



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

IJDR

International Journal of Development Research

Vol. 12, Issue, 12, pp. 60787-60791, December, 2022

<https://doi.org/10.37118/ijdr.25967.12.2022>



RESEARCH ARTICLE

OPEN ACCESS

THE EFFECTS OF PHYSICAL EXERCISE ON SLEEP QUALITY AND STRESS IN MEDICAL STUDENTS IN THE RETURN TO PRESENTIAL ACTIVITIES AFTER THE COVID-19 PANDEMIC

Marina de Sousa Aguiar*¹, Giovanna Marques Resende², Karina Magalhaes Alves da Mata Fernandes³ and Cleverson Rodrigues Fernandes³

¹Graduate student of Medicine Course, Scholarship Holder of the Scientific Initiation Program, University of Rio Verde, Medical School from Formosa-GO; ²Graduate student of medicine course, University of Rio Verde, Medical School from Formosa-GO; ³Advisor, professor Dr. Of Medical School from Formosa-GO

ARTICLE INFO

Article History:

Received 22nd September, 2022

Received in revised form

06th October, 2022

Accepted 17th November, 2022

Published online 25th December, 2022

Key Words:

COVID-19. Psychological Stress. Sleep Hygiene. Sleep Deprivation.

*Corresponding author:

Marina de Sousa Aguiar

ABSTRACT

Sleep is a physiological and behavioral essential state to life, playing an essential role in homeostasis, cognitive function and neural plasticity. Thus, the objective was to understand sleep quality, stress and physical activity of medical students after the COVID-19 pandemic. It was a cross-sectional, quantitative and descriptive study which was sent to the Ethics Committee with protocol: 4,678,352/2021. The research had the participation of medical students from the first to the sixth semester of the University, that fulfilled the eligibility criteria and answered the sociodemographic questionnaire and the Pittsburgh Sleep Quality Index (PSQI). Data were evaluated using the Graph Pad Prism 9 program, using the nonparametric t-Student test statistic. As a result, it was observed that the COVID-19 pandemic is involved in series of changes in the social sphere, with emotional impact (stress), and repercussions on the practice of physical activity of medical students. In this sense, it can be said that the COVID-19 pandemic must be understood as much more than just a danger of infectious disease, and that its impact on mental and physical health during distance learning and after the face-to-face return to the academic group should not be overlooked.

Copyright©2022, Marina de Sousa Aguiar et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Marina de Sousa Aguiar, Giovanna Marques Resende, Karina Magalhaes Alves da Mata Fernandes and Cleverson Rodrigues Fernandes. 2022. "The effects of physical exercise on sleep quality and stress in medical students in the return to presential activities after the COVID-19 pandemic.". *International Journal of Development Research*, 12, (12), 60787-60791.

INTRODUCTION

After being declared by the World Health Organization (WHO, 2020), the COVID-19 outbreak was initially considered as a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, and subsequently declared as a pandemic on March 11, 2020 (apud SARASWATHI *et al.* 2020). Due to the new variants and the worsening condition of patients with COVID-19, it was necessary to establish restrictive measures. Therefore, medical students encountered challenges regarding the distance learning proposed to them, through the use of instruments and digital platforms, which negatively affected the mental health of these individuals during the quarantine, which made them more prone to poor health, sleep quality and high levels of depression and anxiety (SARASWATHI, *et al.*, 2020). Based on the above, it is known that sleep disorders are happening more often, especially in the academic field.

In that regard, anxiety, stress and exogenous factors, such as media hyperstimulation, contribute to sleep dysregulation. Therefore, it is clear that the pandemic also had negative effects on the lives of medical students, which can be related to the challenges regarding the shocks of their academic training, the news about the protection of personal protective equipment, and, consequently, the fear of infection by the virus and its multisystem repercussions (SARASWATHI, *et al.*, 2020). Buysse, in 2014, defined "sleep health" as a multidimensional sleep-wake model that can be adjusted according to personal, social and environmental needs to provide physical and mental health. It is characterized by subjective satisfaction during the waking period, appropriate time, adequate duration, high efficiency and continuous alertness. There is still no defined sleep period, according to The National Sleep Foundation, it is recommended that healthy adults have 7 to 9 hours of sleep per night (HIRSHKOWITZ, *et al.*, 2015). In the view of the above, sleep is a natural biological process of the body and essential to repair and maintain the biopsychosocial balance of human beings, that can be

