ORIGINAL ARTICLE

SLEEP QUALITY AND PERCEIVED STRESS AMONG UNIVERSITY STUDENTS DURING THE COVID-19 PANDEMIC: AN ANALYTICAL STUDY

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Highlights: (1) Stress during the COVID-19 pandemic affected sleep quality and patterns. (2) Quality sleep reduces stress and improves mental health. (3) Better mental health brings physical benefits and collective well-being.

PRE-PROOF

(as accepted)

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ABSTRACT

This study aimed to analyze the relationship between sleep quality and perceived stress among university students during the COVID-19 pandemic. This was a cross-sectional and analytical study conducted with 163 university students. Data were collected using a Google Forms questionnaire containing socioeconomic questions, items related to academic dynamics, sleep patterns, and COVID-19 infection. The Perceived Stress Scale, 14-item version (PSS-14), was also included. Data were analyzed using the R software through descriptive and inferential statistics. Regarding sleep patterns, 112 participants (68.7%) reported changes in their sleep pattern, and 33 (20.2%) reported sleeping less than six hours per day. Self-reported sleep quality was classified as "very good" (n = 14; 8.6%), "good" (n = 84; 51.5%), "poor" (n = 55; 33.7%), and "very poor" (n = 10; 6.2%). When assessing perceived stress levels among participants, most reported that they were never able to cope with the things they had to do (57.7%), and that they sometimes dealt successfully with difficult problems in life (40.5%). When analyzing the association between variables related to sleep and perceived stress among university students during the COVID-19 pandemic, higher stress levels were associated with the absence of good sleep ($p = 0.002$) and poorer sleep quality ($p = 0.001$), as well as with sleep alterations ($p = 0.001$) and the degree of sleep change ($p = 0.038$). Furthermore, students experiencing stress sometimes or always reported changes in their sleep pattern ($p < 0.05$). The perceived stress experienced by participants during the COVID-19 pandemic affected sleep quality and contributed to changes in sleep patterns.

Keywords: Mental Health; COVID-19; Perceived Stress; Sleep Quality; Students.

INTRODUCTION

In 2019, specific cases of pneumonia caused by a new type of coronavirus, SARS-CoV-2, the cause of Covid-19, were reported in China. The transmission of this virus quickly became a threat to global health, and by the end of 2022, approximately 660 million cases of this infection had been reported worldwide[1]. And in Brazil, up to the first half of March 2022, the disease had infected more than 29 million Brazilians, leading to 650,000 deaths[2-3].

The main acute clinical manifestations of Covid-19 are: fever, chills, cough, sore throat, myalgia, nausea, vomiting, and diarrhea. These presentations vary according to the viral

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strain and the occurrence of associated diseases. Severe cases of the disease, for example, can lead to heart and respiratory failure, acute respiratory distress syndrome, or even death. Furthermore, it is noteworthy that the Covid-19 pandemic has had serious effects on people's mental health[4-5], regardless of whether they were infected.

A wide range of psychological impacts were observed at the individual, community, national, and international levels during the Covid-19 pandemic. At the individual level, people were more likely to fear becoming ill or dying, and in addition to mandatory social isolation, they felt helpless, stressed, anxious, and depressed[6]. Furthermore, individuals with the illness presented various symptoms of mental trauma, such as emotional distress, depression, stress, distress, mood swings, irritability, insomnia, attention deficit, hyperactivity disorder, post-traumatic stress disorder, and anger[7].

Regarding the mental health of university students, the target audience of this research, American researchers identified increased stress and anxiety as impacts of the Covid-19 pandemic. Furthermore, depressive thoughts, difficulty concentrating, decreased social interaction, increased concern about academic performance, and disruptions in sleep patterns were also listed among the negative feelings generated by this period[8-9].

Sleep disorders are mental health problems that have been significantly associated with the coronavirus pandemic, which has affected people's lives, since sleep is a fundamental physiological function for maintaining physical and mental well-being, linked to quality of life[10]. Also, prolonged isolation, the unpredictability of the disease, financial insecurity, and exposure to tragic media statistics exacerbated existing vulnerabilities and disrupted crisis adaptation methods, leading to the pandemic being characterized as a mass traumatic event[11-12].

