



Contents lists available at ScienceDirect

Saudi Pharmaceutical Journal

journal homepage: www.sciencedirect.com

Short communication

Impact of COVID-19 lockdown on sleep quality of pharmacy students in UiTM Puncak Alam

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ARTICLE INFO

Article history:

Received 7 March 2022

Accepted 19 July 2022

Available online 28 July 2022

Keywords:

COVID-19

Lockdown

Pharmacy students

Sleep quality

ABSTRACT

Due to the COVID-19 pandemic, the closure of educational institutions was executed during the period of lockdown. This subsequently led to alterations in daily routines and emotional distress, particularly among university students, affecting their sleep quality resulting in disturbance of immune functioning and mood regulation. Hence, the present study aimed to measure students' sleep quality during the first few months of the lockdown period. This study is a cross-sectional, single-centred survey that was done by distributed electronic questionnaire. The e-questionnaire was divided into 4 sections that assessed socio-demographic characteristics, sleep quality, psychological state and engagement in physical activity. Exactly 248 valid responses were received, 82 % female students. Students with poor sleep quality were three times greater than those with good sleep quality. No association were found between physical activity and sleep quality. However, a significant positive relationship between sleep quality and psychological state was observed ($p < 0.01$). In conclusion, this study suggests that the majority of pharmacy students in UiTM Puncak Alam are poor sleepers and psychological distress negatively affects sleep quality but, is mainly due to stress. Thus, interventions such as stress management programs and mental health support can be taken by the faculty's management to overcome this problem.

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1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a virus that causes coronavirus disease, an infectious viral disease also known as COVID-19 (Mohanty et al., 2020). COVID-19 has set off since December 2019 in Wuhan, China and spread globally, leading to the World Health Organization's (WHO) pandemic declaration on 11th March 2020. In response to the outbreak, the Malaysian government enforced a lockdown known as "Movement Control Order" (MCO) on 18th March 2020, which was extended periodically and is still ongoing up until today (Shah et al., 2020). Preventive measures during the MCO led to government and private premises shutdown, international travel bans, and closure of educational institutions, affecting daily movements

and physical activities (Ganasegeran et al., 2020). Not only that, but the restrictive measures also led to stressful circumstances, including the economic downturn, unemployment and financial distress, which trigger psychosocial problems among individuals and cause adverse psychological effects such as anxiety, depression and stress in the general population (Kaur, 2020).

COVID-19 lockdown affects the usual routines of the population and influences their sleep quality. Numerous studies have reported low sleep quality associated with physical activity and psychological problems (Silva et al., 2020; Wang et al., 2020). One of the groups seriously affected is the university students. A study revealed declining physical activity among full-time students during the lockdown (Papazisis et al., 2021). Besides, some studies reported that young adults aged 18–25 are most affected by stress, anxiety, and depression and have the highest prevalence of sleep problems during lockdown (Gubelmann et al., 2018; Peretti-Watel et al., 2020). Among university students, sleep is mainly essential to enhance cognitive skills, especially memory retention, giving rise to better academic performance (Maheshwari and Shaukat, 2019).

However, sleep quality is not solely measured based on its duration; it also takes into consideration the sleep efficiency (i.e., the

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Peer review under responsibility of King Saud University.



prevalence of actual sleep during bedtime), sleep timing (i.e., the time going to sleep), sleep architecture (i.e., the structure of sleep cycles during the night), sleep consistency (i.e., variety in sleep duration, day to day), sleep consolidation (i.e. the arrangement of sleep throughout the night) and sleep satisfaction (Chaput et al., 2018). Thus, this study is done to assess the sleep quality of pharmacy students in UiTM Puncak Alam during the pandemic lockdown, including determining the link between sleep quality with physical activity and psychological disturbances.