manipulated, but cannot be avoided. Thus, it is important to choose the sleep environment and the number of slept hours, as studies have shown that few nights of sleep increase the chance of cardiovascular, metabolic and tumor diseases (GRANDNER MA, *et al.* 2012; ARAUJO, *et al.*, 2015; ARAUJO, *et al.*, 2013). Sleep has been defined as a complex physiological state, which requires complete brain integration, during the changes in physiological and behavioral processes occur (GEIB, 2003; OLIVEIRA, 2012). The main causes of sleep disorders can be divided into pathological conditions, psychological conditions and other factors. Pathological conditions involving the cardiovascular system, such as heart failure, in the neurological system are evident. In addition, there are strokes, headaches and sleep apnea, as well as common endocrine disorders such as hyperthyroidism, pregnancy and diabetes mellitus. By this way, psychiatric conditions, such as depression and anxiety, predispose to insomnia, a dysfunction in which patients have difficulty falling asleep and staying asleep (KARNA B, GUPTA V., 2021). The sleep-wake cycle is described as a circadian rhythm, which in normal conditions synchronizes with environmental factors and varies over a 24-hour period. Factors as luminosity, working at night, loud environmental noise, school schedules, leisure and family activities, as well as the use of sympathomimetic substances, are called exogenous factors, and interfere in this cycle. Furthermore, endogenously, this period is regulated by a neural structure located in the hypothalamus, the suprachiasmatic nucleus (ALMONDES K., ARAUJO J., 2003; KARNA B, GUPTA V., 2021). Thus, sleep has a decisive role in memory consolidation, promoting the processing of new information; on the other hand, its deprivation, even partially, will have a negative impact on learning, causing memory problems, decreased school performance and behavior problems, irritability, tension and anxiety (MARTINI, *et al.*, 2012). It is inferred that students suffer from changes in lifestyle and patterns of the sleep-wake cycle according to the above-mentioned factors. Factors that act in a counterproductive way in the process of synchronizing the sleep-wake cycle. Furthermore, there are still academic demands and class schedules, which tend to disrupt the light-dark cycle (endogenous factor). As a result, there is a decrease in sleep quality and, consequently, a low academic performance (MARTINI, *et al.*, 2012; ALMEIDA, 2015). As water, food, and oxygen, sleep is an important factor in human survival. Combined with physical exercises and a balanced diet, sleep can be adjusted to achieve a dynamic balance of bodily functions, thereby, regulating the immune, cognitive and musculoskeletal systems (ALMEIDA, 2015). It is considered important to understand sleep quality in the context of medical students at the University of Rio Verde - Campus Formosa, in line with the effects of physical exercise on sleep quality and stress in the return to face-to-face activities after the COVID-19 pandemic. 19.

