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The role of sleep chronotype in mental and metabolic health - a review of current evidence

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ABSTRACT

Chronotype is an individual's preferred time of day for being active and asleep. Chronotype refers to how well one's behaviour aligns with their internal bodily rhythms. Studies suggest that poor alignment of one's internal bodily clocks with one's daily patterns is significantly linked to negative mental and metabolic problems. Persons who are classified as evening-types are at a higher risk of developing depression, anxiety disorders, bipolar disorders, suicidal ideation, and difficulties in emotion regulation. They are distinguished from the morning types, who are known to be in good mental health and to have good circadian rhythms, with minimal occurrence of mood disorders. All these factors suggest that evening-types may be at a disadvantage regarding their mental health compared to morning-types. This review summarizes the current evidence linking chronotype with mental health and metabolic regulation, focusing on primary psychiatric conditions and metabolic problems, including insulin resistance, dyslipidemia, and hypertension. The association of eveningness with poor health has been linked to social jet lag, disruption of the wake–sleep cycle, and hypothalamic–pituitary–adrenal axis dysfunction. Desynchrony between internal biological timing and social timing disrupts glucose and lipid metabolism. Therefore, people with eveningness are more likely to develop obesity, hypertension, and metabolic syndrome. Metabolic changes may be related to mood disorders and stress, suggesting the presence of common underlying biological factors in the development of both types of disorders. Recognizing chronotype could help develop improved risk profiles and provide personalized prevention and clinical management for psychological and metabolic health.

Keywords: sleep chronotype; mental health; metabolic health; circadian rhythm; eveningness.

1. INTRODUCTION

The interrelation between sleep and health is mutual and vital to overall well-being and quality of life. Sleep is not just inactivity; it plays an important role in bodily and cognitive functioning. It is important in emotional regulation and in a well-

functioning metabolism. As such, sleep is vital to mood stability and metabolic well-being. Sleep is also intricately linked to the body's circadian rhythm, an innate mechanism that controls periods of alertness and sleepiness. The human circadian rhythm controls important physiological processes, which include sleep-wake cycles, body temperature, hormone release, and cognitive and physical performance (Jiao et al., 2025). The innate timing system varies among individuals, and these individual differences in the internal clock are referred to as chronotypes, which include differences in sleep-wake preferences between mornings and evenings (Zavada et al., 2005). Researchers have identified three chronotypes: morning, evening, and intermediate (Horne & Ostberg, 1976). The most commonly used instrument for measuring chronotype is the Morningness-Eveningness Questionnaire (MEQ), which is often used for chronotype classification (Horne & Ostberg, 1976). Some studies use the short version, while others use the Composite Scale of Morningness (CSM). The suprachiasmatic nucleus, located in the hypothalamus, regulates the sleep-wake cycle and is considered the master biological clock, controlling many physiological functions in relation to a 24-hour diurnal rhythm (Logan & McClung, 2019). Disruption of intrinsic biological rhythmicity is considered the main cause of many health problems and sleep disturbances. New evidence suggests that chronotype is linked to mental health, but the mechanisms are unclear.