2. Methods

A cross-sectional, single centred survey was conducted among pharmacy students in the Faculty of Pharmacy, UiTM Puncak Alam. The study was done to measure the sleep quality of pharmacy undergraduate students during the lockdown and determine its association with physical activity and psychological disturbances. The study was conducted on the running semester from October 2020 until July 2021. The subjects of this study are pharmacy students at the Faculty of Pharmacy, UiTM Puncak Alam. According to the academic year 2020–2021, 701 pharmacy students (129 males and 572 females) enrolled in the Faculty of Pharmacy, UiTM Puncak Alam comprising 175 first-year, 158 s-year, 184 third-year, and 184 fourth-year pharmacy students which focussed on the first two months of the lockdown (March–April 2020). The exclusion criteria for this survey was the first-year students as they were not registered as pharmacy students during that time. So, the population size of this study was 526 students. Participants were selected from different study years (the second, third and fourth year) to establish an unbiased sample size representing the whole population of the undergraduate pharmacy program. The required sample size was calculated using Raosoft. A sample size of at least 223 participants was required to obtain a confidence interval (CI) of 95 % and a 5 % margin of error. An electronic questionnaire prepared using Google Form was distributed to the pharmacy students of UiTM Puncak Alam through online platforms such as WhatsApp and Telegram from March 2021 until June 2021. The objectives of this study and information regarding the survey instruments were notified and briefly described to the participants at the beginning of the questionnaire before answering them. The data of the responses were kept confidential. The sampling technique used was stratified random sampling. The strata were based on the study year. The calculated number of samples required for second, third, and fourth-year students was 67, 78 and 78. This study was approved by the Research Ethics Committee (REC), UiTM (Reference number: REC/04/2021 (UG/MR/366).

2.1. Study tools

The questionnaire comprised four sections, with the first section focusing on participants' socio-demographic background, such as gender, living state, household size, and income. Since there is no instrument currently exists that measures the use of gadgets (screen-based devices such as smartphones, tablets, PCs, and television-gaming consoles), participants were asked to estimate total time spent in hours and minutes using each device. Total time for each gadget was quantified in minutes (e.g. 2 h and 30 min = 150 min). The Pittsburgh Sleep Quality Index (PSQI) instrument was used for the second section to evaluate the sleep quality of pharmacy students during the pandemic lockdown. PSQI is being used as the gold standard to assess sleep quality, verified in clinical and non-clinical populations (Backhaus et al., 2002; Buysse et al., 1989). PSQI has excellent internal consistency and reliability with Cronbach's alpha of 0.83 (Smyth, 1999). The PSQI instrument consists of 19 components: subjective sleep quality, expectancy, sleep

length, sleep routine, sleep disruptions, sleeping medications usage, and daytime dysfunction. A score from 0 to 3 was given to each component. The combined scores of all parts resulted in a PSQI global score ranging from 0 to 21. A PSQI global score of 5 or less showed good sleep quality, whereas poor sleep quality was demonstrated by a PSQI global score of greater than 5.

Kessler Psychological Distress Scale (K10) instrument was used in the third section to assess the psychological state of pharmacy students during the lockdown period. K10 is a widely used instrument, validated for its use in general-purpose health surveys with good psychometric properties and a Cronbach's alpha of 0.88 (Sampasa-Kanyinga et al., 2018). It measures the emotional state and identifies the levels of distress through a 10-item questionnaire. Each question was scored from 1 to 5. The total score of all ten questions were further categorised into no stress (below 20), mild stress (20–24), moderate stress (25–29) and severe stress (30–50). Lastly, the Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLTPAQ) was used in the fourth section to evaluate the physical activity of pharmacy students during the lockdown. This instrument has three open-ended items which directly asks the number of times a week (minimum of 15 min) the subjects engage in mild (e.g., easy walking), moderate (e.g., fast walking) and vigorous (e.g., running) physical activity. The score was expressed in units and calculated by multiplying the weekly frequencies of strenuous, moderate and mild activities with 9, 5 and 3, respectively. From the calculated values, three levels of physical activity were developed, consisting of inactive (<14 units), moderately active (14 to 23 units) and active (24 or more units).