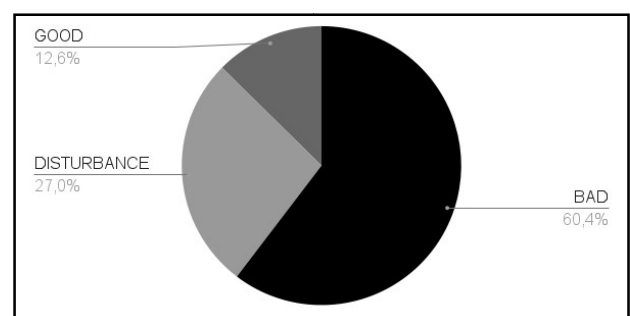
MATERIAL AND METHODS

This is a cross-sectional, quantitative and descriptive study, in the form of applying questionnaires to each participant accomplished on the premises of the university. The application took place during the break between classes. The applicator previously read the Free and Informed Consent Term and, soon after, the academics signed it. The sample consisted of 111 academics, corresponding to 24.6% of the 450 students enrolled at the Faculty of Medicine of Formosa (FAMEF), from the first to the sixth period of the second half of 2021. Medical students were included in the study who entered the university since the selection process 1/2019 to newcomers 2/2021, students who are in their first graduation, students over 18 years old, and those academics who were properly enrolled in the FAMEF Medicine course. Academics who had already attended more than one period of another graduation or who are already trained in another course, those who performed night activities between 7p.m. and 7a.m., academics who had children between 0-5 years old and those who were not in the classroom when the questionnaires were applied. The questionnaires were applied in the week that had completed four weeks of return to presencial activities and had synergism with the week before the tests. Due to eventualities, it was not possible to apply the questionnaires in the fourth period of the semester 2/2021.

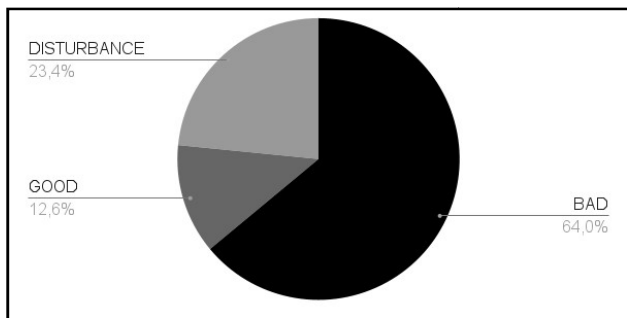
The collected data were added to a Google Forms program database and then entered into an Excel spreadsheet for further analysis. Said that, statistical analyzes were carried out, through the correlation of the evaluated items, via the Graph Pad Prism 9 Program, using the non-parametric Student t-test statistics represented in graphs. Of the 111 academics participating in the study, 19 were in the first period, 15 in the second, 36 in the third, zero (0) in the fourth, 13 in the fifth and 28 in the sixth. Different questionnaires can be used in the clinical routine to assess sleep quality. In this study, two self-administered questionnaires were applied: the Pittsburgh Sleep Quality Index (PSQI) – translated and validated into Portuguese and a sociodemographic questionnaire. So, the applied questionnaire, PSQI, consists of 19 questions grouped into seven sleep components, namely: subjective quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, medication use and daily dysfunction. To each component, the score can vary from 0 (no difficulty) to 3 (severe difficulty). By the end, a maximum score of 21 points is reached, with scores of 0-4 indicating good sleep quality, 5-10 indicating poor quality, and scores above 10 indicating sleep disturbance. Scores above 5 points indicate poor sleep quality (SILVA CC, *et al.*, 2004; PASSOS MHP, *et al.*, 2017; RIBEIRO CRF, SILVA YMGP, OLIVEIRA SMC, 2014). In the application referring to sleep analysis during distance learning, the PSQI was applied without modifications. Regarding the face-to-face period, the scale had a change, being evaluated only the week before the test. Each individual was also evaluated via a sociodemographic questionnaire, which analyzed sex, age, period in which the student was, whether or not they did physical exercise, whether they drank coffee, whether there was improvement or deterioration in academic achievement before and after distance learning (EaD), whether stress increased or decreased with distance learning and whether stress had any changes during this period. The guidelines and standards recommended by Resolution 466 of 2012 of the National Health Council, which regulates research involving human beings, were observed and obeyed, and the study was submitted to the Research Ethics Committee for evaluation, with opinion number 4,678,352 /2021.

RESULTS E DISCUSSION

In view of the data collected, a sample of 111 academics was analyzed, consisting of forms filled out by students from the 1st to the 6th period, with the exception of the fourth period, respectively: 19 (17.12%), 15 (13.5%), 36 (32.4%), 13 (11.7%) and 28 (25.2%). Therefore, it can be seen from Graph 1 that the data referring to the assessment of sleep quality in the month prior to the month in which the data were collected was named BEFORE, that is, the students were in a teaching model a distance. Thus, 60.4% of the medical students presented, in view of the total score of the PSQI scale, a poor quality of sleep, while 27% of the students presented sleep disturbance and only 12.6% obtained a good quality of sleep. In comparison with the quality of sleep in the week after the analysis, in which the academics returned to face-to-face teaching – modified PSQI scale, represented by Graph 2 – the data were named AFTER. In this case, there was a 3.6% increase in sleep disturbances, and a decrease in sleep disturbances, while sleep considered good remained the same.



