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A Sleep Quality in Undergraduate and Clerkship Students during the COVID-19 Pandemic

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ABSTRACT
Since sleeping has a vital role in learning and practice, as well as physical health. Having a good sleep quality helps maintain executive cognitive functions, sensorimotor integration, concentration, and memory processing. Nevertheless the COVID-19 pandemic leads to make any changes in sleep schedule in undergraduate and clerkship medical student that effected the quality of sleep. The study aims to identify the quality of sleep of undergraduate and clerkship students to create proper and effective strategies to build good quality of sleep among medical students during the COVID-19 pandemic. This cross-sectional study was conducted using an online questionnaire. The sleep quality was measured with Pittsburgh Sleep Quality Index (PSQI) test. The subjects of this study were 164 medical students that divided into two groups, the first group consist of 94 final year undergraduate students and the second group consist of 70 final year clerkship students. This study shown that 32% undergraduate students were poor sleepers with the average PSQI score was 4,85±2,23. However, in clerkship students there were 50% students who are poor sleepers and the average PSQI score was 5,87±2,62. The analysis showed significantly statistical differentiation between them (p=0.019). In conclusion, our study suggest that the quality of sleep on clerkship students is slightly worse than undergraduate among the medical students. Awareness and observation should be needed to determine the situation in medical students.

Keywords: *sleep quality, clerkship, undergraduate, COVID-19*

1. INTRODUCTION

There is an outbreak of an unidentified pneumonia in late December 2019, it all began in the Huanan Seafood Wholesale Market, Wuhan, Hubei, China. Furthermore, the outbreak has been spread to other countries. Later then, the cause of this outbreak has been discovered as novel beta-coronavirus, tnamed 2019 novel coronavirus (2019-nCov) [1]. On January 30th 2020, this outbreak has declared by WHO as a global health emergency. It has been reported as of September 28th 2021 that 4.211.460 cases were confirm COVID-19 in Indonesia, which are 141.709 deaths related to COVID-19 and 4.031.099 patients have recovered [2].

In order to suppress the cases, the government has made some prohibition, such as mass gatherings and events were banned, as well as the ban on meeting up for no urgent and events. People are permitted to leave their houses for important reasons. Even schools and universities have been temporarily closed [3]. This situation is concerning since long term home confinement at home during this pandemic could have a negative impact on people's physical and mental health. In addition, social isolation can reduce physical activity and exposure to day light, as well as raise stress levels, which associated with night-time sleep [4].

Sleep, on other hand, is critical for physiology, cognitive human functioning and physical healing. When sleeping, the brain remains active. Due to the activation of the brain during sleeping, biological maintenance happens to keep the body working in peak shape and training, which prepare the individual for the day ahead [5]. In addition, good sleep quality has good

benefit such as less daytime sleepiness and better health. Sleep deprivation could lead to unable to function, study, develop, or engage to their full ability at any given time. Other than that, poor sleep quality causes leads to many endocrine, metabolic, and immune changes [6]. Regardless, each person's sleep patterns and habits are unique. Some factors, such as age, occupational demands, somatic conditions, social engagements, and individual physiological characteristics, contribute to it [5].

Many studies shown, during the lockdown, people's sleep schedules changed and their sleep quality deteriorated. [6]. Moreover, this pandemic situation tends to increase the boredom in individuals and increases the usage of social media. In the previous study, stated that young adults between 18-35 years old tend to have greater sleep issues, young adults use their social media devices extensively, which can interfere daily activities, including sleep [7].

Not only the usage of social media could interfere the sleep schedule. Since universities are closed temporarily, learning is done by virtually as well. It requires the students to use their gadget often more [8]. The use of those devices near bedtime could have a broadly negative effect on sleep outcomes [7].

The COVID-19 outbreak has a huge impact on medical students and most likely to had sleep problems. Since the curriculum has changed into virtually, medical students have to adapt to this whole situation The undergraduate students are preparing to be ready for a change, because there is a transformation of medical education from real classes into virtual classes. Meanwhile, the graduate students have to face both real classes and virtual classes at once [8]. Due to this situation, clerkship students are tending to be more exposed to stress. High prevalence of stress and emotional exhaustion have been associated with sleep problems. Moreover, clerkship students were faced with high-risk environments, physical and emotional exhaustion, worry of inadequate medical equipment, and long working hours [9].

This study aims to identify quality of sleep in undergraduate and clerkship students during the COVID-19 pandemic to create an effective method for improving medical students' sleep quality.