Health crises, such as pandemics, lead to changes in the psychological sphere not only among those on the front line of care, such as healthcare workers, but also across the general population, particularly among those affected by the changes required throughout the period[13-14], as occurred with university students, especially due to adaptations in the teaching modality. In this context, the early identification of psychological disorders at their initial stages makes intervention strategies more effective[15]. Therefore, it is imperative to develop investigations that explore the impacts and consequences of the COVID-19 pandemic on people's mental

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health and sleep quality, with the aim of supporting the development of actions that promote mental health and quality of life. Thus, this study aimed to analyze the relationship between sleep quality and perceived stress among university students during the COVID-19 pandemic.

METHODS

This is a quantitative study with a cross-sectional design, guided by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement, conducted between May and July 2022 with university students from a coastal city in the state of São Paulo, Brazil.

The sample consisted of adults aged 18 years or older who were duly enrolled in a higher education institution located on the coast of the state of São Paulo, Brazil. At the beginning of 2022, a total of 1,354 students were enrolled in the institution. The sample size was calculated using the finite population formula commonly applied in epidemiological studies. A required sample of 209 university students was estimated, considering a 5% margin of error and a 95% confidence level. However, only 163 participants completed the data collection instrument. Therefore, a post hoc power analysis was performed using G*Power software, applying the Student's t-test (for paired samples), assuming an effect size of 0.5, a sample of 163 participants, a significance level of 5%, and a 95% confidence interval. The analysis indicated a statistical power of approximately 0.995 (99.5%), suggesting a high probability of detecting a true effect if one exists.

As inclusion criteria, participants were required to have an active enrollment in one of the seven undergraduate programs offered by the higher education institution (Business Administration, Law, Physical Education, Nursing, Civil Engineering, Physiotherapy, and Medicine) during the data collection period and to be attending classes in either face-to-face or hybrid modalities. Students who were not enrolled in an undergraduate program at the institution between 2020 and 2021 or who were on leave from academic activities during the pandemic period were excluded.

Data were collected online through Google Forms, developed by the authors. Initially, the questionnaire was sent via email to students with active enrollment at the institution, along with the Informed Consent Form. To enable this, a formal request for access to students' email

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addresses was submitted to the institutional administration. Additionally, reminders about the study were provided in classrooms to help achieve the planned sample size.

The questionnaire sent by email included, in addition to the informed consent form, questions related to socioeconomic characteristics (sex, age in years, skin color, marital status, employment status, and family income), academic dynamics (undergraduate program and academic stage), COVID-19 infection, and sleep during the pandemic (self-reported sleep quality, hours of sleep, and changes in sleep patterns). It also included the Perceived Stress Scale, version 14[16], to assess the level of stress. This scale indicates the stress perceived by the participants during the last month. Each item provides five response options: never, almost never, sometimes, almost always, and always. Items no. 1, 2, 3, 6, 9 and 10 are scored from 0 to 4; items no. 4, 5, 7 and 8 are scored inversely, from 4 to 12. Scores range from 0 to 40. In this study, scores equal to or greater than 25 were considered as high perceived stress associated with COVID-19.

The collected data were entered using double data entry by independent typists in an Excel spreadsheet and in the R software, and discrepancies were reviewed and corrected by the coordinator of the data collection. The analysis was conducted using descriptive statistics (absolute and relative frequency). Also, the chi-square test was used to verify the association between the studied variables, with Yates' correction for 2x2 tables and Fisher's exact test in cases of expected frequencies lower than 5. The post-hoc study in cases of significant tests was performed using the Holm test for pairwise comparison. A significance level of 5% (p<0.05) was adopted for the analyses.

This research was approved by the Research Ethics Committee of the University of Ribeirão Preto (CAAE: 61451922.8.0000.5498), under opinion no. 5.769.985, and for the conduct of this study, the standards contained in Resolution of the National Health Council no. 466/2012, Resolution no. 510/2016, and Resolution no. 580/2018 were respected.

RESULTS

Most participants in this study were female (69.9%), white (81.5%), enrolled in the third year of different courses (45.4%), in undergraduate courses in the health sciences field (57.7%), single (84.0%), not engaged in any work activity (67.5%), and had a family income

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of more than five minimum wages (40.5%). Furthermore, it is noteworthy that the average age was 25 years (standard deviation=±21).