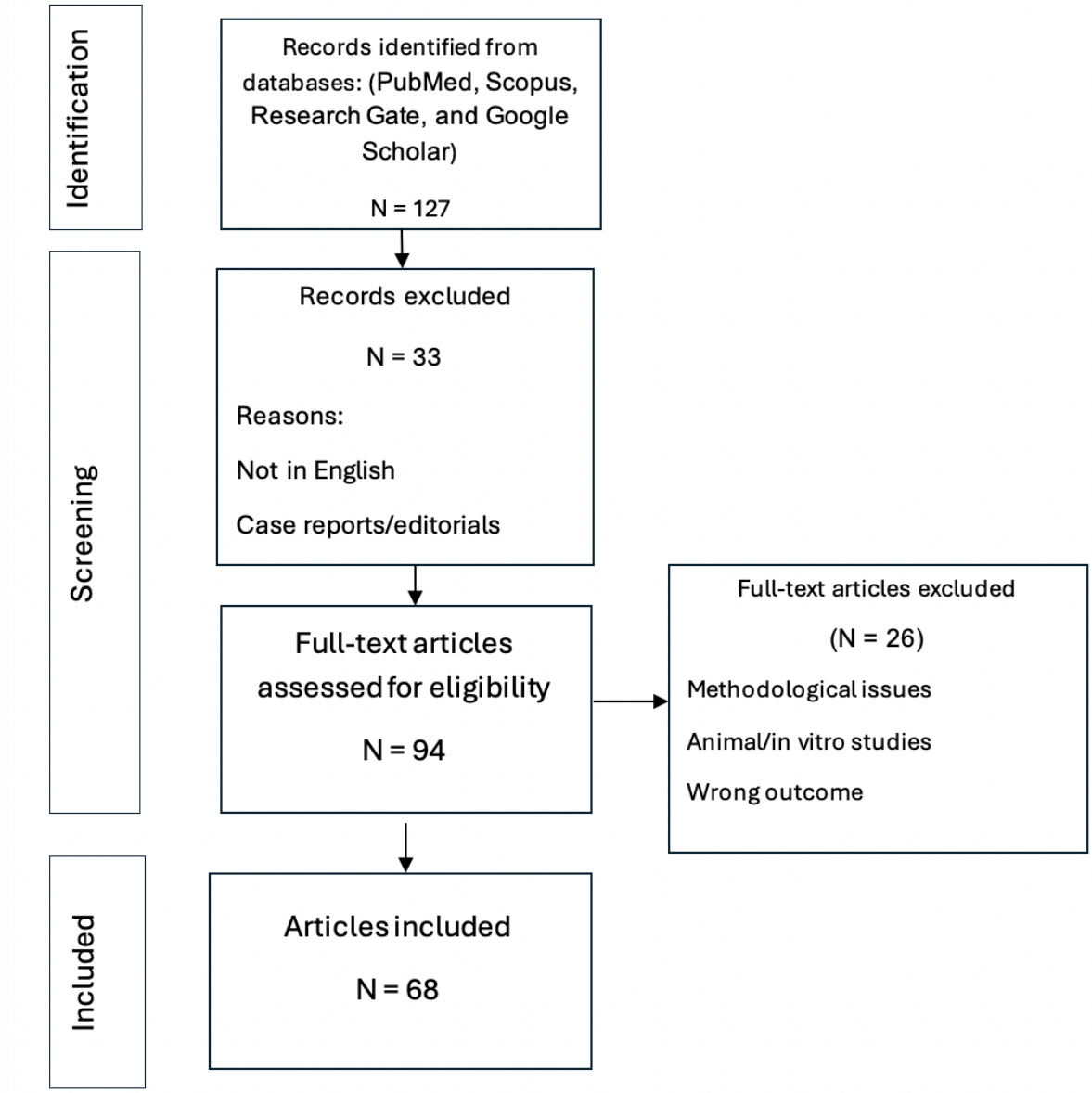

Figure 1. PRISMA flow diagram.

2. REVIEW METHODS

A systematic literature search was conducted to identify literature on chronotype, circadian rhythm, and mental health, to elucidate the relationships among the three concepts. The databases used for the literature search were PubMed, Scopus, Research Gate, and Google Scholar, with search results up to July 2025. The search terms used were "sleep chronotype," "mental health," "circadian rhythm," "eveningness," and "metabolic health," among others.

The search results yielded 127 articles. Two researchers reviewed the titles of the search results for relevance after duplicates were removed. The inclusion criteria for the research were: (1) the study examined the association of chronotype or circadian rhythm with mental health or metabolic health outcomes; (2) the study was conducted on human participants aged 12 years or older; (3) the study utilized a valid chronotype measure instrument (Morningness-Eveningness Questionnaire (MEQ), Reduced MEQ (rMEQ), or Composite Scale of Morningness (CSM)). Both clinical and non-clinical participants were considered for the study. Exclusion criteria were: (1) the publication was conducted in a language other than English; (2) the publication was a case report, editorial, conference abstract, or non-peer-reviewed; (3) the publication was conducted on animal models.

After evaluating the full texts of the search results against the inclusion criteria, 68 studies met the inclusion criteria for the final review. The study selection was conducted according to the PRISMA protocol as shown in Figure 1. The extracted data were thoroughly reviewed to ensure alignment with the research objective, thereby increasing the reliability of the results.