2.2. Statistical analysis

The data was analysed using SPSS version 20. The descriptive statistical method using frequencies was applied for the categorical variables. The Shapiro-Wilk test was used to test the distribution of continuous variables. Next, sleep quality (poor and good) was tested against other categorical variables, including gender, study year, household size, household income, hours spent on gadgets, physical activity level and stress level using the Chi-square test. Bivariate analysis was performed between two numerical variables (the global PSQI scores with K10 measures using the non-parametric Spearman correlation as the data was not normally distributed. Non-parametric Spearman correlation test was performed to find out the strength and direction of the correlation. The results in this study with a p-value < 0.05 were considered significant.

3. Results

A sum of 248 students completed the questionnaire, with the female students account for 81.9 % of the responses (Fig. 1). The second, third and fourth-year pharmacy students involved were 29.4 %, 35.5 % and 35.1 %, respectively. About 25.8 % of the respondents were from Selangor (Fig. 1). Only 0.8 % of the students lived in a household size with more than ten people (Table 1). About 44.4 % of the students were categorised as B40 (Bottom 40 %) based on their household income. As for families of M40 (Middle 40 %) and T20 (Top 20 %), they represented about 36.7 % and 19.0 %, respectively. The majority of the students (48.8 %) claimed to spend 5 to 10 h on gadgets (Table 1).

According to the PSQI calculation, 77 % of the respondents were poor sleepers (Table 1). About 56 % of the students were reported to experience active physical activity compared to 28.2 % who were inactive, based on the GSLTPQA scoring. Stress was prominent in the majority of the students, with 23.4 %, 16.5 % and 35.5 % were classified as mild, moderate and severe stress, respectively, as shown by the K10 scoring. The factor which significantly affected

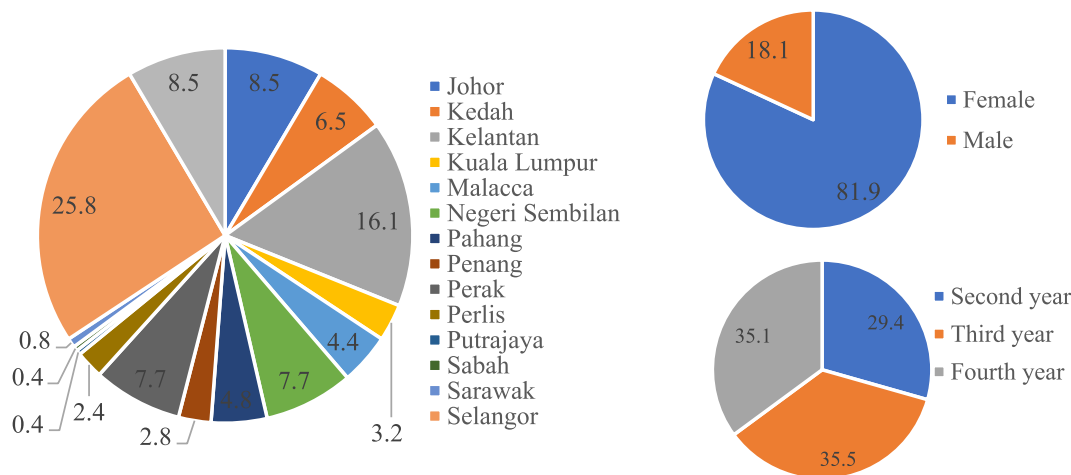


Fig. 1. Demographics of respondents.

Table 1
Sleep quality, physical activity, stress level and factors associated with sleep quality of respondents.