Graphic 1. Sleep quality assessment Before



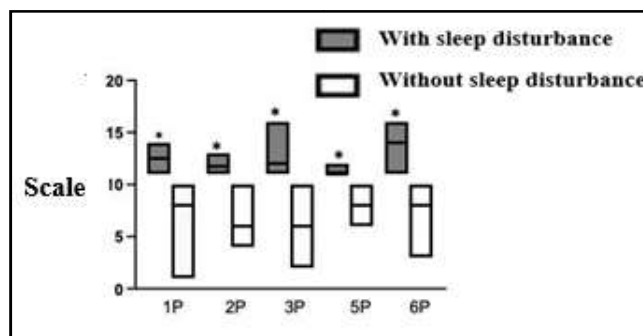
Graphic 2. Sleep quality assessment After

Through Pearson's coefficient of variation, based on two variables, the total score on the Pittsburgh scale a month ago and a week ago considering the data collected, it is reported that all correlations were positive, indicating positive asymmetry. In view of the above, the comparison of the variation in the general total score, through the general Pearson coefficient, was 0.515, with the lowest coefficient referring to the first period, and the highest coefficient analyzed, that is, the closest to 1, corresponding to the sixth period. Thus, the assessment of sleep quality, based on the PSQI, referring to items one to ten, comparing items eleven to nineteen and matching the total score of all components, it is evident that, with regard to the in the first period, there was a decrease in both poor sleep quality and sleep disturbances, respectively, by 1.8% and 0.9%, comparing distance learning and face-to-face teaching. Meanwhile, in relation to the second period, it is noticed that there was no change between the three variables of sleep quality evaluated: good, bad and sleep disturbance.

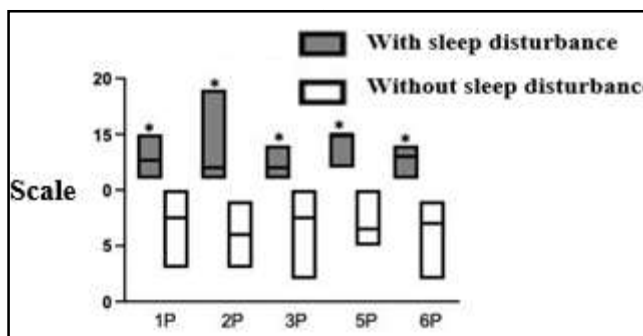
On the other hand, in the analysis of the possibility of sleep disorders, the third period showed an increase of approximately 4.5% in the worsening of sleep, in addition, there was an increase of 9% in sleep disorders, due to the return of face-to-face teaching. However, in the evaluation of the students in the fifth period, initially, 100% of the analyzed ones had poor sleep quality, while, in the second analysis, there was an increase of 2.7% in the quality of sleep considered good. Thus, there was a decrease of less than 1% in the worsening of sleep, and a decrease of 1.8% in the presence of sleep disorders. Finally, the sixth period showed an increase in the quality of sleep, referred to as poor, of 2.7%, as well as a decrease in the quality of good sleep and the presence of sleep disorders of, respectively, 0.9% and 1.8%. As for the use of stimulant or sedative substances, among the evaluated academics, the majority denied the use, corresponding to 84.8% of the analyzed sample. Among those who claimed to use such substances, they claimed to use alcohol, prescription drugs and narcotics. In addition, there was a predominance of coffee consumption, regularly once or twice a day.