Of the participants, 87 (55.1%) reported having been infected with the SARS-CoV-2 virus and diagnosed with COVID-19 between 2020 and 2022. Regarding the manifestation of symptoms, the main ones were: headache (38.6%), cough (37.3%), body aches (32.3%), fever (29.7%), runny nose (28.5%), sore throat (27.2%), nasal congestion (26.6%), hyposmia or dysgeusia (24%), shortness of breath (17.1%), diarrhea (8.9%), and dermatitis (2.5%). In addition, 134 (84.8%) participants reported that someone in their family had contracted the disease. Regarding the need for medical assistance for COVID-19 care, 152 (96.2%) denied seeking these professionals.

When investigating the sleep patterns of university students during the Covid-19 pandemic, 112 (68.7%) reported changes in their sleep patterns and 33 (20.2%) reported sleeping less than six hours a day. Self-reported sleep quality was expressed as "very good" (n= 14; 8.6%), "good" (n= 84; 51.5%), "poor" (n= 55; 33.7%), and "very poor" (n= 10; 6.2%) (Figure 1).
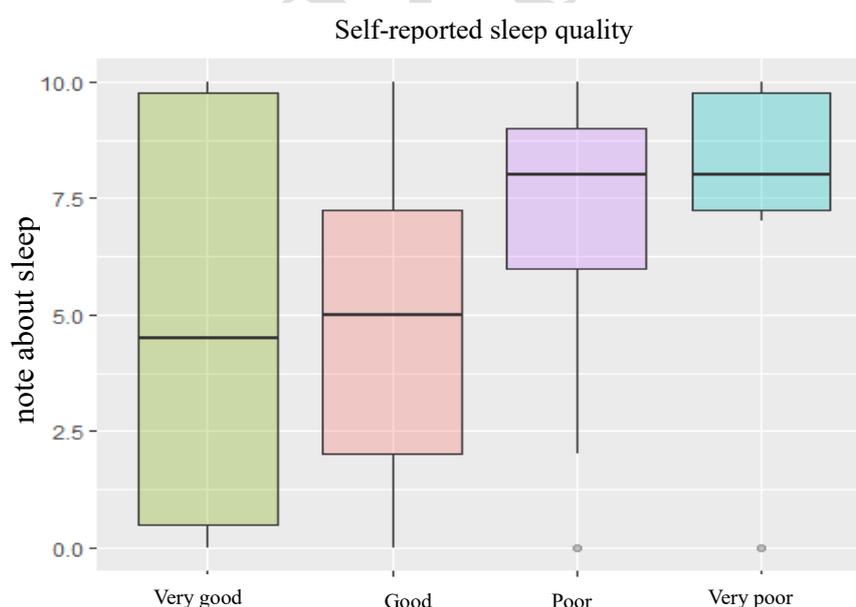
Figure 1. Boxplot on the sleep quality of Brazilian university students during the COVID-19 pandemic. Guarujá, SP, Brazil, 2024. (n= 163).

Source: prepared by the authors (2024)

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When assessing the level of stress perceived by the participants, it is noted that the majority: always felt that difficulties had accumulated to the point of believing they could not overcome them (25.8%), felt nervous or stressed in the last month (35.0%), thought they would not be able to cope with the things they have to do (36.2%) or that they would not be able to cope with the things they should do (57.7%). In addition, sometimes participants felt incapable (27.0%), felt that things were not happening according to their will (32.5%), managed to control how they spend their time (35.6%) and the irritations of their own lives (36.8%), and successfully dealt with difficult life problems (40.5%). And finally, they almost never felt sad in the last month (23.3%) (Table 2).

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Table 2. Stress level of university students, according to the Perceived Stress Scale. Guarujá,
SP, Brazil, 2024. (n= 163)

Variables	Always	Almost always	Sometimes	Almost never	Never
In the last month, how often have you felt sad because of something that happened unexpectedly?	37 (22.7%)	35 (21.5%)	37 (22.7%)	38 (23.3%)	16 (9.8%)
In the last month, how often have you felt unable to control the important things in your life?	33 (20.2%)	34 (20.9%)	44 (27.0%)	31 (19.0%)	21 (12.9%)
In the last month, how often have you felt nervous and stressed?	57 (35.0%)	43 (26.4%)	30 (18.4%)	22 (13.5%)	11 (6.7%)
In the last month, how often have you successfully dealt with life's difficult problems?	11 (6.7%)	44 (27.0%)	66 (40.5%)	29 (17.8%)	13 (8.0%)
In the last month, how often have you felt that things aren't going according to your wishes?	12 (7.4%)	42 (25.8%)	53 (32.5%)	40 (24.5%)	16 (9.8%)
In the last month, how often have you felt that you couldn't handle everything you have to do?	59 (36.2%)	35 (21.5%)	28 (17.2%)	28 (17.2%)	13 (8.0%)
In the last month, how often have you been able to control the irritations in your life?	17 (10.4%)	36 (22.1%)	60 (36.8%)	35 (21.5%)	15 (9.2%)
In the last month, how often have you felt that you couldn't handle everything you have to do?	94 (57.7%)	35 (21.5%)	23 (14.1%)	07 (4.3%)	04 (2.5%)
In the last month, how often have you been able to control how you spend your time?	13 (8.0%)	33 (20.2%)	58 (35.6%)	38 (23.3%)	21 (12.9%)
In the last month, how often have you felt that difficulties are piling up to the point where you believe you can't overcome them?	42 (25.8%)	33 (20.2%)	38 (23.3%)	32 (19.6%)	18 (11.0%)

