Dean&Francis

ISSN 2959-6122

AL004792

How Does Sleep Affect Emotional Status in Adolescence

Xiaodan He*

Shenzhen Huitong School, Shenzhen, 518000, China
**Corresponding author email: amyaa816@outlook.com*

Abstract:

Adolescence is a vital developmental phase characterized by substantial transformations in the physical, cognitive, emotional, and social domains of teenagers. Sleep is crucial for maintaining the mental stability of teenagers; nevertheless, contemporary lifestyle conditions, scholastic expectations, and the use of electronic gadgets are increasingly hindering adolescents' capacity to obtain sufficient nighttime rest. This literature review seeks to consolidate existing studies on the correlation between sleep and emotional well-being in adolescents and propose additional recommendations on the subject.

Keywords: Emotional Status, Adolescence, Sleep, Mental Stability

1. The Neurobiological Mechanism of Sleep and Emotion

1.1 The Mechanism of Sleep Architecture and Emotional Processing

Sleep is not a single state; rather, it is a series of phases that each have a specific function in the processing and control of emotions. The two primary categories of sleep periods are rapid eye movement (REM) and non-rapid eye movement (NREM). Slow-wave sleep, or NREM sleep, is essential for brain development and memory consolidation. Conversely, REM sleep is associated with the regulation of emotional states and the processing of emotional memories.

Research by Walker and van der Helm (2009) suggests that REM sleep plays a crucial role in processing emotional experiences and memories. During REM sleep, the brain reactivates emotional memories in a neural environment devoid of noradrenaline. This absence of noradrenaline allows for the "reprocessing" of these memories without triggering the associated stress response. Consequently, this process is believed to contribute significantly to emotional regulation and resilience, which are profoundly impacted by sleep quality and duration. By reactivating emotional memories in a stress-free environment, REM sleep facilitates the integration and emotional resolution of these memories. This reprocessing helps adolescents manage their emotional responses more effectively, potentially reducing the risk of mood disorders and enhancing overall emotional well-being. Therefore, ensuring adequate REM sleep is essential for maintaining emotional health in adolescents

1.2 The Mechanism of Neural Changes During Sleep

Insufficient sleep will disrupt the equilibrium between neurotransmitters and hormones that regulate mood and emotional reactions. Yoo et al. (2007) found that sleep deprivation leads to diminished

functional connectivity between the amygdala and the medial prefrontal cortex (mPFC), along with heightened amygdala activity in reaction to negative emotional stimuli. This indicates that inadequate sleep may impair the brain's ability to effectively regulate emotional responses. Moreover, insufficient sleep affects the hypothalamic-pituitary-adrenal (HPA) axis, resulting in elevated cortisol levels and exacerbated stress responses. The emotional well-being and stress management abilities of an adolescent can be significantly influenced by these neurological changes. Consequently, adolescents enduring extended sleep loss may exhibit heightened emotional reactivity and diminished stress management capabilities due to increased anxiety, despondency, and reduced positive affect.

2. The Relationship Between Sleep and Emotion Regulation

2.1 Sleep Deprivation and Emotional Dysregulation

A significant amount of research has shown that sleep loss leads to emotional dysregulation in teenagers. A pivotal study by Beebe et al. (2011) revealed that sleep deprivation in adolescents led to a marked rise in negative emotions, such as anger, tension, and anxiety. The researchers utilized a within-subjects crossover design to compare adolescents' emotional states after a week of sleep restriction (6.5 hours in bed nightly) with a week of adequate sleep duration (10 hours in bed nightly). The results suggest that even moderate sleep deprivation adversely affects mood and emotional regulation.

At the same time, Baum et al. (2014) conducted a study examining the effects of chronic sleep restriction on adolescents' emotional functioning. In comparison to teenagers who maintained good sleep patterns, they discovered that adolescents who suffered from chronic sleep restriction (6.5 hours in bed for five nights) reported higher levels of anxiety, aggression, and bewilderment. Significantly, these effects continued even after two nights of restorative sleep, demonstrating the long-term implications of persistent sleep deprivation on psychological health.

2.2 Sleep Quality and Emotional Reactivity

Although sleep time is essential, sleep quality significantly influences emotional reactivity and regulation. Palmer and Alfano (2017) examined the correlation between sleep quality and challenges in emotion control in teenagers. Their research indicated that inadequate sleep quality correlated with increased challenges in emotion regulation, even when accounting for sleep duration. Adolescents exhibiting poor sleep quality reported greater difficulties with emotional awareness, impulsive control, and the utilization of appropriate emotion regulation mechanisms.

