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Relationship between sleep quality, chronotype, and depression in youth: A cross-sectional study

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ABSTRACT

Aims: In today's electronic age, the frequency of both poor sleep quality and the evening chronotype are increasing and are associated with numerous adverse physical and mental health outcomes. This study was conducted on a group of healthy Turkish youth aged 18-24 years to determine whether there are any potential associations between sleep quality, chronotype, and depression.

Methods: In this cross-sectional study involving healthy youth, we utilized the Pittsburgh Sleep Quality Index (PSQI), the Morningness-Eveningness Questionnaire (MEQ), and the Beck Depression Inventory (BDI) to evaluate sleep quality, chronotype, and depression.

Results: The study analyzed 165 youths with a mean age of 21.9±1.6 years (77.6% were females). Overall, 84% of the study participants (PSQI mean score: 7.4±3.0) exceeded accepted thresholds for poor sleep quality, whereas 35.7% (BDI mean score: 16.3±11) exceeded thresholds for depression. The participants were categorized into the following chronotypes: morning (n=19, 11.5%), intermediate (n=109, 66.1%), and evening (n=37, 22.4%) types. Poor sleep quality and eveningness were positively associated with depression (p=0.033 and p=0.012, respectively). Mediation analysis showed that sleep quality acted as a mediator in the relationship between chronotype and depression (β=-0.003, p=0.011).

Conclusions: The results of this study demonstrated a significant association between poor sleep quality, evening chronotype, and an increased likelihood of depression among Turkish youth.

Introduction

Sleep is a fundamental element of both human biology and life, and its impact is crucial for human well-being. It is associated with many physiological processes in the brain and other organs (1,2). The American Academy of Sleep Medicine (AASM) recommends that adults aged 18 to 60 aim for a consistent sleep duration of 7 or more hours per night to promote optimal health (3). Nevertheless, lack of sleep is increasingly becoming a more common health issue in modern societies and, as such, is becoming a greater focus for health professionals (2,4). An analysis of epidemiologic studies showed that approximately one-third of the general population experiences insomnia symptoms (difficulty falling asleep and/or staying asleep) and between 4% and 26% experience excessive sleepiness (5). Although sleep disorders are common in the general population, they are reported to be underrecognized, and less than 20% of insomniacs receive an accurate diagnosis and treatment (5). It has been demonstrated that there is an association between poor sleep and excessive daytime sleepiness, depression, and poor concentration (6), as well as long-term health consequences, such as chronic diseases, including obesity, metabolic syndrome, and cardiovascular problems (4). Consequently, inadequate sleep and untreated sleep disorders can adversely affect the health and safety of a community (7).

The biological and rhythmic activity observed in psychological, cognitive, and physiological variables in humans that affect sleep-wake cycles, mood, endocrine functions, cognition, and body temperature is known as the "circadian rhythm" (8). The biological rhythmicity observed in human metabolism over a period of 24 h is responsive to the light-dark cycle (8,9). Three chronotypes represent individual circadian preferences: morning, evening, and intermediate chronotypes (10-12). A morning person, often called the lark, goes to bed and gets up early. They prefer doing their major jobs and activities in the morning. An evening person, often called the owl, goes to bed and gets up late. They prefer doing their major jobs and activities in the evening. Alongside this, a third category, the intermediate type, has no leaning toward morning or evening (10). A study on people aged 25 to 74 years in Finland over 10 years found an increased prevalence of insufficient sleep, shorter sleep duration, and increased eveningness, with eveningness being more prevalent among young adults across all working years (13). Individuals of the evening type experience more sleep disturbances than those of morning and intermediate types. This condition is characterized by a higher frequency of nightmares, shorter sleep duration, reduced sleep quality, and a longer time taken to fall asleep than morning or intermediate types (14). Recent research suggests that individuals with an evening chronotype are at increased risk of depression (10,15). A meta-analysis showed a significant relationship between evening type and depression in both longitudinal and cross-sectional studies (16). Nevertheless, the link between chronotype and depression remains unclear and warrants further investigation (16).