3. RESULTS & DISCUSSION

Depression and Anxiety Disorders

Majorly, the research on the relationship between chronotype and mental health mainly focuses on disturbances related to mood and anxiety. A large body of research on adolescents has shown that eveningness is associated with shorter sleep duration, greater social jet lag, increased sleepiness, and increased insomnia. All these factors may lead to the worsening of depression and anxiety disorders. Eveningness is characterized by increased social jet lag, severity of symptoms, and sleepiness (Magnusdottir et al., 2024).

Individuals who have been classified as "sleepy during the day" and "moderately active" experience increased levels of depression and anxiety compared to those who experience morning-type patterns. They also experience decreased social function and an increased risk of suicidal behaviors. The group classified as "sleepy during the day" and "moderately active" has been shown to have increased depression and anxiety levels compared to the morning-type individuals. The group has also been characterized by decreased social functioning and increased suicidal behaviors. Thus, chronotype measurement in the context of mental health care may have potential clinical utility (Nowakowska-Domagała et al., 2025). A large body of literature supports this postulation. Antypa et al. (2016) examined the Netherlands Study of Depression and Anxiety, which included 1,944 participants. The results revealed that a late chronotype increased the risk of major depressive disorder.

This association remained after adjustment for other variables (Antypa et al., 2016). The results suggest that eveningness is a risk factor that needs to be taken into account in the diagnosis and treatment of depression.

Meta-analytical studies have supported the findings. Norbury (2021) conducted a meta-analysis on 43 studies involving 28,000 participants and found a moderate yet consistent relationship between eveningness and depressive symptoms in both clinical and general populations. The relationship is not an outcome of depression; instead, it is a heightened risk of depression. A study found that individuals who were evening types had low levels of social support and well-being, factors that may contribute to increased emotional problems (Logan & McClung, 2019).

Numerous studies have found similar results regarding anxiety disorders. Individuals with the evening chronotype report more distressing levels of nightmares. Nightmares are related to anxiety and depression (Choo et al., 2023). There is a markedly increased risk of psychiatric hospitalization in people with the evening chronotype. Sleep deprivation is related to this condition (Logan & McClung, 2019). Mendelian randomization has shown that the relationship between chronotype and mental health is partially causal (O'Loughlin et al., 2021). A greater mismatch between natural biological timing and social timing is related to greater levels of depression, anxiety, and reduced psychological well-being. In general, the results of the study show that the evening chronotype is related to worse mental health, more depression, more anxiety, and a greater risk of psychiatric hospitalizations or suicidal behaviour.

Possible Mechanisms

New studies point to various possible mechanisms that may explain the association between eveningness and depression. The most commonly discussed is social jet lag, which refers to the difference between an individual's endogenous circadian rhythm and socially

determined temporal schedules, such as those for school and/or work. Increased social jet lag is associated with reduced sleep quality, psychological well-being, and health risks. In young people, a social jet lag of two hours or more has been strongly associated with increased depressive symptoms and the risk of mood disorders (Sun et al., 2025).

Another important mechanism is the disruption of the hypothalamic-pituitary-adrenal axis. The overactivation of the HPA axis causes abnormal timing of cortisol peaks and an extension of the period of elevated cortisol levels. This may interfere with the neural mechanisms controlling mood states, increasing the risk of depression (Norbury, 2021; Jiao et al., 2025). The findings demonstrate that both environmental factors, such as social jet lag, and biological factors, such as HPA axis disruption, are key to the relationship between evening chronotype and the risk of depression.

Other Mental Health Outcomes

Increasing evidence suggests that chronotype, particularly eveningness, is related to various aspects of mental health. Longitudinal studies have provided evidence that chronotype may be an independent risk factor. A longitudinal study of the Lifelines cohort of 23,798 adults, spanning a decade, found that individuals with a later chronotype had less desirable health habits. This includes increased alcohol consumption, physical inactivity, smoking, and poor sleep quality (Wenzler et al., 2025).

Each one-hour difference in chronotype was associated with a significant decline in cognitive performance over 10 years; the association was particularly strong among individuals with higher educational levels. Chronotype has an important role in the etiopathogenesis of bipolar disorder. Bipolar disorder patients tend to have later chronotypes compared to healthy controls. Chronotype may have temporal properties and pharmacological effects, possibly associated with the natural course of the disorder. These results suggest that chronotype has the potential to become a biomarker and therapeutic tool for the treatment of bipolar disorder, as proposed by Sperry et al., (2024).