Variables	Percentage of respondents (% , N)	Good Sleep Quality (PSQI ≤ 5), % (N)	Poor Sleep Quality (PSQI greater than 5, % (N))
Gender			
Female	81.9 (203)	23.2 (47)	76.8 (156)
Male	18.1 (45)	22.2 (10)	77.8 (35)
Study Year			
Second-year	29.4 (75)	24.7 (18)	75.3 (55)
Third-year	35.5 (88)	20.5 (18)	79.5 (70)
Fourth-year	35.1 (87)	24.1 (21)	75.9 (66)
Household Size			
Up to 5 people	56.0 (39)	(23.7) 33	76.3 (106)
5 to 10 people	43.1 (107)	(22.4) 24	77.6 (83)
More than 10 people	0.8 (2)	(0.0) 0	100.0 (2)
Household Income			
≤RM4849 (B40)	44.4 (110)	26.4 (29)	73.6 (81)
RM4850 - RM10959 (M40)	36.7 (91)	18.7 (17)	81.3 (74)
≥RM 10,960 (T20)	19.0 (47)	23.4 (11)	76.6 (36)
Hours Spent on Gadgets			
Up to 5 h	10.9 (27)	25.9 (7)	74.1 (20)
5 to 10 h	48.8 (121)	25.6 (31)	74.4 (90)
More than 10 h	40.3 (100)	19.0 (19)	81.0 (81)
Sleep Quality			
Good	23.0 (57)		
Poor	77.0 (191)		
Physical Activity			
Inactive	28.2 (70)	20.0 (14)	80.0 (56)
Moderately active	15.7 (39)	23.1 (9)	76.9 (30)
Active	56.0 (139)	24.5 (34)	75.5 (105)
Stress Level			
No stress	24.6 (61)	52.5 (32)	47.5 (29)
Mild stress	23.4 (58)	22.4 (13)	77.6 (45)
Moderate stress	16.5 (41)	12.2 (5)	87.8 (36)
Severe stress	35.5 (88)	8.0 (7)	92.0 (81)

sleep quality was stress level. More than half of the students with mild, moderate and severe stress of 77.6 %, 87.8 % and 92 %, respectively, were poor sleepers (Table 1). The rest of the students (52.5 %) with no stress demonstrated good sleep quality. Other factors including gender, study year, household size, household income, hours spent on gadgets and physical activity were not significantly associated with sleep quality (p greater than 0.05).

Spearman correlation was run to assess the relationship between sleep quality and stress level involving 248 pharmacy students. It was found that stress level, denoted as K10, significantly affected sleep quality, signified as PSQI. As shown in Fig. 2, a significant positive correlation was observed between stress level and sleep quality, $r_s(246) = 0.501$, ($p < 0.01$).

4. Discussion

COVID-19 pandemic lockdown has led to alterations in daily life activities and the usual routine of the population nationwide. Every individual was pushed to adapt to a new routine that contributed to changes in their physical activity and psychological state, which further could affect their quality of sleep. Students may be vulnerable to the impact of lockdown due to its effect on their academic performance. In addition, students specifically are demanded to keep pace with the 'new normal' whereby they undergo changes in their education routines from physical face-to-face class (before pandemic) to online distance learning (during a pandemic) (Chung et al., 2020).