Source: prepared by the authors (2024)

In turn, when variables related to sleep and perceived stress among university students
during the Covid-19 pandemic were associated, it was observed that high stress levels are
associated with the absence of good sleep (p=0.002) and sleep quality (p=0.001), as well as
sleep disturbances (p=0.001) and the degree of disturbance (p=0.038) (Table 3).

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Table 3. Association between sleep-related variables and perceived stress among university students during the Covid-19 pandemic. Guarujá, SP, Brazil, 2024. (n= 163)

Variables related to sleep	Perceived stress					p-value*
	Always	Almost always	Sometimes	Almost never	Never	
Good sleep						**0.002**
No	31	20	06	07	01	
Yes	26	23	24	15	10	
Sleep disturbance						**0.001**
Yes	45	31	21	11	04	
No	12	12	09	11	07	
Hours of sleep						0.167
Less than six hours a day	18	07	04	03	01	
Six hours or more a day	39	36	26	19	10	
Level of alteration						**0.038**
Completely altered	33	17	10	6	2	
Moderate alteration	17	16	11	8	3	
No alteration	7	10	9	8	6	
Sleep quality						**0.001**
Very poor	6	4	0	0	0	
Poor	25	16	6	7	1	
Good	22	23	19	14	6	
Very good	4	0	5	1	4	
Medication use						0.839
Every day	7	3	1	1	0	
5 or 6 times a week	1	0	0	0	0	
3 or 4 times a week	2	3	0	1	0	
1 or 2 times a week	7	3	4	1	0	
I didn't take any	40	34	25	19	11	
Difficulty staying awake						0.404
Frequently	10	7	2	3	1	
Moderately	26	20	13	7	2	
Rarely	21	16	15	12	8	

Fisher test.

Source: prepared by the authors (2024).

Table 4, which relates good sleep and perceived stress among university students during the Covid-19 pandemic, shows that there is only a statistically significant difference

in the distribution of the categories "sometimes" and "always" (p=0.028). In other words, students who experience stress sometimes or always alter their sleep patterns.

Table 4. Relationship between good sleep and perceived stress among university students during the COVID-19 pandemic. Guarujá, SP, Brazil, 2024. (n= 163)

	Always	**Almost always**	**Sometimes**	**Almost never**	**Never**
Almost always	1.000*	-	-	-	-
Sometimes	**0028***	0.208*	-	-	-
Almost never	0.506*	1.000*	1.000*	-	-
Never	0.066*	0.250*	1.000*	1.000*	-

Holm Test.
Source: prepared by the authors (2024).

DISCUSSION

In the present study, it was observed that the stress perceived by the participants during the Covid-19 pandemic affected the quality and caused alterations in sleep patterns. Before the Covid-19 pandemic, it was already known that students with poor sleep quality were 4.7 times more likely to experience higher stress than students with good sleep quality[17]. During the pandemic, a study conducted with 936 university art students in China identified that COVID-19 stress had a statistically significant association with sleep quality (p<0.001), with poor sleep quality as the outcome[18]. In the same country, but in Liaoning province, research conducted with 1,034 university students revealed that those who experienced more negative emotions had worse sleep quality (p<0.001)[19].

Furthermore, an integrative literature review identified that, among the effects related to disorders in emotional competencies experienced by university students during the COVID-19 pandemic, stress (21.7%) was present, being preceded in prevalence by moderate to severe anxiety (39.1%) and moderate to severe depression (26.0%). In addition, the presence of sleep problems and sleep disturbances (21.7%) was also observed[20]. In this context, a study conducted with 584 students from a federal public university in Brazil revealed poor sleep quality in 428 (73.9%) and stress in 473 (81.0%) during the COVID-19 pandemic[21].