2. METHOD

This is an observational analytical with a cross sectional study design among the medical students of Faculty of Medicine Universitas Muhammadiyah Surakarta. Total 164 medical students were involved using the universal sampling technique. The respondents were divided into two level of medical education, the final year of clerkship students who were still on their clinical rotation and the final year of undergraduate students who were ready to start their clinical rotation.

The required data were collected from August 31th 2020 until September 9th 2020. The assessment used the standard Pittsburgh Sleep Quantity Index (PSQI) questionnaire that was translated into Bahasa Indonesia. It was divided into two main section. The first one was question on identity, demographic data, and family history. The second one was PSQI questionnaire itself that was a self reported sleep quality measure and sleep disturbance indicator during the past month. PSQI consists of 18 items self-rated questions about their sleep quality that yield seven components: subjective sleep quality, sleep latency, sleep duration, sleep disturbance, sleep efficiency, daytime dysfunction and use of sleeping medication. Each component was score the range from zero to three, so total range score goes from 0 to 21. A global score less than 5 categorized as good sleep quality, then 5 or more indicates poor sleep quality.

The PSQI questionnaire was distributed using the google form link and online completion. Descriptive data were presented in the form of mean, standard deviation and proportion. All data were organized and statistically analysis using statistical package of social science (IBM SPSS Statistic) version 25. Hypothesis from the study was tested using Chi Square test. A p-value of less than 0.05 was considered statistically significant for all purposes. An ethical clearance of this study was granted from the Ethical Clearance Committee of Faculty of Medicine Universitas Muhammadiyah Surakarta No. 3044/B.2/KEPK-FKUMS/IX/2020.

3. RESULT

The total subject of this study were 164 medical students, 70 students were currently on clerkship and 94 students were undergraduate student. The average age of subject was 23 years old and consist of 113 women and 51 men. The mean of PSQI score for all research subject was 5.32. Another socio-demographic characteristics of respondent include marital status, parents' job, city of residence, isolation experience on COVID-19, financial problem, blood type, having children, and preference on learning method during pandemic. The results of socio-demographic characteristics in this study could be seen in table 1.

Table 1. Sample characteristics variable related to quality of sleep in medical students

Number of subject	Mean age ± SD* (years old)		Mean PSQI Score ± SD	
164	23.15 ± 1.17		5.32 ± 2.43	
Variables	Number	Percent	Quality of Sleep Mean PSQI Score ± SD	p**
Gender (n=164)				
Male	51	31,1%	5.05 ± 2.21	0.786***
Female	113	68,9%	5.44 ± 2. 53	
Level of Medical Education (n=164)				
Undergraduate	94	57,3%	4.75 ± 2.09	0.019****
Clerkship	70	42,7%	6.08 ± 2.67	
Undergraduate (n=94)				
Male	33	35,1%	4.76 ± 2.53	0.253***
Female	61	64,9%	4.75 ± 1.94	
Clerkship (n=70)				
Male	18	25,7%	5.61 ± 1.85	0.918***
Female	52	74,3%	6.25 ± 2.90	
Marital status (n=164)				
Single	160	97,6%	5.34 ± 2.45	0.101***
Married	4	2,4%	4.75 ± 0.5	
Parents' job (n=164)				
Paramedic	60	36,6%	4.77 ± 2.72	0.055***
Non Paramedic	104	63,4%	5.64 ± 2.48	
City of residence (n=164)				
Capital city	4	2,4%	5.00 ± 1.82	0.668***
Non-capital city	160	97,6%	5.33 ± 2.46	
Isolation experience (n=164)				
Yes	9	5,5%	5.44 ± 3.84	0.691***
No	155	94,5%	5.31 ± 2.35	
Financial problem (n=164)				
Yes	54	32,9%	6.16 ± 2.78	0.025****
No	110	67,1%	4.9 ± 2.14	
Blood Type (n=164)				
A	36	22,0%	5.86 ± 2.59	0.302***
B	42	25,6%	5.16 ± 1.94	
AB	18	11,0%	5.22 ± 2.56	
O	68	41,5%	5.16 ± 2.60	
Having children (n=164)				
Yes	2	1,2%	5.00 ± 0.00	0.249***
No	162	98,8%	5.32 ± 2.45	
Prefer offline lecture during pandemic				
Yes	75	45,7%	5.21 ± 2.37	0,382***
No	89	54,3%	5.41 ± 2.50	

*Standard deviation

**Chi-square test result

***Nonsignificant difference

****Significant difference

PSQI questionnaire was used in evaluating quality of sleep in undergraduate and clerkship medical student. The result of seven components or parameters of PSQI questionnaire between undergraduate and clerkship was given in table 2.