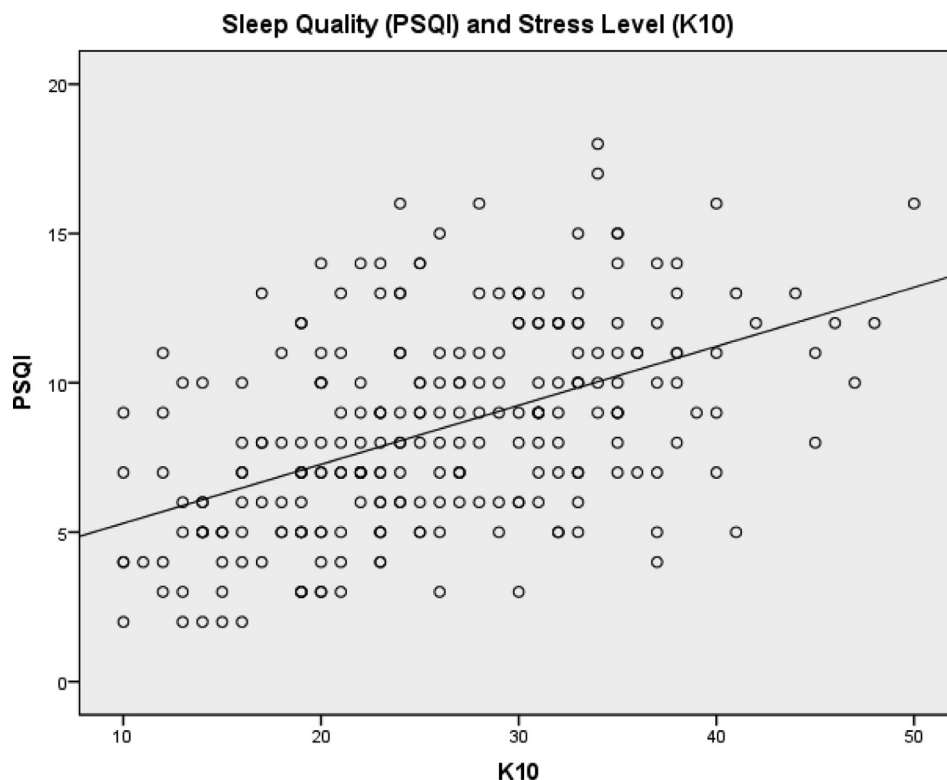


Fig. 2. Sleep Quality and Stress Level of the Respondents.

In this study, about 77 % of the students had poor sleep quality, with the rest accounting for 23 % having good sleep quality. This is consistent with multiple studies done worldwide that reported a high prevalence of poor sleep quality among students during the period of lockdown. This study was corroborated by a study done in Milan, where 73.3 % of the students had poor sleep quality during COVID-19 lockdown (Marelli et al., 2021). The effects of lockdown on sleep were due to delayed bedtime and rise time, increased time spent in bed, and increased sleep latency, which was pronounced among students (Cellini et al., 2021).

A few studies have shown that females are more likely to experience poor sleep quality than males (Fatima et al., 2016; Madrid-Valer et al., 2017). In this current study, the students with poor sleep quality were slightly higher in males (77.8 %) compared to females (76.8 %). However, there were no significant differences between gender and sleep quality ($p = 0.893$) which is in line with a systematic review study that found no significant gender differences in PSQI scores among gender (Alimoradi et al., 2021), even though female is a risk factor for insomnia and mental health problems (Ornell et al., 2020).

A high incidence of students with poor sleep quality was observed in all academic year students (the second year to the fourth year). Nevertheless, no significant differences were observed between study year and sleep quality ($p = 0.779$). The Pharmacy Board Malaysia (PBM) regulates the pharmacy profession in Malaysia and is responsible for recognition of pharmacy undergraduate degrees which in UiTM is divided into Fundamental Years (Year 1 and 2) and Practice Years (Year 3 and 4). However, during the pandemic, the curriculum were revised based on the online distance learning (ODL) framework that considered student learning time. Hence, the impact of changing from dictatic approach to ODL was not substantial.

Previous studies have linked household size and household income with sleep quality during COVID-19 lockdown (Beck et al., 2021; Saadeh et al., 2021). However, in this study, household

size ($p = 0.435$) and household income ($p = 0.472$) did not significantly affect sleep quality. This is supported by a study done in China; monthly income per capita did not affect sleep quality (Li et al., 2020). No significant differences were found between hours spent on gadgets and sleep quality ($p = 0.472$). This outcome was similar to a study performed in the Minnesota State University, Mankato, USA, which studied the effect of electronic device use on the sleep quality of the undergraduate students (Sargent, 2017). However, another study reported a significant weak relationship between gadget addiction and sleep quality, whereby individuals who were severely addicted to gadgets experienced worse sleep quality than those who were mildly addicted to devices (De Niro et al., 2020).

In this present study, physical activity was measured according to students' weekly engagement in mild, moderate and strenuous exercises during the lockdown. Surprisingly, it was observed that more than half (56 %) of the respondents were categorised as physically active, whereas the remaining 16 % and 28 % were classified as moderately active and physically inactive. This data is supported by a study carried out in Spain among health science students. The increase in physical activity among the students may be influenced by their academic programme, which promotes a healthy lifestyle (Romero-Blanco et al., 2020). The same could be said for UiTM's pharmacy students. However, no significant difference was found between physical activity status and sleep quality ($p = 0.770$), which suggested that physical activity was not a determinant for sleep quality in this study.