These findings suggest that interventions aimed at improving adolescent emotional health should focus not only on increasing sleep duration but also on enhancing sleep quality. Factors such as sleep continuity, sleep onset latency, and the presence of parasomnias can all impact sleep quality and, consequently, emotional regulation.

3. Specific Effects of Sleep Duration on Adolescent Emotional Status

3.1 Anxiety and Depression

The correlation between sleep duration and mood disorders, particularly anxiety and depression, has been thoroughly examined in adolescent cohorts. A comprehensive longitudinal study conducted by Roberts and Duong (2014) monitored 4,175 teenagers over one year and identified a correlation between sleep deprivation and an elevated risk of developing anxiety and depressive symptoms. This link was bidirectional, with anxiety and sadness also forecasting future sleep disturbances, indicating a complicated interaction between sleep and mood disorders.

Gangwisch et al. (2010) conducted a study utilizing data from the National Longitudinal Study of Adolescent Health, comprising more than 15,000 individuals. Research indicated that adolescents who retired after midnight exhibited a 24% increased likelihood of experiencing depression in comparison to those who retired before 10 PM. This study emphasizes the significance of both sleep duration and sleep scheduling concerning teenage emotional well-being.

Furthermore, a meta-analysis conducted by Lovato and Gradisar (2014) aggregated data from 23 research investigating the correlation between sleep and depression in teenagers. A strong correlation was identified between brief sleep duration and depression symptoms, with effect sizes varying from minor to moderate. The authors underscored the necessity for longitudinal studies to elucidate the causal links between sleep habits and depressed symptoms in teenagers.

3.2 Suicidal Ideation and Behavior

Perhaps one of the most concerning aspects of sleep deprivation in adolescents is its association with suicidal ideation and behavior. A study by Liu (2004) found that adolescents who slept 5 hours or less per night were 71% more likely to report suicidal ideation compared to those

ISSN 2959-6122

who slept 8 hours or more.

Furthermore, Winsler et al. (2015) discovered that every hour of sleep loss was linked to a 38% rise in the likelihood of feeling depressed or hopeless and a 58% increase in attempts to commit suicide. The study involved almost 27,000 high school students. These results highlight how crucial getting enough sleep is for preventing serious consequences for adolescents' mental health.

3.3 Difficulties in Emotion Regulation

Sleep deprivation not only affects mood but also impairs adolescents' ability to regulate their emotions effectively. A study by Baum et al. (2014) found that sleep-restricted adolescents showed reduced positive affect and increased negative affect in response to both positive and negative stimuli. This suggests that sleep deprivation may lead to a generalized dysregulation of emotional responses, which makes it difficult for adolescents to appropriately modulate their reactions to various emotional situations.

Also, McMakin et al. (2016) employed functional magnetic resonance imaging (fMRI) to examine the brain mechanisms associated with emotion control challenges in sleep-deprived adolescents. Research indicated that sleep restriction correlated with heightened amygdala response to negative emotional stimuli and diminished functional connection between the amygdala and regulatory areas of the prefrontal cortex. The alterations are associated with self-reported challenges in emotion regulation, establishing a neurobiological foundation for the noted behavioral impacts of sleep loss on emotional control.

4. Causes of Sleep Deprivation in Adolescents

4.1 Biological Factors

Adolescence is characterized by significant changes in daily schedual. Carskadon (2011) reviewed the biological factors affecting adolescent sleep and highlighted the delay in circadian timing that occurs during puberty. This biological shift results in a tendency for later bedtimes and difficulties waking up early.

Additionally, changes in slow-wave sleep dynamics during adolescence may affect sleep quality and restorative functions. These biological changes make adolescents particularly vulnerable to sleep deprivation, especially when it is combined with environmental and social factors.

4.2 Social and Environmental Factors

4.2.1 Academic Pressure: Increased homework loads and extracurricular activities often lead to later bedtimes. Research from Yan et al. (2018) illustrates that academic stress significantly contributes to poor sleep quality among students, with those experiencing high academic stress having a four times higher risk of poor sleep quality compared to their less stressed peers.

4.2.2 Technology Use: The utilization of electronic gadgets prior to sleep has been linked to postponed sleep initiation and diminished sleep duration. Bartel et al. (2015) found that 97% of teenagers utilized technology prior to sleep, which was substantially correlated with reduced sleep duration and heightened daytime drowsiness.