Maintaining a stable circadian rhythm is critical for human health (10), but university students are known to be more susceptible to sleep disturbances and psychological distress due to the rigorous study, work, and extracurricular activities (17). Improving sleep quality has also been reported to contribute to mental health (18). It is possible that understanding these patterns and establishing a consistent daily routine could help reduce the incidence of the aforementioned complications (10).

Studies on sleep health, including chronotype, sleep disorders, and depression in youth, are limited, with inadequate sample sizes and inconsistent findings (10,15). The AASM recommends more sleep and circadian rhythm research to highlight their importance for public health and the negative consequences of insufficient sleep (7). Given the increased incidence of sleep disturbances, eveningness, and susceptibility to depressive symptoms among youth, the purpose of this study was to explore the association between sleep quality and chronotype and depression in university students.

Methods

Study design and participants

This cross-sectional study enrolled university students aged 18-24 using a non-probability sampling method. The study was conducted in İstanbul between April and June 2023. Approval for this research was granted by the Koç University Institutional Review Board (decision no: 2022.290.IRB3.125, date: 16.09.2022). The research was conducted according to the tenets of the Declaration of Helsinki.

The eligibility criteria included being a healthy youth aged 18-24 years, being a university student, and having no previous history of chronic disease or current regular medication use.

For the study, university students were contacted directly or via e-mail. The participants were asked to answer four questionnaires covering sociodemographics, sleep quality, chronotype, and depression. Questionnaires were made available via Qualtrics. Before the start of the surveys, each participant read a brief explanation of the study and provided online consent. All surveys were conducted anonymously.

Measures

The sociodemographics form was used to collect data on age, gender, weight, height, electronic device usage (television, computer, phone), tea and caffeine consumption, university department attendance, and smoking status.

Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI), initially developed by Buysse et al. (19) and subsequently adapted into Turkish by Agargun et al. (20), is a self-report scale comprising 19 items. The instrument evaluates standards of sleep and disruptions in one month past. It contains 24 questions, with 19 being self-report queries and 5 requiring responses from a spouse or roommate. The 18 questions scored within the scale encompass seven key areas: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disorder, sleep medication use, and daytime dysfunction. These components are assessed on a scale of 0-3. The total score across the seven components gives the total scale score ranging from 0 to 21. A total score greater than 5 indicates "poor sleep quality".

Beck Depression Inventory

Depression was evaluated with the Beck Depression Inventory (BDI). The BDI was developed by Beck et al. (21) and was later adapted for Turkish use by Hisli et al. (22,23). The scale comprises 21 items, each scored between 0 and 3. The highest score was 63, indicating more significant depression. The participants were further categorized as having minimal depression (BDI score <10) or clinically significant depression (moderate to severe) (BDI score >18). A Cronbach's alpha coefficient of BDI was reported to be 0.80 (23). The Cronbach's

alpha coefficient for the measurement instrument used in this study was 0.910, indicating high internal consistency among the items.

The Morningness-Eveningness Questionnaire

Chronotype was evaluated using the 19-item Morningness-Eveningness Questionnaire (MEQ), which was developed by Horne and Ostberg (11) in 1976. A Turkish reliability study was conducted in 2005 by Pündük et al. (24). This self-reporting scale is designed to assess individual differences in the degree to which a respondent is active and alert at certain times of the day (e.g., in the morning and the evening). According to the total score obtained at the end of the questionnaire, chronotype characteristics are determined. The final questionnaire scores ranged from 16 to 86, with higher scores indicating a preference for the morning and lower scores indicating a preference in the evening. Scores between 16 and 41, 42 and 58, and 59 and 86 indicate "evening type", "intermediate type" and "morning type", respectively (24). The Cronbach's alpha coefficient for the measurement instrument used in this study was 0.798, indicating high internal consistency among the items.

Statistical Analysis

The data analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 28.0 (IBM Corp., Armonk, NY., USA)

The Shapiro-Wilk test was used to test the assumption of normality. The Mann-Whitney U test was used to compare variables that were non-normally distributed. Chi-square tests were performed to compare categorical variables. The association between PSQI, MEQ, faculty type, smoking status, and electronic device use and depression was examined using logistic regression. Mediation models were analyzed using the partial least squares (PLS) structural equation modeling algorithm in SmartPLS4. A comprehensive examination of the mediated effects for each model was conducted using a total of 10,000 bootstrapped samples to ensure statistical rigor.