This study revealed that the majority of the respondents are experiencing stress (mild to severe), with a significant difference detected between the quality of sleep and stress level ($p < 0.01$). The correlation of K10 scores (representing the severity of stress) and PSQI index (defining quality of sleep) between stress and sleep quality also showed a significant positive correlation, $r_{s(246)} = 0.501$, ($p < 0.01$). The higher the K10 scores, the higher the PSQI index, thus implying that increasing stress severity will

lead to poorer sleep quality. The increased occurrence of psychological distress among students may be due to study-related stress such as the closing of campus, future career uncertainty and adaptation to a new remote e-learning environment, among others (von Keyserlingk et al., 2021).

Sleep and stress are directly associated with the hypothalamic-pituitary-adrenal (HPA) axis. Physiologically, this explains the close link between these two factors, sleep and stress, related to (REM), a decline in slow-wave and sleep deficit (Aljomali et al., 2017). This will affect sleep architecture and circadian rhythms, and eventually, these distinctive sleep electroencephalogram changes can cause affective disorders such as depression (Steiger and Pawlowski, 2019). Hence, it is important for students to effectively manage their stress to avoid sleep deprivation or disturbances to minimise physiological disturbances. Not only that, a more effective and improved ODL approach should be implemented to prevent any unnecessary workload (Matthew and Chung, 2021). Furthermore, the Ministry of Higher Education and the Higher Learning Education Providers (HLEP) should undertake proper measures to mitigate any negative impact of the COVID-19 pandemic via motivations and psychosocial counselling (Muniruzzaman & Siddiky, 2021).

5. Limitations

One of the limitations is the students' circadian rhythms were not assessed. This will further determine if the poor sleep during COVID-19 was due to stress or changes in the sleep/wake rhythm. Moreover, this survey should have been extended to other health science programmes in the same institution.

6. Conclusion

In summary, this study identified stress as the main factor influencing sleep quality in pharmacy students during the first month of COVID-19 lockdown. High-stress levels significantly led to poorer sleep quality. Hence, to ensure academic excellence, especially students in the health professions, it is suggested that good stress management will lead to good sleep quality and better physical and mental health. Interventions such as stress management programs based on cognitive behavioural therapy (CBT) can be taken by the management of HLEP to reduce students' stress, which may help minimise disturbances in sleep.

7. Suggestion for future research

This study was carried out on pharmacy students of UiTM. It would benefit this group of people when this study is extended to other pharmacy students in Malaysia and other disciplines. This would paint a better picture in providing the right approach in improving ODL or hybrid learning in the future with the goal of promoting healthy sleep habits to enhance academic performance.

8. Co-author contribution

The authors declared that there is no conflict of interest in this article. Author1, carried out the survey ran the statistical analysis and data interpretation, anchored the article, revisions, and approved the article submission. Author2 conceptualised the central research idea and provided the theoretical framework.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to acknowledge Nurul Fatin Mohd Hattan for assisting in this study and the Faculty of Pharmacy, Universiti Teknologi MARA, for supporting this research.