The COVID-19 pandemic contributed to the perception of stress, with the development of psychotic disorders, and to poor sleep quality among university students,

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since students who experienced stress sometimes or always had altered sleep patterns. A longitudinal study conducted in Guangdong Province, China, with 569 university students who completed online surveys twice (time 1: between December 2020 and January 2021; and time 2: between November and December 2021), observed that those who had poor sleep quality at both time points or who changed from good to poor sleep quality had higher levels of post-traumatic stress than those who maintained good sleep quality over time[22].

Poor sleep quality can lead to sympathetic hyperactivity, which generates increased metabolism, systemic blood pressure, heart rate, and secretion of hormones such as cortisol, norepinephrine, and thyroid hormones, thereby resulting in stress[23-25]. It should also be emphasized that stress can affect sleep quality; thus, these variables are considered to have a bidirectional relationship, highlighting the importance of investigating them jointly, both in scientific research and in clinical and healthcare practice.

In addition to stress, poor sleep quality can lead to cognitive impairments, causing deficiencies in sustained attention[26]. This aspect was not investigated in the present study, but it is important to highlight it since the participants were university students, who need to be capable of continuous learning and acquiring skills that will be required in their future profession.

A cross-sectional study conducted with 388 students from a university in Ethiopia identified that insomnia may be significantly related to reduced memory and decreased learning abilities, ultimately leading to a decline in academic performance[27]. A multiple logistic regression analysis also revealed that poor sleep quality was significantly associated with low self-perceived academic performance (Adjusted Odds Ratio = 2.95; 95% CI = 1.25–6.96; p = 0.013) and with students who miss classes (Adjusted Odds Ratio = 1.70; 95% CI = 1.00–2.91; p = 0.046)[28].

In view of the above, it is evident that sleep plays an important role in mental health[29] and in individuals' cognition, as it allows the restoration of the body after the wear generated during waking hours, representing an important physical necessity for the individual's quality of life[30]. In this regard, a meta-analysis conducted with 65 randomized controlled clinical trials, including a total of 8,086 participants, demonstrated significant and positive effects of improved sleep quality on composite mental health, depression, anxiety,

and rumination, as well as on stress and positive symptoms of psychosis. Better sleep quality also showed positive impacts on physical health, with reductions in fatigue, chronic pain, and improvements in health-related quality of life[31].

It is also noteworthy that the stress perceived by the participants in the present study resulted from self-perception of low individual problem-solving capacity commonly mentioned by participants when responding to the PSS scale. Feelings of frustration regarding planned activities were identified, as well as low control over irritation, and consequently perceived stress. It should be noted that the combination of poor sleep and stress among university students during COVID-19 was permeated by changes toward online education, which increased the workload for this population, as it imposed demands for self-organized learning. In addition, isolation resulted in a lack of social support, which may have contributed to depressive symptoms and affected study-related behaviors, such as procrastination, due to fear of failure and beliefs that intensify stress[32].

Thus, it can be observed that improving sleep quality leads to better mental and physical health; therefore, the implementation of health promotion actions involving sleep quality and the prevention or relief of stress among individuals, especially university students, is essential. It should also be emphasized that less invasive practices that promote self-care should be considered, suggesting potential impacts on reducing healthcare costs for the population and addressing the problem at the primary care level[31].

Finally, it should be noted that the present study presented limitations, such as the cross-sectional design, which prevented the establishment of a causal model and does not allow conclusions about cause–effect relationships; and the fact that data collection occurred online and all instruments were self-administered, thus not excluding the possibility of reporting, recall, and social desirability bias.

CONCLUSION

The stress perceived by the participants during the COVID-19 pandemic affected sleep quality and caused changes in sleep patterns. Thus, this study contributes in its originality by providing new and promising insights, as it emphasizes that, to the extent that quality sleep reduces stress and improves mental health, there are implications of benefits for physical health

and for individual and collective well-being. These findings may be applied at the primary care level for the prevention of sleep disorders and the promotion of healthy lifestyle habits.

REFERENCES

[1] Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Boletim Epidemiológico nº 146: Boletim COE Coronavírus. Semana epidemiológica 52. Ministério da Saúde [Internet]. 2022. Disponível em: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/covid-19/2022/boletim-epidemiologico-no-146-boletim-coe-coronavirus/view.