Results

Sociodemographic results

A total of 455 individuals were contacted, and 276 (60.6%) completed the questionnaires. One hundred and eleven participants were excluded from the analyses because of chronic illness (n=59), regular medication usage (n=26), and unconfirmed current university engagement (n=26). Finally, the analyses included 165 youths with a mean age of 21.9±1.6 years (77.6% were females). The characteristics of the participants are presented in Table 1.

The mean PSQI score was 7.4±3.0, ranging from 1 to 16. The mean MEQ score was 47.7±9.0, ranging from 28 to 72. The mean BDI score was 16.3±11, ranging between 0 and 63.

BDI analyses

Increased depression scores above the BDI cut-off (≥19) were detected in 59 (35.7%) participants. There were no differences in age, gender, body mass index (BMI), electronic device usage, or daily tea and coffee consumption between participants with and without depression, as determined by the BDI score. The prevalence of depression was lower among students in medical faculty than among students in other faculties [29.7% (n=35) and 51.1% (n=24), p=0.012].

Table 1. Characteristics of the study participants (n=165)

Age, years, mean±SD	21.9±1.6
Gender, female, n (%)	128 (77.6)
BMI, (kg/m²), mean±SD	22.9±4.2
Duration of electronic device use (TV, computer, phone); n (%)	
<3 h/day	22 (13.3)
≥3 h/day	143 (86.7)
Faculty type, n (%)	
Medical faculty	118 (71.5)
Other university departments	47 (28.5)
Smoking current, n (%)	23 (13.9)
Daily tea consumption, cups, mean±SD	2.0±2.0
Daily coffee consumption, cups, mean±SD	1.4±1.0

SD: Standard deviation, BMI: Body mass index

Chronotypes and depression

Participants were found to be morning, intermediate, and evening type by 11.5% (n=19), 66.1% (n=109), and 22.4% (n=37), respectively. There were no differences in age, gender, faculty type, BMI, daily tea and coffee consumption, electronic device usage, smoking status, or sleep quality across the three chronotypes. Depression, as defined by the BDI score, was more prevalent among evening-type individuals (p=0.012). Comparisons of gender, faculty type, duration of electronic device use, depression, and sleep quality between morning, intermediate, and evening are presented in Table 2.

Sleep quality and depression

According to the PSQI, 16% of participants had good sleep quality and 84% had poor sleep quality. In addition, 33.9% of the participants slept less than seven hours, and 63% slept after midnight. There were no differences in age, BMI, or daily tea and coffee consumption between participants with a good vs. poor sleep quality. Poor sleep quality was significantly associated with depression, as defined by the BDI score (p=0.033). Comparisons of gender, faculty type, duration of electronic device use, and depression between sleep quality classes are presented in Table 3.

Correlations analyses

Higher MEQ scores were associated with morningness. BDI was inversely correlated with MEQ (r=-0.238, p<0.001) and positively correlated with PSQI (r=0.522, p<0.001).

Regression analyses

The multivariable logistic regression model included the following explanatory variables: PSQI score, chronotype, faculty type, and other factors that may be associated with depression, such as smoking status and duration of electronic device use; depression was the outcome variable. Poor sleep quality [odds ratio (OR): 1.514, 95% confidence interval (CI): 1.293-1.772] and non-medical faculty program (OR: 2.710, 95% CI: 1.147-6.402) were independently associated with depression diagnosis. The overall model significance was confirmed by the Omnibus test (χ^2=57.944, p<0.001), with evidence of no multicollinearity (VIF values< 5). The Hosmer-Lemeshow test indicated good model fit (χ^2=6.524, p=0.589). The Nagelkerke R^2 value of 0.411 (Table 4).

