



# Circadian Rhythm and Its Influence over Sleep and Mental Health - A Review

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## Abstract

Circadian rhythms are internal manifestations of the solar day that permit adaptations to predictable environment changes. These 24 hours are controlled by molecular clockworks within the brain that are reset daily to precisely 24-hour exposure to the light-dark cycle. The circadian rhythm regulation plays a crucial role in people's healthy lives affected by factors consisting of cosmic events related to the universe and earth, environmental factors (light, night and day duration, seasons) and lifestyles. In humans, dysfunction or misalignment of the circadian clock with environmental cues alters the timing of the sleep-wake cycle, leading to a variety of circadian rhythm sleep disorders. Evidence suggests strong associations between circadian rhythms and mental health, but only recently have studies begun to discover the direct interactions between the circadian system and mood regulation. This review provides an overview of circadian rhythms, its mechanism, the role of social media, few important sleep disorders and its influence over mental health.

**Keywords:** Circadian rhythm, cosmic events, Mental health, sleep wake cycle.

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## INTRODUCTION:

Circadian rhythms are internal manifestations of the solar day that permit adaptations to predictable environmental temporal changes [1]. The most common symptoms of these disorders are difficulties with sleep onset and/or sleep maintenance and excessive sleepiness that are associated with impaired social and occupational functioning. Effective treatment for most of the CRSDs requires a multimodal approach to accelerate circadian realignment with timed exposure to light, avoidance of bright light at inappropriate times, and adherence to scheduled sleep and wake times. In addition, pharmacologic agents are recommended for some of the CRSDs. For delayed sleep-phase, non-24-hour, and shift work disorders, timed low-dose melatonin can help advance or entrain circadian rhythms; and for shift work disorder, wake-enhancing agents such as caffeine, modafinil, and armodafinil are options for the management of

rhythm leads to various sleep-related disorders. Between 80% and 90% of depressed patients report insomnia, and insomnia is also a risk factor for developing depression. Sleep disturbances are associated with impaired quality of life and a greater risk of relapse [3]. Understanding relations between sleep and mental health in university students with generally healthy sleep habits is important because student sleep habits tend to worsen over time and even time-limited experience of sleep problems may have significant implications for the onset of mental health problems [4]. Mental health comprises of emotional, psychological and social well-being. It influences our thoughts, emotions, and behaviours. It influences how we respond to stress, interact with others, and make good decisions. Mental health is important in each and every stage of our life. Poor mental health and mental illness are not the same. Workplace

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mental health issues have major ramifications for both the individual and the organization's productivity. [5]. Social media play a significant part in our daily lives. Digital days, the growing connectivity provided by devices and platforms has permitted not only an increase in the amount of time spent engaging in these media activities, but also significant changes in social norms and expectations around accessibility and online interaction etiquette. Because of this, social media use is drawing more attention than other types of electronic media, and academics are urging better comprehension of its distinct social, emotional, and cognitive elements in relation to consequences for sleep and mental health [6]. It is becoming more and more clear that sleep is crucial for maintaining health and preventing disease as well as for healing and restoring the body and mind. The suprachiasmatic nucleus in the hypothalamus acts as a pacemaker to regulate sleep and wake cycles, but illnesses of the nervous system that cause disordered sleep can interfere with its activity. A rise in mortality from all causes has been linked to sleep deprivation. Similar to how sleep disorders and disruptions can affect neurological conditions by interfering with neural circuits. Studies on sleep deprivation in healthy adults show that sleep deprivation might decrease working memory and attention. [7].

### **MATERIALS AND METHODS:**

This review article compared the different studies about circadian rhythms, its mechanism, the various sleep related disorders and its impact over our mental health. Various articles about mental health, sleep deprivation and circadian rhythms were selected and for all the included studies, the importance of mental health, the impact of social media on our sleep wake cycle were included in the review.

### **MECHANISM OF CIRCADIAN RHYTHM**

The immunological, reproductive, gastrointestinal, skeletal, endocrine, renal, and cardiovascular systems, among others, can all suffer grave health consequences from the disruption of the circadian rhythm. Recent studies have revealed the existence of secondary or peripheral oscillators throughout

the body in a number of organs including the heart, liver, kidneys, lungs, intestines, skin, lymphocytes, oesophagus, spleen, thymus, adrenal gland, prostate, and olfactory bulb, proving that the central clock, or suprachiasmatic nucleus (SCN), is not the only internal mechanism of control. Despite being independent, these secondary clocks nonetheless synchronise with the SCN and other elements such as temperatures, mealtimes, and environmental signals [8]. The collective oscillators in organisms connected to diverse physiological processes make up the circadian clock system. This system generally consists of three parts in mammals including the input pathway, the core circadian clock, and the output pathway. The input pathway senses external timing signals, for example, light/dark, and sends information to the core circadian clock. The core circadian clock forms endogenous CR according to external time cues to allow for adaptation to the environment. Based on changes in the core circadian clock, the output pathway adjusts the physiological activities in various tissues and organs through neurohumoral regulation [9]. The suprachiasmatic nucleus (SCN) in the hypothalamus is the circadian pacemaker. The retinohypothalamic pineal pathway receives inputs from the body when it changes from light to dark. Axons from retinal ganglionic cells send signals to the suprachiasmatic nucleus via cranial nerve II, the optic nerve, during the light cycle. The paraventricular nucleus is then inhibited by a signal that the SCN sends via the inhibitory neurotransmitter GABA (gamma-amino-butyric acid). The superior cervical ganglion is then inhibited by axon impulses sent through the intermediate lateral column, which also suppresses the sympathetic nervous system. The fading of light signals the retinal ganglion cells to inhibit the suprachiasmatic nucleus, which activates the paraventricular nucleus and sends axons through the intermediolateral nucleus (IML) to the superior cervical ganglion, stimulating the sympathetic nervous system and causing sleepiness as night falls. To release melatonin into the bloodstream, the pineal gland is activated.[10].