In that way, factors that interfere with the quality of sleep of students, identified by the PSQI questionnaires, were evaluated, based on the mode of the two analyzed variables, among which the most relevant were the feeling of being too hot, anxiety attacks and stress as a malefic factor, in addition to the interference of bad dreams and muscle spasms during sleep. In this way, it is worth to highlight that both during distance learning and in the face-to-face model, academics demonstrated how problematic it is to remain sufficiently enthusiastic when carrying out the activities offered, and the frequency of one to three times or more per week exceeds 50%. Graph 3 – Sleep disturbance BEFORE Graph 4 – Sleep disturbance AFTER. In the present article, the results of the obtained sample were based on the GraphPad Prism 9 Program, with the assistance of the non-parametric Student t-Test (Mann-Whitney) represented in graphs. The chosen significance level was 5%. In this form, it was evident that regarding sleep disorders, during the pandemic which is referred to as BEFORE, as well as from the perspective of sleep quality in university teaching in person, referred to as AFTER, respectively, graphs 3 and 4, there was a statistical difference in all evaluated periods.

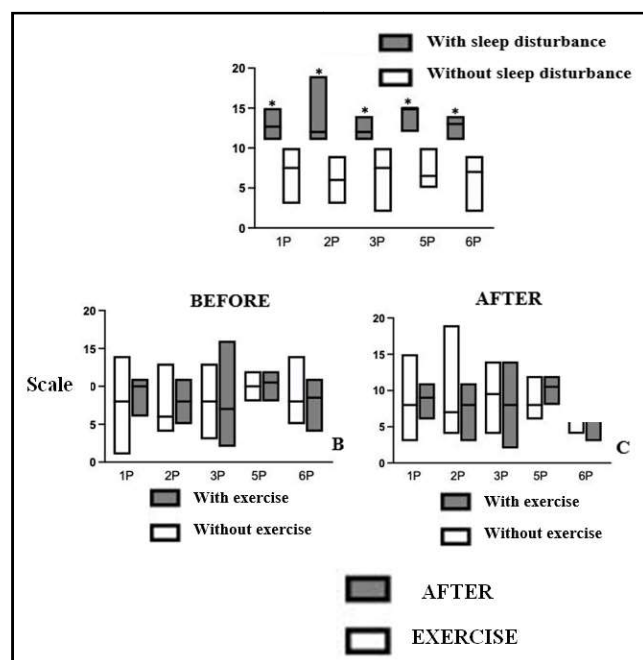
With this, the relationship with the level of stress of the academics analyzed was confirmed, being directly proportional to the presence of the sleep disorder.



Graphic 3. Sleep disturbance BEFORE



Graphic 4. Sleep disturbance AFTER

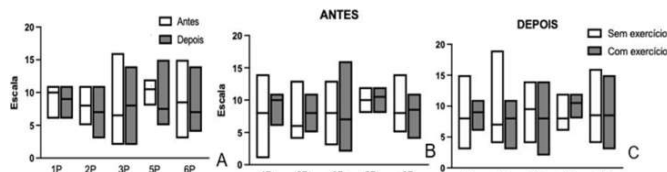


Statistically significant results. *p values < 0.05. Source: own authors (2022)

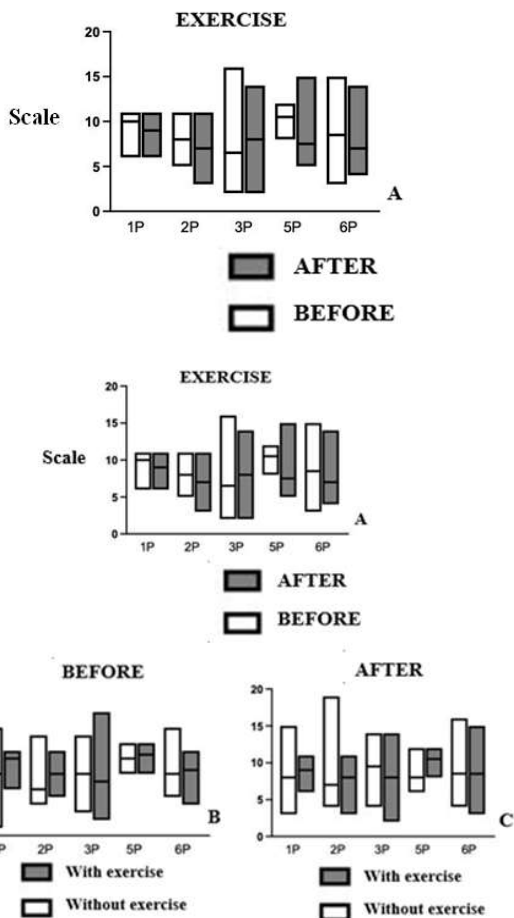
Graphs 5. Practice of physical exercises in medical students BEFORE and AFTER with and without physical exercises