Table 2. Pittsburgh sleep quality index components in undergraduate and clerkship

Component	PSQI Score	Undergraduate (N= 94; 100%)	Clerkship (N=70;100%)
Sleep duration (hour)	≥7	35 (37%)	12 (17%)
	6-6.9h	32 (34%)	29 (41%)
	5-5.9h	19 (20%)	22 (32%)
	<5	8 (9%)	7 (10%)
Sleep latency time	0	34 (36%)	15 (21%)
	1	40 (43%)	31 (44%)
	2	18 (19%)	15 (22%)
	3	2 (2%)	9 (13)
Sleep efficiency (%)	≥ 85	86 (91%)	52 (74%)
	75-84	6 (7%)	13 (19%)
	65-74	2 (2%)	4 (6%)
	<65	0 (0%)	1 (1%)
Daytime dysfunction	0	42 (45%)	19 (27%)
	1	41 (43%)	40 (57%)
	2	10 (11%)	8 (12%)
	3	1 (1%)	3 (4%)
Overall sleep quality	Very good	19 (20%)	5 (7%)
	Fairly good	63 (67%)	53 (76%)
	Fairly poor	12 (13%)	11 (16%)
	very poor	0 (0%)	1 (1%)
Sleep distrubance	0	11 (12%)	8 (12%)
	1	71 (75%)	52 (74%)
	2	11 (12%)	9 (13%)
	3	1 (1%)	1 (1%)
Use of sleeping pill	Not during the past month	92 (98%)	67 (96%)
	Less than once a week	2 (2%)	2 (3%)
	Once or twice a week	0 (0%)	1 (1%)
	Three or more times a week	0 (0%)	0 (0%)
Mean ± SD of sleep duration (hours)		6.24 ± 1.66	5.73 ± 1.00

Mean ± SD of global PSQI score		4.75 ± 2.09	6.08 ± 2.67
PSQI category (sum score <5 or >5)	Good sleepers	64 (68%)	35 (50%)
	Poor sleepers	30 (32%)	35 (50%)

4. DISCUSSION

According to this study, the quality of sleep among medical students, was affected by COVID-19 outbreak. Sleep quality is a problem that often arises in the age group of adolescents and young adults. This is due to the increase in sleep disturbances in students caused by the study load and lifestyle that occurs in students. In a study showed that sleep quality is influenced by several factors including gender, academic success, academic background, general health, financial problems and student stress levels [10]

Therefore, to determine the sleep quality among the medical students during the COVID-19 pandemic, this study uses the PSQI. The PSQI is a questionnaire that used to assess sleep quality. The PSQI could be used to represent sleep quality, as it incorporates both qualitative quantitative. The PSQI is a questionnaire which consists of 18 items and divided into 7 derived component. The PSQI designed to assess overall sleep quality over a 1-month period [11].

PSQI scores in clerkship students are higher than undergraduate students, the difference is significant. Due to the pandemic, there was classes shifting from real classes to online classes for the undergraduate students. Meanwhile, the clerkship students have to face not only the online classes, but also the real classes. Hence, those issues can caused stress and emotional exhaustion that could lead to sleep problems [6]. It is also supported by another study, clerkship students have to face the pandemic directly that can increase anxiety among them. It was possibly because they lack experience in controlling infectious disease in high-risk environments, the fear of medical errors, physical and emotional exhaustion that can caused by a high pressure in health care system, fear of inadequate medical equipment, and separation from families. By those points, there was a correlation between sleep disruption and emotional functioning that could lead to insomnia [9].

This study also reveals that, generally, female medical students tend to have higher PSQI scores than male medical students. However, if PSQI scores were viewed from gender and level of education, there is a slight difference. Undergraduate male medical students have a higher score compared with undergraduate female medical students, whereas clerkship female medical students have a higher score compared with clerkship male students. Nonetheless, there was no significant difference. According to meta-analytic, women tend to experience 41% more insomnia compared to male. Moreover, there is also another explanation, sleep disturbance are often associated with hormonal fluctuations, especially estrogen [12].

Marital status has the lowest PSQI score among the other aspects and the difference was not significant. However, marriage and the quality of relationship are associated with mental and physical health and health behaviors, it is believed that they are associated with sleep. Marriage affects almost every aspect of individual well being, including emotional and physical health. Couple who already married tends to provide material and other resources such as emotional support and sense of social integration. Therefore, it is important and associated with health, because the quality of the relationship could reduce stress, since the partner relationship can be a source of support or strain. According to that, previous studies shown that better marital quality will improve sleep [13]. This study also did not show any significant difference in terms of having or not having children because the number of medical students who are having children are few.