4.2.3 Social Media: Nighttime social media use has been linked to poor sleep quality and duration. Statistics from Arora et al. (2014) shows that 62.3% reported adolescents have their cell phone on in their bedroom while sleeping, and poor sleep quality was significantly related to higher social media use (P-Value = 0.02)

4.2.4 Early School Start Times: Many schools start early in the morning, conflicting with adolescents' natural circadian rhythms. Research from American Academy of Pediatrics (2014) indicates that delaying school start times increases weeknight sleep duration among adolescents, with most studies showing a significant increase in sleep duration even with delays as small as 30 minutes

5. Strategies to Improve Sleep in Adolescents

5.1 Delayed School Start Times

Owens et al. (2010) found that even minor delays in school start times—ranging from thirty to sixty minutes—correlated with significant improvements in students' sleep duration, daytime alertness, and mental health. In a subsequent study, Boergers et al. (2014) found that teenagers experienced enhanced moods, increased sleep duration, and reduced daytime sleepiness when school commenced 25 minutes later than originally planned.

5.2 Sleep Hygiene Education

Owens et al. (2010) examined the data favoring delayed school start times and determined that even little postponements (30-60 minutes) correlated with substantial enhancements in sleep duration, daily alertness, and mental health outcomes. A further study by Boergers et al. (2014) revealed that postponing school start times by merely 25 minutes led to enhanced sleep duration, reduced daytime

drowsiness, and elevated mood in teenagers.

5.3 Cognitive-Behavioral Therapy for Insomnia (CBT-I)

Blake et al. (2017) conducted a meta-analysis of CBT-I interventions for adolescents and found moderate to large effects on sleep onset latency, total sleep time, and sleep efficiency. Importantly, these improvements in sleep were associated with reductions in symptoms of anxiety and depression.

5.4 Technology Use Restrictions

Bartel et al. (2019) found that a one-week technology restriction intervention led to earlier bedtimes, increased sleep duration, and improvements in daytime alertness among adolescents. The intervention involved removing electronic devices from bedrooms and restricting their use in the hour before bedtime.

6. Future Directions

6.1 Individual Differences

Future studies should investigate and examine genetic variations linked to sleep architecture and circadian rhythms, as well as personality qualities like resilience and neuroticism, and environmental factors like family dynamics, socioeconomic position, and cultural background. Extensive research observing these fluctuations over an extended period would offer significant perspectives on the consistency of these correlations.

6.2 Intervention Studies

In order to find practical methods for enhancing the emotional and sleep well-being of adolescents, extensive randomised controlled trials (RCTs) are required. Cognitive-behavioral treatment for insomnia (CBT-I), mindfulness exercises, and sleep monitoring applications are a few possible interventions. It is crucial to evaluate their effects on affective outcomes such as mood, anxiety, and depression in addition to their viability and long-term sustainability in practical contexts. Developing customised treatment programs would be made easier by looking at how these interventions differed in their effectiveness on different teen subgroups.

6.3 Neuroimaging Research

Further neuroimaging studies can focus on the brain processes that underlie the connection between teenage emotion control and sleep. Electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) are two methods that can be used to investigate the impact of sleep quality on brain regions such the hippocampus, prefrontal cortex, and amygdala. The effects of sleep habits during adolescence on brain development and emotional regulation can be seen in longitudinal neuroimaging investigations. Combining neuroimaging with behavioral evaluations and hormone assays may lead to a more thorough understanding about the relationship between teenager's sleep and their emotional regulation ability.

7. Suggestion

Using modern technologies offers multiple opportunities to improve teenagers' quality and duration of sleep. Apps for tracking sleep, such SleepScore and Sleep Cycle, could track sleep patterns and offer individualized advice for bettering their quality. Align with smart sleep devices, including smart beds and wearables like the Apple Watch, can change environmental variables including temperature and illumination to optimize adolescent's sleep. While online sleep education platforms teach teenagers the value of sleep and healthy sleep practices through interactive and interesting content, AI-based sleep coaching systems analyze sleep data and provide customized guidance. Furthermore, Telehealth services allow virtual meetings with sleep experts, therefore offering customized therapy and support for sleep disorders.

Teenagers' sleep also needs strong community and legislative projects. Using social media, school programs, and local events to reach a large audience, public health campaigns should stress the need of sleep for mental and physical health. Including sleep education within the K–12 syllabus will enable kids to develop good sleeping habits and grasp the need of sleep. Programs such as Healthy Sleep for Healthy Schools (HS4HS) have showed promise in raising students' knowledge of and practices for sleep. Organizations like the American Academy of Pediatrics and the American Medical Association advocate delaying school start times to better match teenagers' natural sleep patterns, therefore enhancing sleep duration and general health. Schools and communities can also support settings fit for healthy sleep hygiene, including limiting the use of electronic devices before bedtime, encouraging regular sleep cycles, and lowering of light and noise exposure at night.