Mediation analyses

Mediation analysis was conducted to investigate the role of sleep quality in the influence of chronotype on depression. Mediation analysis showed that sleep quality acted as a mediator in the relationship between chronotype and depression (β=-0.003, p=0.011). The outcomes of the mediation analyses are presented in Figure 1. In addition, in the mediation analysis conducted to examine the effect of electronic device use time on chronotype, sleep quality, and depression, we found that electronic device use had no mediating effect on any relationship between sleep, chronotype, and depression.

Table 2. Association between youth chronotype and several factors (n=165)

	Morningness (n=19)	Intermediate (n=109)	Eveningness (n=37)	p*
Gender, n (%)				
Female	14 (10.9)	86 (67.2)	28 (21.9)	0.839
Faculty type, n (%)				
Medical faculty	15 (12.7)	76 (64.4)	27 (22.9)	0.696
Other university departments	4 (8.5)	33 (70.2)	10 (21.3)	
Duration of electronic device use, n (%)				
<3 h/day	4 (18.1)	11 (50.0)	7 (31.9)	0.144
≥3 h/day	15 (10.5)	98 (68.5)	30 (21.0)	
Smoking, n (%)		20 (87.0)	3 (13)	0.053
Depression level according to BDI score, n (%)				
Minimal (BDI score <10)	11 (20.4)	34 (63.0)	9 (16.7)	**0.012**
Mild (BDI score 10-18)	5 (9.6)	39 (75.0)	8 (15.4)	
Moderate (BDI score 19-29)	3 (7.3)	27 (65.9)	11 (26.8)	
Severe (BDI score 30-63)	0 (0.0)	9 (50.0)	9 (50.0)	
Sleep quality level according to PSQI score, n (%)				
Good sleep quality	5 (19.2)	16 (61.5)	5 (19.2)	0.414
Poor sleep quality	14 (10.2)	91 (66.4)	32 (23.4)	

*Chi-square tests.
BDI: Beck Depression Inventory, PSQI: Pittsburgh Sleep Quality Index

Discussion

The current study examined sleep quality, chronotype, and its association with depression among university students aged 18-24 years. In terms of sleep quality, 84% of participants had poor sleep quality according to the PSQI, and 66.1% had an intermediate chronotype according to chronotype. In terms of depression levels, 35.7% of the participants were depressed according to the BDI (≥19). It was also found that evening chronotype was associated with poor sleep quality and depression. There were also no differences in age, gender, coffee and tea consumption, chronotype, sleep quality, and depression between the participants. In the literature, while there are studies on chronotype, sleep disorders, and depression (10,15,25), this area is not well known, and there is little public awareness of the importance of this disorder and its health problems in our country.

Chronotype and mental health

Stable circadian rhythm is a critical element of human well-being, and unstable circadian rhythms have been associated with physical and psychiatric disorders (10). In recent years, there has been a growth in the interest in studies examining any relationship between sleep, chronotype, and depression (10,15,25). Our findings showed that the majority of young people had an intermediate chronotype (66.1%), with a smaller proportion having an evening chronotype (22.4%) and the smallest proportion having a morning chronotype (11.5%). In addition, no gender or age differences were observed between chronotypes. In contrast, a national study completed in Finland estimated that evening types made up 11-13% of the general adult population, with the eveningness characteristic being slightly more prevalent in women than in men (26). In a Norwegian study of 59,554 students, 10% were morning, 60% were intermediate, and 30% were evening types (27) whereas in a Canadian study of 3160 young adults, 9% were morning, 55% were intermediate, and 36% were evening types (14) and in a Turkish study of 339 university students, 18% were morning, 55.7% were intermediate, and 26.2% were evening types (28).

Table 3. Youth sleep quality level according to several factors

	Good sleep quality (n=31)	Poor sleep quality (n=183)	p*
Gender, female, n (%)	5 (13.5)	32 (86.5)	0.645
Faculty type			
Medical faculty	18 (15.3)	100 (84.7)	0.694
Other university departments	8 (17.8)	37 (82.2)	
Duration of electronic device use, n (%)			
<3 h/day	4 (18.1)	18 (81.8)	0.622
≥3 h/day	22 (15.6)	119 (84.4)	
Smoking, n (%)	4 (17.4)	19 (82.6)	0.839
Depression level according to BDI score, n (%)			
Minimal (BDI score <10)	14 (26.4)	39 (73.6)	**0.033**
Mild (BDI score, 10-18)	8 (15.4)	44 (84.6)	
Moderate (BDI score 19-29)	4 (9.8)	37 (90.2)	
Severe (BDI score 30-63)	-	17 (100.0)	

*Chi-square tests, BDI: Beck Depression Inventory, PSQI: Pittsburgh Sleep Quality Index.