References

- Alimoradi, Z., Broström, A., Tsang, H.W.H., Griffiths, M.D., Haghayegh, S., Ohayon, M. M., Lin, C.Y., Pakpour, A.H., 2021. Sleep problems during COVID-19 pandemic and its' association to psychological distress: a systematic review and meta-analysis. *EClinicalMedicine* 36., <https://doi.org/10.1016/j.eclinm.2021.100916>
- Almojali, A.I., Almalki, S.A., Alotman, A.S., Masuadi, E.M., Alaqeel, M.K., 2017. The prevalence and association of stress with sleep quality among medical students. *J. Epidemiol. Global Health* 7 (3), 169–174.
- Backhaus, J., Junghanns, K., Broocks, A., Riemann, D., Hohagen, F., 2002. Test-retest reliability and validity of the Pittsburgh Sleep Quality Index in primary insomnia. *J. Psychosom. Res.* 53 (3), 737–740.
- Beck, F., Léger, D., Fressard, L., Peretti-Watel, P., Verger, P., 2021. Covid-19 health crisis and lockdown associated with high level of sleep complaints and hypnotic uptake at the population level. *J. Sleep Res.* 30 (1), e13119.
- Buyse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., Kupfer, D.J., 1989. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 28 (2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4).
- Cellini, N., Conte, F., De Rosa, O., Giganti, F., Malloggi, S., Reynt, M., Guillemin, C., Schmidt, C., Muto, V., Ficca, G., 2021. Changes in sleep timing and subjective sleep quality during the COVID-19 lockdown in Italy and Belgium: age, gender and working status as modulating factors. *Sleep Med.* 77, 112–119.
- Chaput, J.-P., Dutil, C., Sampasa-Kanyinga, H., 2018. Sleeping hours: what is the ideal number and how does age impact this? *Nat. Sci. Sleep* 10, 421.
- Chung, E., Subramaniam, G., Dass, L.C., 2020. Online learning readiness among university students in Malaysia amidst COVID-19. *Asian J. Univ. Edu.* 16 (2), 46–58.
- De Niro, A.J.N., Pawitra, A., Faizah, N.N., Putra, R.D., Arfiputri, V.F., Sihombing, R.V., Rachmi, S.N., Nuswantoro, D., Martha, L., 2020. Correlation of gadgets addiction with sleep quality in 4th–6th grade students at SDN 01 Srigading Lawang in 2019. *J. Commun. Med. Public Health Res.* 1 (2), 80.
- Fatima, Y., Doi, S.A., Najman, J.M., Al Mamun, A., 2016. Exploring gender difference in sleep quality of young adults: findings from a large population study. *Clin. Med. Res.* 14 (3–4), 138–.
- Ganasegeran, K., Ch'ng, A.S.H., Looi, I., 2020. COVID-19 in Malaysia: crucial measures in critical times. *J. Global Health* 10 (2).
- Gubelmann, C., Heinzer, R., Haba-Rubio, J., Vollenweider, P., Marques-Vidal, P. (2018). Physical activity is associated with higher sleep efficiency in the general population: the CoLaus study. *Sleep*, 41(7), zsy070.
- Kaur, S., 2020. The coronavirus pandemic in Malaysia: a commentary. *Psychol. Trauma: Theory, Res., Pract., Policy* 12 (5), 482.
- Li, Y., Bai, W., Zhu, B.o., Duan, R., Yu, X., Xu, W., Wang, M., Hua, W., Yu, W., Li, W., Kou, C., 2020. Prevalence and correlates of poor sleep quality among college students: a cross-sectional survey. *Health Qual. Life Outcomes* 18 (1). <https://doi.org/10.1186/s12955-020-01465-2>.
- Madrid-Valero, J.J., Martínez-Selva, J.M., Ribeiro do Couto, B., Sánchez-Romera, J.F., Ordoñana, J.R., 2017. Age and gender effects on the prevalence of poor sleep quality in the adult population. *Gac. Sanit.* 31 (1), 18–22.
- Maheshwari, G., Shaikat, F., 2019. Impact of poor sleep quality on the academic performance of medical students. *Cureus* 11 (4).
- Marelli, S., Castelnuovo, A., Somma, A., Castronovo, V., Mombelli, S., Bottoni, D., et al., 2021. Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *J. Neurol.* 268 (1), 8–15.
- Mathew, V., Chung, E., 2021. University students' perspectives on open and distance learning (ODL) implementation amidst COVID-19. *Asian J. Univ. Edu.* 16 (4), 152–160. <https://doi.org/10.24191/ajue.v16i4.11964>.
- Mohanty, S.K., Satapathy, A., Naidu, M.M., Mukhopadhyay, S., Sharma, S., Barton, L. M., Stroberg, E., Duval, E.J., Pradhan, D., Tzankov, A., Parwani, A.V., 2020. Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and coronavirus disease 19 (COVID-19)—anatomic pathology perspective on current knowledge. *Diagn. Pathol.* 15 (1).
- Muniruzzaman, M., Siddiky, M., 2021. Association between students' inattentiveness to study and their psychological conditions during the COVID-19 pandemic. *Asian J. Univ. Edu.* 17 (2), 27–38. <https://doi.org/10.24191/ajue.v17i2.11011>.