In regard to academics who perform physical exercise, described through the analyzed periods, it was verified, according to the Student's t-test statistical pattern, that there was no statistical difference, as shown in graph 5A below. Graphs 5B and 5C show the correlation between the execution of physical exercises during and after the pandemic, analyzing the students of the evaluated periods. Even though there was no statistical difference, this correlation showed a tendency to reduce physical exercise after the pandemic in the first, second and third periods.

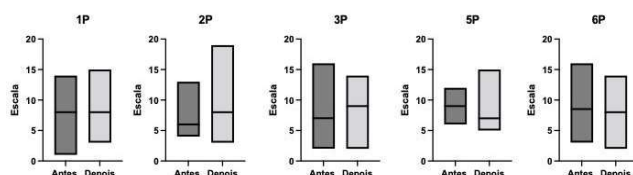
However, still based on the performance of exercise, comparing the parameters of BEFORE and AFTER, even though there was no statistical difference, there was a tendency to increase the practice of physical activities after the pandemic in periods one, two and five; as well as a decrease in it after the pandemic in periods three and six, as shown in graph 6 below.



A. Practice of physical exercises by academics BEFORE and AFTER. B and C. Practice of physical exercises in all periods BEFORE and AFTER.



It is observed that physical activity has little clinical relevance for sleep disorders, compared to the study by LASTELLA, *et al.* (2021), in which nine of the evaluated studies (56.25%) found positive effects of napping on physical performance measures, concluding that napping improves cognitive performance in the form of visual reaction time, attention and mental rotation tasks.



Graphics 6. Practice of physical exercises by students in each period BEFORE and AFTER

Given the above, XIE, *et al.* (2021), correlated, after an analysis of 14 studies according to PSQI measures, that regarding the type of physical and mind-body exercise, both had favorable effects on sleep

disturbance with significantly greater reductions in PSQI sleep assessment scales. However, the results did not reveal superiority in a specific type of exercise, such as walking, swimming, cycling, among others, related to sleep deprivation, since in our study no such association was found. According to the study by ÖZLÜ, *et al.* (2021), who evaluated the issue of muscle relaxation and sleep quality, noted in a single study that progressive muscle relaxation exercises are effective in eliminating sleep problems in patients with COVID-19. Furthermore, these practices mentioned above revealed that they help in the recovery of patients with chronic obstructive pulmonary disease, for example. Likewise, in the study by ÖZLÜ, *et al.* (2021), it was also shown that there is the possibility of reducing fatigue, anxiety and depression, in addition to providing better quality of sleep by performing progressive muscle relaxation exercises. In view of our study, we did not obtain the same positive relationship when comparing physical activity and sleep. In line with our study, the work by MULYADI, *et al.* (2021), evaluated nursing students, and inferred that of the 3359 students who participated in the research, about 25% of them developed sleep disorders during the COVID-19 pandemic, but it was not compared to the quality of sleep during and after, as well as in our work. It should be noted that in the study by NEWBURY, *et al.* (2021), it was found that sleep deprivation after learning was associated with impairment, rather than facilitation in memory. Thus, it was demonstrated that the medical students in our research could have impaired memory, in view of the sleep deprivation found to be positive.