Table 4. The association of PSQI, MEQ, faculty type and smoking status with depression as defined by the BDI in multivariable logistic regression analysis

Variables	β	Standard error	Wald	df	β	OR	95% confidence interval	
							Lower	Upper
PSQI score	0.414	0.080	26.523	1	**<0.001**	1.514	1.293	1.772
MEQ score	-0.016	0.046	0.117	1	0.732	0.984	0.900	1.077
Faculty type (reference: medical faculty)	0.997	0.439	5.168	1	**0.023**	2.710	1.147	6.402
Smoking status (reference: non-users)	0.813	0.556	2.133	1	0.144	2.254	0.757	6.707
Duration of electronic device use (reference: <3 h/day)	-0.261	0.622	0.177	1	0.674	0.770	0.228	2.604

Independent variable: Depression as defined by the BDI score (≥19); Hosmer-Lemeshow test p=0.589; β: regression coefficient of the variable. OR: Odds ratio; BDI: Beck Depression Inventory, MEQ: Morningness Eveningness Questionnaire, PSQI: Pittsburgh Sleep Quality Index

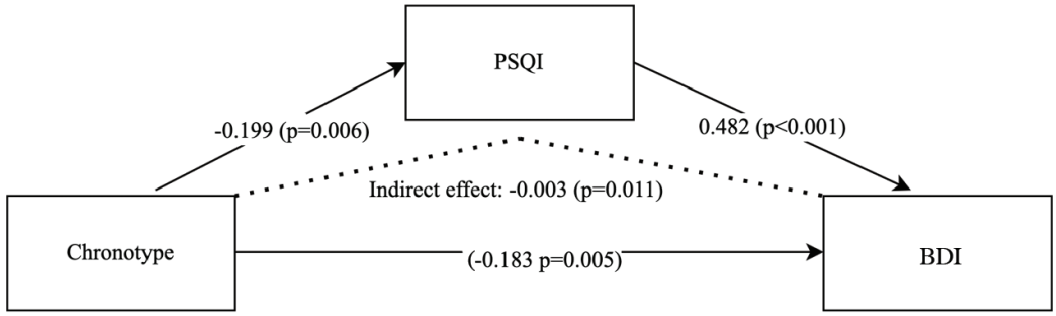

Figure 1. Mediation of the association between chronotype and depression by sleep quality

PSQI: Pittsburgh Sleep Quality Index, BDI: Beck Depression Inventory

Our study also showed that eveningness is associated with a higher depression rate. Moreover, a higher PSQI score, indicating poor sleep, was correlated with a lower chronotype score, indicating eveningness. Our results are consistent with a meta-analysis of 43 studies involving 27,996 participants, which found that the evening chronotype was associated with depression (15). Moreover, one review found that evening preference was related to an increased risk of depressive symptoms, whereas morning chronotype was considered a protective factor (10). Meanwhile, a study of medical students in Türkiye found no association between chronotype and depression (29), and a further study conducted in Türkiye with 339 participants observed no direct relationship between evening chronotype and depression (28).

Similar studies have found a connection between eveningness and depression and anxiety symptoms, alcohol and tobacco use, and a high suicide risk. If we analyze our study alongside other recent studies (10,15,25,30), it can be seen that chronotype indeed plays an important role in depressive disorders and that people with depression or mental health problems should be considered for evaluation of chronotype and sleep disorders. In addition, young people should be educated about the importance of regular routines and sleep patterns as part of preventive health care.