Refining and improving these approaches depend on constant study. Emphasizing on preserving improvements in sleep behavior over time, long-term studies are required to assess the efficacy of technological interventions and sleep education programs. Research should also seek to create and evaluate personalized sleep interventions considering individual variations in sleep needs and preferences, in-

ISSN 2959-6122

cluding the investigation of artificial intelligence to offer tailored solutions. Moreover, looking at the sleep quality of underprivileged groups—such as teenagers housed in poverty or those in juvenile detention—can guide focused treatments meant to correct sleep differences.

Combining technical developments with community and policy programs will help us to develop a whole strategy for enhancing teenagers' emotional well-being and sleep quality. This multifarious approach will improve their general development and quality of life as well as their health and academic achievement.

8. Conclusion

In conclusion, there is a substantial and intricate association between teenage sleep and emotional state. During this crucial developmental stage, getting enough sleep is essential for resilience, emotional control, and general mental health. Insufficient sleep will disrupts the balance of neurons and hormones, which will ultimately impaired emotion management. Chronic sleep deprivation has been related to mood disorders like anxiety and sadness, increased negative affect, and even suicidal thoughts and actions. Furthermore, the quality of sleep also has a major influence on the regulation of emotions, with poorer sleep quality linked to more challenges with emotional awareness and impulse control.

Teenagers experience widespread sleep deprivation owing to a combination of social and environmental influences, including technology use and academic expectations, as well as biological changes that occur during adolescence, such as alterations in circadian rhythms. Delaying the start time of schools, educating teenagers about good sleep hygiene, offering cognitive-behavioral therapy for insomnia (CBT-I), and limiting technology use are all useful methods for enhancing sleep. These treatments have demonstrated potential in improving the quantity and quality of sleep, and therefore, emotional health.

To further understand the intricate relationship between sleep and emotional state in teenagers, future research should concentrate on individual differences, large-scale intervention studies, neuroimaging research, and cultural factors. Utilizing contemporary technologies also presents a number of chances to enhance the length and quality of sleep. In addition, Apps for tracking sleep, smart sleep devices, online sleep education platforms, AI-based sleep coaching systems, and telehealth services can provide further personalized guidance and support to adolescents. Besides, encouraging healthy sleep patterns can also be achieved through community and legislative initiatives like school programs and public health campaigns. As the result, we can greatly increase sleep quality by addressing the social and biological drivers of sleep and putting evidence-based interventions into practice.

References

1. *Walker, M. P., & van der Helm, E. (2009). Overnight therapy? The role of sleep in emotional brain processing. Psychological Bulletin, 135(5), 731-748. https://doi.org/10.1037/a0016570*

2. *Yoo, S. S., Gujar, N., Hu, P., Jolesz, F. A., & Walker, M. P. (2007). The human emotional brain without sleep—A prefrontal amygdala disconnect. Current Biology, 17(20), R877-R878. https://doi.org/10.1016/j.cub.2007.08.007*

3. *Beebe, D. W., Simon, S., Summer, S., Hemmer, S., Strotman, D., & Dolan, L. M. (2011). Dietary intake following experimentally restricted sleep in adolescents. Sleep, 34(12), 1843-1850. https://doi.org/10.5665/sleep.1432*

4. *Baum, K. T., Desai, A., Field, J., Miller, L. E., Rausch, J., & Beebe, D. W. (2014). Sleep restriction worsens mood and emotion regulation in adolescents. Journal of Child Psychology and Psychiatry, 55(2), 180-190. https://doi.org/10.1111/jcpp.12125*

5. *Palmer, C. A., & Alfano, C. A. (2017). Sleep and emotion regulation: An organizing, integrative review. Sleep Medicine Reviews, 31, 6-16. https://doi.org/10.1016/j.smrv.2015.12.006*

6. *Roberts, R. E., & Duong, H. T. (2014). The prospective association between sleep deprivation and depression among adolescents. Sleep, 37(2), 239-244. https://doi.org/10.5665/sleep.3388*

7. *Gangwisch, J. E., Babiss, L. A., Malaspina, D., Turner, J. B., Zammit, G. K., & Posner, K. (2010). Earlier parental set bedtimes as a protective factor against depression and suicidal ideation. Sleep, 33(1), 97-106. https://doi.org/10.1093/sleep/33.1.97*