Given the above, the studies by SUN, *et al.* (2022), demonstrated an important relevance, by conducting a survey with Chinese medical students, in which a prevalence of sleep problems (27.38%) was found, with gender, region, education, as risk factors, grade and type of university, places of residence, socioeconomic status and work concurrent with graduation. In this research by SUN, *et al.* (2022), it was taken into account that from the beginning of the medical course there is a high load of medical knowledge, which with time deepens and becomes complex, which results in a high prevalence of sleep problems. Thus, they found that the prevalence of sleep problems followed a clear upward trend from the second semester onwards and reached the highest rate in the sixth year. According to our research, it was shown that students in the 2nd and 3rd period had worse sleep rates, AFTER distance learning in the 2nd period and BEFORE face-to-face teaching in the 3rd period, during the period of the COVID-19 pandemic. Furthermore, SUN, *et al.* (2022) stated, according to the surveys carried out, the prevalence of sleep problems in traditional Chinese medicine (TCM) universities, which is significantly lower than in Western medical universities, because TCM students are better at adjusting schedules of life according to their specialized courses. According to research conducted by JAHRAMI, *et al.* (2022), found that health workers, university students and special populations had sleep disorders with an overall rate of approximately 41%, according to the 250 meta-analyses analyzed, since the general population was the least affected by the pandemic, with an overall prevalence of sleep disorders of about 36%. Finally, the study cited above, SUN, *et al.* (2022), also evaluated the prevalence of sleep disorders in the COVID-19 pandemic, inferring from articles that 39.7% to 60% of health professionals suffered from poor sleep quality and most are associated to moderate to severe stress during the COVID-19 outbreak, in view of medical students, who are similar to these populations, leading to a greater risk of sleep problems during the pandemic.

CONCLUSION

In summary, the impact of academic performance on sleep quality in the post-pandemic period of COVID-19 is noted, in addition to associated essential factors, such as physical exercise and stress, among medical students at the Universidade de Medicina de Rio de Janeiro. Green, which act as modifying factors of the sleep-wake cycle, assessed using the Pittsburgh Sleep Quality Index (PSQI). In view of this, it is observed that the presence of sleep disturbance is directly proportional to the level of stress that these academics face,

from the beginning of the university journey to the students in the middle of the course. In addition, the reduction in the practice of physical exercise by academics is related to the worsening of sleep quality, as well as to impaired cognitive performance. Finally, it is noted that the results of this research conclude the presence of a positive correlation between the poor quality of sleep of the students evaluated and the performance of physical exercises, comparing the periods of quarantine and return to face-to-face activities, a fact that corroborated the increase in stress caused by this atypical moment in the lives of students. Therefore, it is proposed that more studies be carried out on the quality of sleep and the practice of physical exercises, not only in medical students, but for students of the most diverse courses, such as, for example, in courses of physical education, nutrition and nursing.