Alongside this, it is also believed that several other factors may influence the associations between chronotypes and depression. It has been proposed that functional relationships between regulation of mood and the biological clock might exist which control day preference, and that evening preference may heighten vulnerability to mood complaints (30). In a study of 913 Polish adults, high neuroticism and low conscientiousness were found to be associated with depression in individuals with evening chronotypes (31). In a study of adults between the ages of 18 and 35, while eveningness was found to be related to depression, it was also found that this effect could be mitigated by high briskness and low emotional reactivity (32). Hence, taking the above into consideration it is hypothesized that various factors, such as personality and lifestyle, might influence correlations between circadian preference and depression. Further studies are required to better understand this relationship and to adopt preventive measures.

Sleep and mental health

Most of the participants in this study met the criteria for poor sleep quality (84%), which was associated with depression. A study of 559 medical students in Greece found that 52.4% had poor sleep quality, 22.6% had moderate symptoms of depression, and 13.9% had moderately severe symptoms of depression. In addition, changes in sleep parameters were associated with moderate to severe deterioration in mental health (33). A systematic review of 16-25 year olds a significant association between poor sleep quality and mental health (34). A previous study found that people with sleep problems were 10 and 17 times more likely to have clinically significant depression than people without sleep problems (35). A meta-analysis of 21 longitudinal studies found that people with sleep problems at baseline were twice as likely to develop depression at follow-up as those without sleep problems (36). A meta-analysis of randomized controlled trials found that sleep improvement had a beneficial effect on mental health disorders, regardless of the severity of mental disorders or the presence of comorbid health problems (18). Taken together, existing studies suggest that improving sleep quality is a preventive parameter for depression and has a positive effect on recovery from mental illness.

In our study, the rate of depression among university students was 2.7 times lower in the medical faculty group than in the non-medical faculty group. In contrast to our study, a systematic review of students in the USA and Canada found a high prevalence of depression among medical students, with levels of overall psychological distress being consistently higher than those in the general population and their peers in later years of training (37). Another study from Portugal found that anxiety symptoms were significantly more common among

medical students than among non-medical students (38). The results obtained in our study may be attributable to the large number of medical students. Moreover, the fact that medical students are more disciplined due to intensive programs than in other departments may also be a factor. However, our results are inconsistent with the limited existing literature. Further research is required to clarify this situation.

Duration of electronic device use, sleep, and mental health

In recent years, as electronic devices have become lighter and more portable, their use has increased significantly, and people have started to use them more frequently in daily life and in bed (39). In our study, most of the participants (86.7%) used electronic devices for 3 hours or more per day; there was no association between electronic device use and chronotype, sleep quality, or depression, and mediation analysis also showed that electronic devices were not a mediator in the associations between chronotype, sleep quality, and depression, which may be due to overuse by the overall majority. A systematic review of 16-25 years olds found that extended time spent on social media was associated with poor sleep quality and issues with mental wellbeing (34). In another study, a significant number of students met the criteria for low sleep, Internet addiction, and depression. In addition, Internet addiction and sleep quality were found to mediate a substantial portion of the indirect effect on depression (40). A study of 319 university students in Türkiye found that the quality of sleep and symptoms of depression were associated with excessive smartphone use (41). To fully elucidate the relationship between the use of electronic devices, circadian rhythms, sleep, and depression, more detailed studies should be conducted by examining the type, duration, location, and reason for the use of such devices. It should also be noted that young people with depression and sleep disorders should be screened for screen addiction.

This research has a number of limitations. First, the cross-sectional study design makes it difficult to infer causal relationships between sleep-related variables and depression. In addition, because non-probability sampling was used and the study was voluntary, it is possible that people with depression might not have participated, which could have affected the results. Second, participants' socio-cultural and economic status, family structure, and relationship status, which may affect sleep quality and depression, were not analyzed. Third, sleep quality and chronotype may vary seasonally and during the day between weekdays and weekends, but these differences were not examined. Finally, factors that may influence the association between chronotype and depression, such as temperament, personality traits, and lifestyle, were not examined and should be considered in future studies.

Despite these limitations, the results of the current study are believed to contribute to the literature by drawing attention to the increase in depression and mental disorders in young people, especially after Coronavirus disease-2019, and factors such as sleep disturbance and chronotype that may contribute to this increase.

