectively indicate that while diet is not the sole cause, certain dietary patterns, particularly high-GL foods and dairy, can exacerbate acne severity through hormonal and inflammatory mechanisms.

In conclusion, the intricate relationship between sleep, mental health, and acne pathogenesis is increasingly evident. Sleep deprivation acts as a physiological stressor, increasing cortisol and

adrenal androgens which contribute to inflammation and sebum production, key factors in acne development. Studies highlight the significance of sleep quality and quantity, demonstrating that both can impact acne severity and even the effectiveness of treatments like lasers for acne scars. Moreover, research has shown that mental health, particularly stress, anxiety, and depression, can trigger inflammatory responses and exacerbate existing skin conditions, including acne. This connection is so strong that researchers have created a new field of study—psychodermatology—to explore it further. The impact of acne on an individual's quality of life and self-esteem creates a cycle where both acne and mental distress can worsen each other. Recognizing this multifaceted interplay is essential for a holistic approach to managing acne, where addressing sleep patterns, emotional well-being, and mental health issues can lead to improved skin health and overall quality of life.

References

Schrom, K., Ahsanuddin, S., Baechtold, M., Tripathi, R., Ramser, A., & Baron, E. (2019). Acne Severity and Sleep Quality in Adults. *Clocks & Sleep*, *1*(4), 510–516. https://doi.org/10.3390/clockssleep1040039

Can a lack of sleep lead to breakouts? Experts explain. (n.d.). Curology. https://curology.com/blog/ask-an-expert-does-a-lack-of-sleep-cause-acne/

Chen, Y., & Lyga, J. (2014). Brain-Skin Connection: Stress, Inflammation and Skin Aging. *Inflammation & Allergy-Drug Targets*, *13*(3), 177–190. https://doi.org/10.2174/18715281136661405221044422

Dashti, H. S., Cade, B. E., Stutaite, G., Saxena, R., Redline, S., & Karlson, E. W. (2020). Sleep health, diseases, and pain syndromes: findings from an electronic health record biobank. *Sleep*, *44*(3), zsaa189. https://doi.org/10.1093/sleep/zsaa189

Hua, H., Li, M., Zhai, X., Zhou, S., Pan, Z., Hou, Z., & Zhou, B. (2024). Sleep quality correlates with effectiveness of ultrapulse fractional CO_2 laser in the treatment of facial atrophic acne scars. *The Journal of Dermatology*, *51*(8), 1120–1124. https://doi.org/10.1111/1346-8138.17112

Güler, D., Soylu, S., & Güler, H. A. (2023). The relationship of quality of life and acne severity with chronotype and insomnia in patients with acne vulgaris. *Archives of Dermatological Research*. https://doi.org/10.1007/s00403-023-02569-7

Samaniego, M., Alonso, M., Sohail, N., & Ladan Mostaghimi. (2025). Sleep in Dermatologic Conditions: A Review. *JAAD Reviews.* https://doi.org/10.1016/j.jdrv.2025.02.009

Hua, H., Li, M., Zhai, X., Zhou, S., Pan, Z., Hou, Z., & Zhou, B. (2024). Sleep quality correlates with effectiveness of ultrapulse fractional CO_2 laser in the treatment of facial atrophic acne scars. *The Journal of Dermatology*, *51*(8), 1120–1124. https://doi.org/10.1111/1346-8138.17112

Zhang, H., Wang, M., Zhao, X., Wang, Y., Chen, X., & Su, J. (2024). Role of stress in skin diseases: A neuroendocrine-immune interaction view. *Brain, Behavior, and Immunity*, *116*(116), 286–302. https://doi.org/10.1016/j.bbi.2023.12.005

Richeal, M. (2021, April 9). *Skin Conditions Caused by Stress and Anxiety*. APDerm. https://www.apderm.com/blog/the-skin-stress-connection/

Panych, S. (2010, October 13). *The Emotional Effects of Acne*. Allure. https://www.allure.com/story/the-emotional-effects-of-acne?utm_source=chatgpt.com

Ganceviciene, R., Böhm, M., Fimmel, S., & Zouboulis, C. C. (2009). The role of neuropeptides in the multifactorial pathogenesis of acne vulgaris. *Dermato-Endocrinology*, *1*(3), 170–176. https://doi.org/10.4161/derm.1.3.8496

Weiner, Z. (2018, February 8). *Study Links Acne to Depression*. Teen Vogue. https://www.teenvogue.com/story/study-links-acne-to-depression?utm_source=chatgpt.com

Morshed, A. S. M. 1, Noor, T. 2, Uddin Ahmed, M. A. 3, Mili, F. S. 4, Ikram, S. 5, Rahman, M. 6, Ahmed, S. 7, Uddin, M. B. 6 1 D. S. I. M. C., Bangladesh Psychiatric Care Limited, D. of P., Venereology, D., Diagnostic, M., Wellness Center, D. of D., Venereology, D., Gynecology, M., Hospital, D. of P., & North South University, D. of P. S. (2023). Understanding the impact of acne vulgaris and associated psychological distress on self-esteem and quality of life via regression modeling with CADI, DLQI, and WHOQoL. *ProQuest*, *13*, 21084. https://doi.org/10.1038/s41598-023-48182-6

Michopoulos, V., Powers, A., Gillespie, C. F., Ressler, K. J., & Jovanovic, T. (2016). Inflammation in Fear- and Anxiety-Based Disorders: PTSD, GAD, and Beyond. *Neuropsychopharmacology*, *42*(1), 254–270. https://doi.org/10.1038/npp.2016.146

Arifi, F. (2024, December 20). *Stress acne: How stress triggers breakouts*. NOCD. https://www.treatmyocd.com/blog/stress-acne-how-stress-triggers-breakouts

Revankar, R. R., Revankar, N. R., Balogh, E. A., Patel, H. A., Kaplan, S. G., & Feldman, S. R. (2022). Cognitive behavior therapy as dermatological treatment: a narrative review. *International Journal of Women's Dermatology*, *8*(4), e068. https://doi.org/10.1097/jw9.0000000000000068