Later chronotype has also been linked to various psychological characteristics, which may have a negative impact on mental health. Evening types show increased social anxiety and emotional instability (Azad-Marzabadi & Amiri, 2017), impulsiveness (Yılbaş & Günel Karadeniz, 2022), and aggression (Schlarb et al., 2014). Inflammation has been put forward as a biological process through which chronotype might affect adverse outcomes. The trait of eveningness has additionally been correlated with increased systemic inflammatory markers and reduced immune system activity, both peripheral and central mechanisms. This could be the explanation for the association between eveningness and depression, as well as suicidal behavior. The evidence suggests that people with the evening chronotype are more likely to have suicidal ideation, and this may be mediated by perceived personal failure (Rasmussen et al., 2024). This again highlights the need to identify people with the evening type early on.

The evening type has been related to psychological and social problems in young people. Specifically, this type has been related to increased vulnerability to smartphone/internet and social media addictions, possibly because of impulsiveness and attention problems (Yılbaş & Günel Karadeniz, 2022).

Thus, a summary of the literature suggests that being an evening type is related to a number of detrimental mental health issues, including anxiety, depression, emotional instability, suicidal behaviors, and cognitive impairment, while assessing an individual's chronotype is proposed as a predictor for mental health risks, and interventions that regulate an individual's circadian rhythms could also play a role in achieving positive mental health outcomes.

Morningness and Mental Health

While much of the research emphasizes the disadvantages of being a night owl, newer research suggests that individuals who tend toward morningness may have an advantage in terms of mental health. Individuals with the morning chronotype go to bed earlier and wake up earlier. They benefit from an increased level of psychological well-being and quality of life (Ibáñez-del Valle et al., 2025). In terms of genetics, a study established that a preference for morning activity reduces the risk of depression and schizophrenia and increases subjective well-being (Logan & McClung, 2019).

Overall, this body of research suggests that the genetic factors underlying the individual's chronotype may also play a role in the individual's susceptibility to mood disorders. Morningness acts as a protective factor against psychological disorders. People who prefer mornings have lower depressive symptoms (Daghlas et al., 2021). In addition, the risk of suicidal tendencies is lower in morning people (Park et al., 2018). People who prefer mornings have lower aggression and impulsivity (Yılbaş & Günel Karadeniz, 2022). This could be the reason for the reduced risk of major affective disorders (Menculini et al., 2023). People who prefer mornings have a higher tendency towards healthy lifestyles and greater life satisfaction (Díaz-Morales et al., 2013).

There seems to be a definite trend in the literature, however, as many studies home in on the bad effects of eveningness, whereas the good effects of morningness receive little attention. The trend nonetheless suggests that morningness is positively correlated with mental health, as in the study by Ibáñez-del Valle et al., (2025). The exact biological/behavioral reasons why going to bed and waking up early may reduce the risk of mood disorders, as well as enhance mental health in general, are not well understood, however.

Metabolic Health

New findings indicate that persons with a preference for the evening during the routine cycle of life exhibit a less desirable metabolic profile. Such individuals are more likely to experience problems with metabolism, are at greater risk for cardiovascular threats, and are more likely to experience mortal outcomes (Makarem et al., 2020). Large samples show the obvious correlation between being a night owl and high blood pressure. In the analysis, being an evening type individual was associated with nearly twice the risk for hypertension compared to morning type persons (OR = 1.88; 95% CI = 1.02–3.47; p = 0.04). Such an association is due to a variety of contributory behavioral and biological determinants. Such persons exhibit lower quantities of physical activity and consume meals later during the routine cycle. These persons are more likely to be smokers and alcohol drinkers, which makes them more vulnerable to cardiovascular and other problems related to metabolism (Didikoglu et al., 2019).