Conclusion

This study revealed a significant relationship between eveningness, poor sleep quality, and an increased likelihood of depression among Turkish youths. Given that poor sleep quality, eveningness, and depression, which are common among young people, affect many areas of life, such as work, social and family life, and also increase the risk of accidents on the road, at work or at home, it is clear that these conditions are a significant public health problem that deserves more attention from health authorities. Moreover, promoting a more routine lifestyle alongside healthier sleep habits among youths could make a significant contribution to preventing sleep and mental health conditions, such as depression.

Ethics

Ethics Committee Approval: Approval for this research was granted by the Koç University Institutional Review Board (decision no: 2022.290.IRB3.125, date: 16.09.2022).

Informed Consent: Consent form was filled out by all participants.

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Footnotes

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References

1. Grandner MA, Fernandez FX. The translational neuroscience of sleep: A contextual framework. Science. 2021;374:568-573.
2. Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR. The Global Problem of Insufficient Sleep and Its Serious Public Health Implications. Healthcare (Basel). 2018;7:1.
3. Panel CC, Watson NF, Badr MS, et al. Recommended Amount of Sleep for a Healthy Adult: A Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society. Sleep. 2015;38:843-844.
4. Institute of Medicine (US) Committee on Sleep Medicine and Research. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Colten HR, Altevogt BM, editors. Washington (DC): National Academies Press (US); 2006.

5. Ohayon MM. Epidemiological overview of sleep disorders in the general population. Sleep Medicine Research. 2011;2:1-9.

6. Goel N, Rao H, Durmer JS, Dinges DF. Neurocognitive consequences of sleep deprivation. Semin Neurol. 2009;29:320-339.

7. Ramar K, Malhotra RK, Carden KA, et al. Sleep is essential to health: an American Academy of Sleep Medicine position statement. J Clin Sleep Med. 2021;17:2115-2119.

8. Reddy S, Reddy V, Sharma S. Physiology, circadian rhythm. StatPearls [Internet]: StatPearls Publishing; 2022.

9. Eid B, Bou Saleh M, Melki I, et al. Evaluation of Chronotype Among Children and Associations With BMI, Sleep, Anxiety, and Depression. Front Neurol. 2020;11:416.

10. Zou H, Zhou H, Yan R, Yao Z, Lu Q. Chronotype, circadian rhythm, and psychiatric disorders: Recent evidence and potential mechanisms. Front Neurosci. 2022;16:811771.

11. Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. Int J Chronobiol. 1976;4:97-110.

12. İpar N. The effect of circadian preference and sleep disturbances on depression in children 6 to 12 years of age. Chronobiol Int. 2023;40:1375-1386.

13. Merikanto I, Partonen T. Increase in eveningness and insufficient sleep among adults in population-based cross-sections from 2007 to 2017. Sleep Med. 2020;75:368-379.

14. Walsh NA, Repa LM, Garland SN. Mindful larks and lonely owls: The relationship between chronotype, mental health, sleep quality, and social support in young adults. J Sleep Res. 2022;31:e13442.

15. Norbury R. Diurnal preference and depressive symptomatology: a meta-analysis. Sci Rep. 2021;11:12003.

16. Au J, Reece J. The relationship between chronotype and depressive symptoms: A meta-analysis. J Affect Disord. 2017;218:93-104.

17. Wang J, Liu S, Guo J, et al. Chronotypes, Sleep and Mental Distress Among Chinese College Students: A Cross-Sectional Study. Front Psychiatry. 2022;13:883484.

18. Scott AJ, Webb TL, Martyn-St James M, Rowse G, Weich S. Improving sleep quality leads to better mental health: A meta-analysis of randomised controlled trials. Sleep Med Rev. 2021;60:101556.

19. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28:193-213.

20. Agargun M, Kara H, Anlar O. Pittsburgh Uyku Kalitesi İndeksi'nin Geçerliği ve Güvenirliği. Turk Psikiyatri Derg. 1996;7:107-111.

21. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry. 1961;4:561-571.