### **IMPACT OF SOCIAL MEDIA OVER SLEEP WAKE CYCLE**



Applications for social media have proliferated in daily life, particularly among young people. The relationship between social media use and sleep quality as well as with typical mental health outcomes (anxiety, depression, and stress) in child and adult populations has been the subject of numerous observational studies and reviews. However, there hasn't been a thorough analysis of how social media, sleep, and mental health interact with one another among teenagers and young adults [11]. Electronic Media devices like computers, smartphones, televisions, and video games were increasingly used by Teenagers all across the world. Smart devices are becoming increasingly widely used, however several surveys indicate that utilisation varies from 50% to more than 90%. A higher body mass index (BMI), neck or shoulder pain, eye strain symptoms, poorer daytime functioning, and problems with parent-child relationships have all been linked to this irregular use of electronic devices. One of the top ten indicators of adolescent suicide is disturbed sleep, therefore avoiding sleep concerns may help people avoid mental health problems, especially depression. [12].

### **DISCUSSION:**

Daytime sleepiness and other symptoms may occur from sleep disorders, which affect your sleep quality or prevent you from receiving enough restorative sleep. Everybody occasionally struggles with sleep issues. However, if you experience any of the following You frequently have trouble falling asleep. Even though you slept for at least seven hours the night before, you are frequently exhausted during the day. Your capacity to carry out typical daytime tasks has been diminished or hampered [13]. Sleep loss can be either acute—consisting of a single extended period of wakefulness or chronic- consisting of insufficient sleep spread out over several days. Much research has been done to comprehend the former, but more lately, the impact of chronic sleep loss has also received attention. [14]. More than just being fatigued results from inadequate sleep quantity or quality. Sleepiness impairs cognitive function, which can result in personality changes, depression, learning problems in children, and memory loss in adults of all ages. People who lack sleep

have trouble making judgements, are irritable, perform poorly, have shorter reaction times, and are more likely to be involved in workplace and car accidents. Losing sleep can also have a negative impact on one's health, as it can increase the risk of developing diabetes, heart disease, and obesity.[15].

Brain activity fluctuates during sleep, increasing and decreasing during different sleep stages that make up the sleep cycle. In NREM (non-rapid eye movement) sleep, overall brain activity slows, but there are quick bursts of energy. In REM sleep, brain activity picks up rapidly, which is why this stage is associated with more intense dreaming. Each stage plays a role in brain health, allowing activity in different parts of the brain to ramp up or down and enabling better thinking, learning, and memory. Brain activity during sleep has profound effects on emotional and mental health. Sufficient sleep, especially REM sleep, facilitates the brain's processing of emotional information [16]. The brain works to analyse and retain thoughts and memories when we sleep, and it appears that lack of sleep is particularly detrimental to the consolidation of emotionally positive information. This is linked to mental health illnesses and their severity, including the likelihood of suicidal thoughts or actions, and can affect mood and emotional reactivity. As a result, the conventional belief that sleep issues were a sign of mental health issues is being challenged more and more. [17]. It is now apparent that there is a bidirectional relationship between sleep and mental health, and that sleep issues may both contribute to and be a result of mental health issues. Obstructive sleep apnea (OSA) is another aspect of sleep that has been linked to mental health. OSA is a disorder that involves pauses in breathing during sleep and a reduction in the body's oxygen levels, creating fragmented and disturbed sleep. OSA occurs more frequently in people with psychiatric conditions and may detract from their physical health and heighten their risk of serious mental distress [18].

The most common type of sleep disorder is insomnia. In the last two decades, several models have been proposed to understand the



etiology and pathophysiology of insomnia and most of them have emphasized the importance of the joint effect of stress and psychological factors in the pathogenesis of insomnia. The characteristic psychological profile of patients with insomnia, consisting of cognitive-emotional hyperarousal (i.e., obsessive, anxious, ruminative, and dysthymic personality traits) and emotion-oriented coping strategies, is thought to be present pre-morbidly and play a key role in the etiology of the disorder [19]. Insomnia is associated with precipitating life events and cognitive-emotional arousal and is perceived by the patient as stressful on its own. Thus, insomnia should be expected to be associated with activation of the stress system. Stress has been associated with the activation of the hypothalamic-pituitary-adrenal (HPA) and the sympatho-adrenal-medullary axes, whereas corticotropin-releasing hormone (CRH) and cortisol (products of the hypothalamus and adrenals, respectively), and catecholamines (products of the sympathetic system) are known to cause arousal and sleeplessness to humans and animals [20]. On the other hand, sleep and particularly deep sleep appears to have an “anti-stress” effect as it is associated with an inhibitory effect on the stress system including its main two components, the HPA axis and the sympathetic system [21].

### CONCLUSION:

The present study gathered information about circadian rhythm, its mechanism, the various sleep related disorders and the role of social media in our day today lives. It also covers most common disorders like obstructive sleep apnea and insomnia. A good sleep wake cycle needs to be balanced by every human being to lead a healthy lifestyle and also to work efficiently.

**CONFLICT OF INTEREST:** None declared.

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