Unhealthy behaviors, such as smoking, lack of physical activity, and an unbalanced diet, are fully recognized risk factors for heart disease. On the other hand, moderate alcohol intake and physical activity will protect the heart and reduce total cardiovascular risk (Visseren et al., 2021; Makarem et al., 2020). It has long been recognized that circadian desynchrony plays an important role in the regulation of metabolic processes. Desynchrony is defined as the desynchronization between the central clock, located in the suprachiasmatic nucleus (SCN), and the peripheral clocks in the liver, pancreas, and adipose tissue. The dissociation between the central circadian clock located in the suprachiasmatic nucleus and the peripheral oscillators in various organs has a negative impact on the metabolism of glucose and lipids, reflected by a decrease in high-density lipoprotein cholesterol, increased triglyceride concentration, and insulin resistance. Circadian desynchrony has been implicated in the development of type 2 diabetes and atherosclerosis (Davoodian et al., 2025; Visseren et al., 2021). Experimental models of circadian desynchrony, simulating the effects of shift work or delayed sleep-wake cycles, have shown the onset of insulin resistance, increased postprandial glucose levels, and altered lipid metabolism, thus indicating a cause-and-effect relationship between circadian desynchrony and the onset of metabolic disorders (Al-Naimi et al., 2004).

The impact of sleep duration on metabolic health is non-linear. Prolonged sleeping times of less than 7 hours or more than 8 to 9 hours are associated with a higher probability of cardiovascular disease, type 2 diabetes, stroke, and early death. Furthermore, short sleeping times are associated with increased fasting glucose levels, hypertension, and inflammatory markers. Conversely, long sleeping times are associated with other chronic health conditions or inflammatory illnesses (Albers et al., 2023).

Differences between endogenous sleep timing and imposed social schedules, such as those related to work, are associated with unfavorable metabolic profiles. Greater social jetlag is associated with reduced high-density lipoprotein (HDL) cholesterol, triglycerides, fasting insulin, insulin resistance, and an increased body mass index (BMI). Both cross-sectional and cohort studies show that those with high social jetlag are at an increased risk of developing metabolic syndrome and type 2 diabetes (Koopman et al., 2017).

The effects of chronotype and social jetlag are additive on cardiometabolic health. Individuals with an evening chronotype, short sleeping duration, and large social jetlag have the worst health outcomes. They are found to have higher blood pressure, unfavorable lipid profiles, and elevated inflammatory markers. Assessing chronotype and sleep regularity could provide additional prognostic information.

These elements may include those outside traditional cardiometabolic risk (Albers et al., 2023). There is evidence that restoring rhythmicity can improve metabolic function. As indicated in Table 1, the table describes the key findings pertaining to chronotype, mental health, and metabolic outcomes.

The sleep-wake cycle, meal times, and natural morning daylight exposure are positively associated with insulin and lipid profiles. When these factors are matched with the individual's chronotype, the benefits are maximized while the risk of developing metabolic diseases is minimized, as Bouman et al., (2024) indicate. More studies are recommended to determine causality. Future studies should include assessments to determine whether circadian-based therapies can prevent and/or treat both mental and metabolic diseases.

Table 1. Summary of key findings on chronotype, mental health, and metabolic outcomes

Area	Evening chronotype	Morning chronotype
Mental health	Higher risk of depression and anxiety, greater emotional instability, increased suicidal ideation and hospitalization	Better emotional regulation, lower risk of mood disorders, higher psychological well-being
Psychological traits	Higher impulsivity, aggression, social anxiety, and cognitive decline	Lower impulsivity and aggression, greater life satisfaction
Lifestyle behaviours	Shorter and irregular sleep, greater social jet lag, later meals, less physical activity, higher substance use	Regular sleep-wake patterns, healthier daily routines
Metabolic health	Higher risk of insulin resistance, dyslipidemia, hypertension, obesity, and metabolic syndrome	More favourable metabolic profile
Underlying mechanisms	Circadian desynchrony, social jet lag, HPA axis dysregulation, metabolic disruption	Better alignment of biological and social time
Clinical relevance	Higher psychiatric and cardiometabolic risk	Potential protective factor

4. CONCLUSION

The existing literature indicates that chronotype is a major predictor of both mental and metabolic health. Overall, evening types are found to be at a heightened risk of suffering from mood disorders, suicidal ideation, and metabolic problems. Conversely, morning types are associated with better emotional regulation and overall well-being. Overall, disruption of the body's circadian rhythms appears to be the mechanism underlying these effects. In practice, including chronotypes in the assessment could enable the design of an individualized approach to prevention and treatment. Further research is needed to determine the effectiveness of this intervention.

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All authors have read and agreed with the published version of the manuscript.

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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