- Ornell, F., Schuch, J.B., Sordi, A.O., Kessler, F.H.P., 2020. "Pandemic fear" and COVID-19: mental health burden and strategies. *Brazilian J. Psychiatry* 42, 232–235.
- Papazisis Z, Nikolaidis PT, Trakada G. Sleep, Physical Activity, and Diet of Adults during the Second Lockdown of the COVID-19 Pandemic in Greece (2021). *International Journal of Environmental Research and Public Health*, 18(14): 7292. <https://doi.org/10.3390/ijerph18147292>.
- Peretti-Watel, P., Alleaume, C., Léger, D., Beck, F., Verger, P., 2020. Anxiety, depression and sleep problems: a second wave of COVID-19. *General Psychiatry* 33 (5), e100299.
- Romero-Blanco, C., Rodríguez-Almagro, J., Onieva-Zafra, M.D., Parra-Fernández, M. L., Prado-Laguna, M.D.C., Hernández-Martínez, A., 2020. Physical activity and sedentary lifestyle in university students: changes during confinement due to the Covid-19 pandemic. *Int. J. Environ. Res. Public Health* 17 (18), 6567.
- Saadeh, H., Saadeh, M., Almobaideen, W., Al Refaei, A., Shewaikani, N., Al Fayez, R.Q., Khawaldah, H., Abu-Shanab, S., Al-Hussaini, M., 2021. Effect of COVID-19 quarantine on the sleep quality and the depressive symptom levels of university students in Jordan during the spring of 2020. *Front. Psychiatry* 12.
- Sampasa-Kanyinga, H., Zamorski, M. A., Colman, I. (2018). The psychometric properties of the 10-item Kessler Psychological Distress Scale (K10) in Canadian military personnel. *PLoS one*, 13(4), e0196562.
- Sargent, A. L. (2017). Screen Time and Sleep Condition among Selected College Students [Master's thesis, Minnesota State University, Mankato]. Cornerstone: A Collection of Scholarly and Creative Works for Minnesota State University, Mankato. <https://cornerstone.lib.mnsu.edu/etds/681/>.
- Shah, A.U.M., Safri, S.N.A., Thevadas, R., Noordin, N.K., Rahman, A.A., Sekawi, Z., Ideris, A., Sultan, M.T.H., 2020. COVID-19 outbreak in Malaysia: actions taken by the Malaysian government. *Int. J. Infect. Diseases* 97, 108–116.
- Silva, E.d.S.M.e., Ono, B.H.V.S., Souza, J.C., 2020. Sleep and immunity in times of COVID-19. *Rev. Assoc. Méd. Brasileira* 66 (suppl 2), 143–147.
- Smyth, C., 1999. The Pittsburgh sleep quality index (PSQI). SLACK Incorporated Thorofare, New Jersey.
- Steiger, A., Pawlowski, M., 2019. Depression and sleep. *Int. J. Mol. Sci.* 20 (3), 607. <https://doi.org/10.3390/ijms20030607>.
- von Keyserlingk, L., Yamaguchi-Pedroza, K., Arum, R., Eccles, J.S., 2021. Stress of university students before and after campus closure in response to COVID-19. *J. Commun. Psychol.* 2021, 1–17.
- Wang, S., Zhang, Y., Ding, W., Meng, Y., Hu, H., Liu, Z., Zeng, X., Wang, M., 2020. Psychological distress and sleep problems when people are under interpersonal isolation during an epidemic: a nationwide multicenter cross-sectional study. *Eur. Psychiatry* 63 (1).