8. *Lovato, N., & Gradisar, M. (2014). A meta-analysis and model of the relationship between sleep and depression in adolescents: Recommendations for future research and clinical practice. Sleep Medicine Reviews, 18(6), 521-529. https://doi.org/10.1016/j.smrv.2014.03.006*

9. *Liu, X. (2004). Sleep and adolescent suicidal behavior. Sleep, 27(7), 1351-1358. https://doi.org/10.1093/sleep/27.7.1351*

10. *Winsler, A., Deutsch, A., Vorona, R. D., Payne, P. A., & Szklo-Coxe, M. (2015). Sleepless in Fairfax: The difference one more hour of sleep can make for teen hopelessness and suicidal ideation. Journal of Youth and Adolescence, 44(2), 362-378. https://doi.org/10.1007/s10964-014-0170-3*

11. *McMakin, D. L., Dahl, R. E., Buysse, D. J., Cousins, J. C., Forbes, E. E., Silk, J. S., & Franzen, P. L. (2016). The impact of insufficient sleep on adolescent neural processing of emotional faces. Journal of Sleep Research, 25(5), 504-514. https://doi.org/10.1111/jsr.12497*

12. *Carskadon, M. A. (2011). Sleep in adolescents: The perfect storm. Pediatric Clinics, 58(3), 637-647. https://doi.org/10.1016/*

j.pcl.2011.03.003

13. *Owens, J. A., Belon, K., & Moss, P. (2010). Impact of delaying school start time on adolescent sleep, mood, and behavior. Archives of Pediatrics & Adolescent Medicine, 164(7), 608-614. https://doi.org/10.1001/archpediatrics.2010.96*

14. *Boergers, J., Gable, C. J., & Owens, J. A. (2014). Later school start time is associated with improved sleep and daytime functioning in adolescents. Journal of Developmental & Behavioral Pediatrics, 35(1), 11-17. https://doi.org/10.1097/DBP.0000000000000018*

15. *Tan, E., Healey, D., Gray, A. R., & Galland, B. C. (2012). Sleep hygiene intervention for youth aged 10 to 18 years with problematic sleep: A before-after pilot study. BMC Pediatrics, 12(1), 189. https://doi.org/10.1186/1471-2431-12-189*

16. *Blake, M. J., Sheeber, L. B., Youssef, G. J., Raniti, M. B., & Allen, N. B. (2017). Systematic review and meta-analysis of adolescent cognitive–behavioral sleep interventions. Clinical Child and Family Psychology Review, 20(3), 227-249. https://doi.org/10.1007/s10567-017-0234-5*

17. *Bartel, K. A., Gradisar, M., & Williamson, P. (2019). Protective and risk factors for adolescent sleep: A meta-analytic review. Sleep Medicine Reviews, 43, 3-17. https://doi.org/10.1016/j.smrv.2018.10.004*

18. *Gao, M., Li, X., Lee, C.-Y., Ma, H., Chen, T., Zhang, S., & Chiang, Y.-C. (2022). Sleep duration and depression among adolescents: Mediation effect of collective integration. Frontiers in Psychology, 13, 1015089. https://doi.org/10.3389/fpsyg.2022.1015089*

19. *Gradisar, M., & Short, M. A. (2022). Sleep's role in the development and resolution of adolescent depression. Nature Reviews Psychology, 1(2), 74-84. https://doi.org/10.1038/s44159-022-00074-8*

20. *Bartel, K., Gradisar, M., & Williamson, P. (2015). Adolescent sleep and the impact of technology use before sleep. Journal of Clinical Sleep Medicine, 11(8), 865-871. https://doi.org/10.5664/jcsm.5026973*

21. *Yan, Y.-W., Lin, R.-M., Su, Y.-K., & Liu, M.-Y. (2018). The relationship between adolescent academic stress and sleep quality: A multiple mediation model. Journal of Adolescence, 67, 118-126. https://doi.org/10.1016/j.adolescence.2018.06.004*

22. *Arora, T., Broglia, E., Thomas, G. N., & Taheri, S. (2014). Associations between specific technologies and adolescent sleep quantity, sleep quality, and parasomnias. Sleep Medicine Reviews, 18(6), 554-568. https://doi.org/10.1016/j.smrv.2014.02.009*

23. *American Academy of Pediatrics. (2014). School start times for adolescents. Pediatrics, 134(3), 642-649. https://doi.org/10.1542/peds.2014-1697*