22. Hisli N. Beck Depresyon Envanterinin Gecerligi Uzerine bir Calisma. Journal of Psychology. 1988;6:118-122.

23. Hisli N. The validity and reliability of Beck Depression Inventory for university students. Psikoloji dergisi. 1989;7:3-13.

24. Pündük Z, Gür H, Ercan I. Sabahçil-Akşamcil Anketi Türkçe Uyarlamasinda Güvenilirlik Calişmasi [A reliability study of the Turkish version of the mornings-evenings questionnaire]. Turk Psikiyatri Derg. 2005;16:40-45.

25. Merikanto I, Kronholm E, Peltonen M, Laatikainen T, Vartiainen E, Partonen T. Circadian preference links to depression in general adult population. J Affect Disord. 2015;188:143-148.

26. Merikanto I, Kronholm E, Peltonen M, Laatikainen T, Lahti T, Partonen T. Relation of chronotype to sleep complaints in the general Finnish population. Chronobiol Int. 2012;29:311-317.

27. Kjørstad K, Vedaa Ø, Pallesen S, Saxvig IW, Hysing M, Sivertsen B. Circadian preference in young adults: Associations with sleep and mental health outcomes from a national survey of Norwegian university students. Chronobiol Int. 2022;39:1465-1474.

28. Üzer A, Yücens B. Chronotype and depressive symptoms in healthy subjects: the mediating role of hopelessness and subjective sleep quality. Chronobiol Int. 2020;37:1173-1180.

29. Cim EFA, Kiran SG, Kurhan F, Atli A. Relationship between chronotype and depression schemas and sensitivity to depression in medical students. Annals of Medical Research. 2021;28:767.

30. Kitamura S, Hida A, Watanabe M, et al. Evening preference is related to the incidence of depressive states independent of sleep-wake conditions. Chronobiol Int. 2010;27:1797-1812.

31. Gorgol J, Waleriańczyk W, Stolarski M. The moderating role of personality traits in the relationship between chronotype and depressive symptoms. Chronobiol Int. 2022;39:106-116.

32. Gorgol J, Waleriańczyk W, Stolarski M, Cyniak-Cieciura M. Temperament moderates the association between chronotype and depressive symptoms: A Regulative Theory of Temperament approach. Personality and Individual Differences. 2022;185:111304:1-6.

33. Eleftheriou A, Rokou A, Arvaniti A, Nena E, Steiropoulos P. Sleep Quality and Mental Health of Medical Students in Greece During the COVID-19 Pandemic. Front Public Health. 2021;9:775374.

34. Alonzo R, Hussain J, Stranges S, Anderson KK. Interplay between social media use, sleep quality, and mental health in youth: A systematic review. Sleep Med Rev. 2021;56:101414.

35. Taylor DJ, Lichstein KL, Durrence HH, Reidel BW, Bush AJ. Epidemiology of insomnia, depression, and anxiety. Sleep. 2005;28:1457-1464.

36. Baglioni C, Battagliese G, Feige B, et al. Insomnia as a predictor of depression: a meta-analytic evaluation of longitudinal epidemiological studies. J Affect Disord. 2011;135:10-19.

37. Dyrbye LN, Thomas MR, Shanafelt TD. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety,

and other indicators of psychological distress among U.S. and Canadian medical students. Acad Med. 2006;81:354-373.

38. Moreira de Sousa J, Moreira CA, Telles-Correia D. Anxiety, Depression and Academic Performance: A Study Amongst Portuguese Medical Students Versus Non-Medical Students. Acta Med Port. 2018;31:454-462.

39. Fossum IN, Nordnes LT, Storemark SS, Bjorvatn B, Pallesen S. The association between use of electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness, morningness, and chronotype. Behav Sleep Med. 2014;12:343-357.

40. Bhandari PM, Neupane D, Rijal S, Thapa K, Mishra SR, Poudyal AK. Sleep quality, internet addiction and depressive symptoms among undergraduate students in Nepal. BMC Psychiatry. 2017;17:106.

41. Demirci K, Akgönül M, Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. J Behav Addict. 2015;4:85-92.