[2] Bavinger JC, Shantha JG, Yeh S. Ebola, COVID-19, and emerging infectious disease: lessons learned and future preparedness. Curr Opin Ophthalmol. 2020 Sep;31(5):416-422. doi: 10.1097/ICU.0000000000000683.

[3] Organização Mundial da Saúde (OMS). COVID-19 Dashboard. [Internet]. Geneva: World Health Organization; 2024. Disponível em: https://data.who.int/dashboards/covid19/cases.

[4] Araújo MFM, Monteiro FPM, de Araújo TM, Lira Neto JCG, Santos LFS, Rolim ILTP, et al. Individual and mutual effects of diabetes, hypertension, and obesity on acute respiratory distress syndrome mortality rates in clinical patients: a multicentre study. Front Public Health. 2023;11:1219271. doi: 10.3389/fpubh.2023.1219271.

[5] Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, Ng CH. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. Lancet Psychiatry. 2020 Mar;7(3):228-229. doi: 10.1016/S2215-0366(20)30046-8.

[6] Glinianowicz M, Ciura D, Burnatowska E, Olszanecka-Glinianowicz M. Psychological effects of the COVID-19 pandemic - what do we know about them? Eur Rev Med Pharmacol Sci. 2023 Jul;27(13):6445-6458. doi: 10.26355/eurrev_202307_33006.

[7] Wu T, Jia X, Shi H, Niu J, Yin X, Xie J, Wang X. Prevalence of mental health problems during the COVID-19 pandemic: A systematic review and meta-analysis. J Affect Disord. 2021 Feb 15;281:91-98. doi: 10.1016/j.jad.2020.11.117.

[8] Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. J Med Internet Res. 2020 Sep 3;22(9):e21279. doi: 10.2196/21279.

[9] Ventura-León J, López-Jurado R, Porturas E, León-Mostacero I, Canchanya-Balbin SE. Anxiety, depression, stress, worry about COVID-19 and fear of loneliness during COVID-19 lockdown in Peru: A network analysis approach. Front Public Health. 2022;10:946697. doi: 10.3389/fpubh.2022.946697.

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[10] Telles SL, Voos MC. Distúrbios do sono durante a pandemia de COVID-19. Fisioter Pesqui [Internet]. 2021;28(2): 124–5. doi: https://doi.org/10.1590/1809-2950/00000028022021.

[11] Bacelar A, Conway SG, Assis M, Silva VM, Genta PR, Pachito DV, et al. Insomnia symptoms during the covid-19 pandemic: a case-control study. Rev Saúde Pública [Internet]. 2023; 57(Supl.1):8. doi: https://doi.org/10.11606/s1518-8787.2023057004801.

[12] Horesh D, Brown AD. Traumatic stress in the age of COVID-19: A call to close critical gaps and adapt to new realities. Psychol Trauma [Internet]. 2020;12(4):331-335. doi: 10.1037/tra0000592.

[13] Zhang Y, Wang S, Ding W, Meng Y, Hu H, Liu Z, et al. Status and influential factors of anxiety depression and insomnia symptoms in the work resumption period of COVID-19 epidemic: a multicenter cross-sectional study. J Psychosom Res 2020;138:110253. doi: 10.1016/j.jpsychores.2020.110253.

[14] Chen, R.-N., Liang, S.-W., Peng, Y., Li, X.-G., Chen, J.-B., Tang, S.-Y., Zhao, J.-B., 2020a.Mental health status and change in living rhythms among college students in China during the COVID-19 pandemic: A large-scale survey. J. Psychosom. Res 2020;137:110219. doi: https://doi.org/10.1016/j.jpsychores.2020.110219.

[15] Bourmistrova NW, Solomon T, Braude P, Strawbridge R, Carter B. Long-term effects of COVID-19 on mental health: A systematic review. J Affect Disord. 2022;299:118-125. doi: 10.1016/j.jad.2021.11.031.

[16] Pedrozo-Pupo JC, Pedrozo-Cortés MJ, Campo-Arias A. Perceived stress associated with COVID-19 epidemic in Colombia: an online survey. Cad Saúde Pública [Internet]. 2020;36(5):e00090520. doi: https://doi.org/10.1590/0102-311X00090520.