This study showed that respondents who had parents with non-paramedical work backgrounds had a higher PSQI score than the PSQI scores of respondents with parents with paramedical work backgrounds. However, this study did not show any significant difference. Medical students that come from family who have medical background are easier to adapt to the pandemic situation. Medical students who have medical background tend to have insufficient knowledge about the COVID-19 and do not easier provoke by the hoax. Thus, who easier provoke by the hoax tend to experience anxiety and have sleep problems [14].

The average PSQI score of respondents living in the capital city is lower than respondents living outside the capital city. The study did not show a significant difference. Living in a capital city, such as DKI Jakarta could lead to anxiety because it had the highest number of COVID-19 cases. Anxiety is one of mental health problems is a risk factor for sleep problems. A person that experience sleep problems tend to insomnia and having a poorer quality of sleep [14].

Another variable that is measured is the experience of isolation. Quarantine is one of the most predictive factors of acute stress disorder symptoms. In Hong Kong mental health is closely related to behavior or activities to be carried out, one of them is sleep, adequate sleep can cause the hormone melatonin to increase and be produced and can reduce anxiety and

stimulate a good immune system, but when stressed most people have difficulty sleeping regularly at the same time [15]. However, there is no significant difference in this study.

The results showed that the average PSQI score of respondents who had financial problems was higher than the average PSQI of respondents who did not have financial problems. Furthermore, the study showed a significant difference. Financial problem is one of social issues that lead sleep problems in medical students [16]. Financial problems can lead students to have short sleep duration and poor sleep quality, and these sleep issues can lead to poor dietary behaviors that can affect students health [17].

The PSQI value in terms of blood type, it appears that respondents with blood type A have the highest average PSQI. The study did not show a significant difference. In another study, also shown female students in the A+ blood type slept more while those in the AB- blood group slept less. Male students with the B+ blood group sleep more, while those with the O- and AB- blood groups sleep less [18]. Individuals with different blood types respond to stress management in different ways. Red blood cell (RBC) membranes carry a range of genetic material on their surface (antigen). The blood group A, AB, and B contain H antigen. Blood group A mostly represents high levels of cortisol which is a stress hormone. Therefore, they are more predisposed to develop depression, obsessional neurosis, and stress in personality [19].

Furthermore, the PSQI value based on respondents' interest in offline learning during the pandemic, showed that respondents who liked offline learning during the pandemic had an average PSQI score of 5.21 lower than respondents who prefer online learning, although the difference was not significant. One thing that might be the reason is the students were still worried about the transmission of COVID-19 in offline learning. The results shown the number of students that preferred online learning was higher than offline learning during this pandemic. It indicates that the online learning method is quite well received by students. Medical schools need to make continuous improvements to improve the online learning system that have developed because there still almost half of the students preferred offline learning.

Medical students have a high risk for experiencing sleep disorders. This is due to the factors of the long study duration and high learning intensity, the presence of clinical night calls, emotionally challenging work and the lifestyle of medical students. Further evaluation in level of education of sleep quality in respondents is done in this study. The PSQI includes open-ended question that can be used to identify the nature and possible causes of sleep problem to help direct treatment, also can indicate the type of sleep problems, which is the seven main assessment components, as sleep duration, efficiency, latency, daytime disturbance, quality, and use of sleeping pills [20].

The results of measurement of the seven main components shown in table 2. Total 37% of undergraduate had a sleep time more than or equal to seven hours, it was better than clerkship that only 17% respondents. In another study, the recommendation for sleep duration at ages 18-60 years is seven hours [21]. Inadequate sleep duration can have a negative impact on physical health, general alertness, and impair attention, affecting in slowed cognitive functioning. The prefrontal cortex, which is responsible for higher brain functions such as working memory, language, logical reasoning, and creativity, was the most affected structure. This resulted in decreased memory encoding, which led to less knowledge retention, implying that the hippocampus was affected [22].

Sleep latency is the amount time in minutes a person it takes to fall asleep. In undergraduate 36% had sleep latency time less than or equal to fifteen minutes, that was better than clerkship that only had 21%. The normal average latency to sleep is 10-20 minutes in healthy adults. A longer sleep latency more than 20 minutes may indicate for having difficulty initiating sleep in person. This could be due to problem with insomnia, which may affect the ability to initiate and maintaining sleep [23].