REFERÊNCIAS

- ALMEIDA, Bruno Ratier Saconi de. The relevance of sleep as a basic human need in the critical patient scenario. 2015. 64f. Bachelor of Nursing, UnB – Faculty of Ceilândia, Brasília, 2015.
- ALMONDES, Katie Moraes de; ARAUJO, John Fontenele de. Sleep-wake cycle pattern and its relationship with anxiety in university students. *Psychology Studies*, vol. 8, n.1, p.37-43, 2003.
- ARAUJO, Marcos Antônio Nunes *et al.* Sleep patterns in a nursing ward at the State Public University. *Revista Cubana de Enfermería*, Rio Grande, v. 32, no. 2, p. 162-170, May/Sept. 2015.
- ARAUJO, Márcio Flávio Moura de *et al.* Evaluation of the quality of life at the university-fortaleza-CE. *Text Context Nursing*, Florianópolis-SC, v. 22, no. 2, p. 352-360, Apr./June. 2013.
- BUYSSE, Daniel J. Sleep Health: Can We Define It? Does It Matter? Sleep Medicine Institute and Department of Psychiatry, School of Medicine, University of Pittsburgh, Pittsburgh-PA, v. 37, n. 1, p. 9-17, 2014.
- GEIB, Lorena Teresinha Consalter *et al.* Sleep and Aging. *Journal of Psychiatry of Rio Grande do Sul*. Porto Alegre, v.25, n.3, p.453-465, Dec, 2003.
- GRANDNER, Micheal A. *et al.* Sleep disturbance is associated with cardiovascular and metabolic disorders. *J sono Res*. 2012;21:427-33.
- HIRSHKOWITZ, Max. *et al.* National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health*, v. 1, n. 1, p. 40-43, mar. 2015. Elsevier BV.
- JAHRAMI, Haitham A. *et al.* Sleep disturbances during the COVID-19 pandemic: a systematic review, meta-analysis, and meta-regression. *Sleep Medicine Reviews*, [S.L.], v. 62, p. 101591, apr. 2022. Elsevier BV.
- KARNA, Bibek; GUPTA, Vikas. Sleep Disorder. [Updated Feb 6, 2021]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-
 LASTELLA, Michele *et al.* To Nap or Not to Nap? A Systematic Review Evaluating Napping Behavior in Athletes and the Impact on Various Measures of Athletic Performance. *Nature And Science Of Sleep*, [S.L.], v. 13, p. 841-862, jun. 2021. Informa UK Limited.
- MARTINI, Mayara *et al.* Factors associated with sleep quality in Physiotherapy students. *Physioter. Pesqui.*, São Paulo, v. 19, no. 3, p. 261-267, Sept. 2012.
- MULYADI, Mulyadi *et al.* Prevalence of mental health problems and sleep disturbances in nursing students during the COVID-19 pandemic: a systematic review and meta-analysis. *Nurse Education In Practice*, [S.L.], v. 57, p. 103228, Nov. 2021. Elsevier BV.
- NEWBURY, Chloe R. *et al.* Sleep deprivation and memory: meta-analytic reviews of studies on sleep deprivation before and after learning. *Psychological Bulletin*, [S.L.], v. 147, no. 11, p. 1215-1240, Nov. 2021. American Psychological Association (APA).
- OLIVEIRA, João V. The importance of sleeping well. *Rev. Open space*. Ed.140th. São Paulo, 2012.
- ÖZLÜ, İbrahim *et al.* The effects of progressive muscle relaxation exercises on the anxiety and sleep quality of patients with COVID-19: a randomized controlled study. *Perspectives In Psychiatric Care*, [S.L.], v. 57, no. 4, p. 1791-1797, 2 Mar. 2021. Wiley. <http://dx.doi.org/10.1111/ppc.12750>.
- PASSOS, Muana H.P *et al.* Reliability and validity of the Brazilian version of the Pittsburgh Sleep Quality Index in adolescents. *J Pediatr (Rio J)*. Pernambuco, Vol. 93, no. 2, p. 200-206, Mar; 2017.
- RIBEIRO, Caira Rodrigo Faria; SILVA, Yasmin Maria Garcia Prata da; OLIVEIRA, Sandra Márcia Carvalho de. The impact of sleep quality on medical training. *Rev Soc Bras Clin Med*, Rio Branco, v. 12, no. 1, p. 8-14, Jan./Mar. 2014.
- SARASWATHI, Ilango *et al.* Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-19 treating medical college: a prospective longitudinal study. *Peerj*, [S.L.], v. 8, p. 1-25, 16 Oct. 2020.
- SILVA, Carla Cristiane *et al.* Does physical exercise enhance or compromise the longitudinal growth of children and adolescents? Myth or truth?. *Rev Bras Med Esporte*. Sao Paulo, vs. 10, no. 6, Nov/Dec; 2004.
- SUN, Yuanlong *et al.* Prevalence of Sleep Problems Among Chinese Medical Students: a systematic review and meta-analysis. *Frontiers In Psychiatry*, [S.L.], v. 13, no. 62, p. 1-25, 9 Mar. 2022. Frontiers Media SA.
- XIE, Yi *et al.* Effects of Exercise on Sleep Quality and Insomnia in Adults: a systematic review and meta-analysis of randomized controlled trials. *Frontiers In Psychiatry*, [S.L.], v. 12, p. 1-13, 7 Jun. 2021. Frontiers Media SA.