[17] Herawati K, Gayatri D. The correlation between sleep quality and levels of stress among students in Universitas Indonesia. Enfermería Clínica. 2019;29:357-61. doi: https://doi.org/10.1016/j.enfcli.2019.04.044.

[18] Liu R, Qiu Q, Ye B. The relationship between COVID-19 stress and test anxiety in art students: the chain mediating roles of intolerance of uncertainty and sleep quality. BMC Public Health. 2024;24(1):1163. doi: 10.1186/s12889-024-18684-7.

[19] Liu F, Liang W, Li H, Li Y, Zhang Y, Ding L, Zhang Q, Chen L. What can we learn about stress and sleep from COVID-19 pandemic-perspective from the theory of preventive stress management. Front Public Health. 2024;12:1383966. doi: 10.3389/fpubh.2024.1383966.

[20] Fiorentin L, Beltrame V. Distanciamento social por Covid 19: repercussão na rotina de universitários. Revista Cuidarte [Internet]. 2022;13(1): e2093. Disponível em: https://revistas.udes.edu.co/cuidarte/article/view/2093.

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[21] Baumgratz LD, José Maria AR, Oliveira MM, Gomes Júnior LC, Cândido APC, Moreira AVB, et al. Dificuldades financeiras, aspectos alimentares e de saúde em estudantes universitários, durante a pandemia de Covid-19. DEMETRA [Internet]. 2023;18:e72281. Disponível em: ht22tps://www.e-publicacoes.uerj.br/demetra/article/view/72281.

[22] Feng J, Lau PWC, Shi L, Huang WY. Longitudinal Shifts in Movement Behaviors during the COVID-Pandemic: Relations to Posttraumatic Stress Disorder among University Students. Int J Environ Res Public Health. 2022;19(20):13449. doi: 10.3390/ijerph192013449.

[23] Moraes CA, Edelmuth DG, Novo NF, Hübner CV. Qualidade de Sono em Estudantes de Medicina do Método de Aprendizado Baseado em Problemas. Medicina (Ribeirão Preto) [Internet]. 2013;46(4):389-97. Disponível em: https://www.revistas.usp.br/rmrp/article/view/73517.

[24] Kahn M, Sheppes G, Sadeh A. Sleep and emotions: bidirectional links and underlying mechanisms. Int J Psychophysiol[Internet]. 2013;89(2):218-28. Disponível em: 10.1016/j.ijpsycho.2013.05.010.

[25] Kuetting DLR, Feisst A, Sprinkart AM, Homsi R, Luetkens J, Thomas D, et al. Effects of a 24-hr-shift-related short-term sleep deprivation on cardiac function: A cardiac magnetic resonance-based study. J Sleep Res. 2019;28(3):e12665. doi: 10.1111/jsr.12665.

[26] MacDonald KJ, Lustig KA, Geniole SN, McCormick CM, Cote KA. Sleep restriction alters reactive aggressive behavior and its relationship with sex hormones. Aggress Behav. 2019;45(2):193-205. doi: 10.1002/ab.21809.

[27] Haile YG, Alemu SM, Habtewold TD. Insomnia and Its Temporal Association with Academic Performance among University Students: A Cross-Sectional Study. Biomed Res Int. 2017;2017:2542367. Disponível em: 10.1155/2017/2542367.

[28] Jie KY, Mohamad N, Mohd Adnan M, Mohd Nor NA, Abdul Hamid NF, Abllah Z. Factors associated with poor sleep quality among dental students in Malaysia. PeerJ. 2024;12:e17522. doi: 10.7717/peerj.17522.

[29] Tang W, Hu T, Hu B, Jin C, Wang G, Xie C, Chen S, Xu J. Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. J Affect Disord. 2020;274:1-7. doi: 10.1016/j.jad.2020.05.009.

[30] Bardini R, Pereira TF, Sakae TM, Remor KVT. Prevalência de sonolência excessiva diurna e fatores associados em adolescentes universitários do sul catarinense. Arq Catarin Med . 2017;46(1):107-24. Disponível em: https://revista.acm.org.br/arquivos/article/view/257.

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[31] 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. doi: 10.1016/j.smrv.2021.101556.

[32] Auerswald S, Koddebusch C, Hermann C. Elevated perceived stress in university students due to the COVID-19 pandemic: Potential contributing factors in a propensity-score-matched sample. Scand J Psychol. 2024;65:715-728. doi: https://doi.org/10.1111/sjop.13013.

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