Sleep efficiency was the percentage of the night that a person spends asleep. Sleep efficiency is calculated by dividing the total sleep time by the total time in bed. Sleep efficiency for healthy young individuals is 80% or higher. In undergraduate the result of sleep efficiency habits more than or equal to eighty five percent was about 91% of respondents, but in clerkship there was only 74% of respondent. A decreased sleep efficiency may indicate increased a person total wake time. Increased total wake time can indicate disruption during sleep caused by any number of factors including leg movement, apnea, insomnia, pain, and soon [24].

Sleep quality also affect on daily activity on patients. Daily disturbance manifest in patients with poor sleep quality. Daily disturbance could be seen on daytime dysfunction and sleep disturbance parameters [25]. Daytime dysfunction component on the PSQI is based on two items: one item assesses daytime sleepiness and whereas another item assesses energy/enthusiasm to get things done. Daytime dysfunction was mainly associated with reduced enthusiasm, rather than excessive sleepiness [26]. The result of undergraduate who never get daily disfunction was about 45%, it was better than clerkship who only 27% respondents. Sleep disturbance on undergraduate and clerkship are similar, only few respondents about 1% who experience severe sleep disturbance. Sleeping medication parameter in respondents also showed a good result, as many as 98%

undergraduate and 96% clerkship respondents did not use sleeping pills during the past month. A few respondents who take sleeping pills.

When asked about their subjective sleep quality, most of respondent both undergraduate and clerkship answered fairly good, 67% and 76% respondents respectively. In undergraduate, their global PSQI score, which was summaries of the seven components, the frequency distribution and the minimum score was 1 and the maximum score was 11. The mean of their PSQI global score was 4.75 that was classified as good sleepers. Even though, the mean of all global score was classified as good sleepers, there was still 32% of respondents that were poor sleepers. In clerkship, their total PSQI score showed the minimum score was 2 and the maximum score was 14. There were 50% respondents that had total score more than 5, classified as poor sleepers. The mean of their PSQI global score was 6.08 that supported as poor sleepers.

There are several limitations to our study. First, this is a self-reported designed study so there is lack of objective evidence to back up the data accuracy, which could bring bias into the study. Second, the recruitment of respondents from a single educational institute may limit the extrapolation of the findings. Third, in this study caution should be taken when interpreting the results and also cannot explain the heterogeneity between other studies. Another limitation is we do not have baseline data about medical students' sleep quality before the COVID-19 pandemic, as a comparison.

5. CONCLUSION

There is a difference in sleep quality between undergraduate and clerkship. The mean of global PSQI score in clerkship was higher than undergraduate. The statistic showed a significant difference in sleep quality between them. It occurs because clerkship students have to face not only the online classes, but also the real classes. The clerkship students also have to face the pandemic directly that can increase anxiety, stress, and emotional exhaustion that could lead to sleep problems. Further evaluation and observation are needed to make sure their psychological conditions.

AUTHORS' CONTRIBUTIONS

I.N.N.M, SS, and A.H were responsible conceived of the presented idea, distributed the questionnaire, data collection, and ethics approval. NWR and YR were responsible for method, analysis, and authorship manuscript. All authors discussed and approved the final manuscript to be published.

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REFERENCES

[1] Y.-C. Wu, C.-S. Chen and Y.-J. Chan, "The Outbreak of COVID-19: An Overview," *Journal of the Chinese Medical Association*, vol. 83, no. 3, pp. 217-220, 2020.

[2] WHO, "Coronavirus disease (COVID-19)," 2021. [Online]. Available: https://www.who.int/indonesia/news/novel-coronavirus. [Accessed 1 October 2021].

[3] S. Marelli, A. Castelnuovo, A. Somma, V. Castronovo, S. Mombelli, D. Bottoni, C. Leitner, A. Fossati and L. Ferini-Strambi, "Impact of COVID-19 lockdown on sleep quality in university students and administration staff," *Journal of Neurology*, 2020.

[4] N. Cellini, N. Canale, G. Mioni and S. Costa, "Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in italy," *European Sleep Research Society*, pp. 1-5, 2020.

[5] N. A. M. Zuki, M. A. N. Azhan, H. K. Kamaruddin, A. F. M. Kassim, M. F. Ahmad and A. H. Abu Bakar, "Sleep Quality Among University Students During Covid-19 Lockdown," *International Journal of Academic Research in Progressive Education & Development*, vol. 10, no. 2, pp. 814-822, 2021.

[6] D. Shrestha, S. P. Adhikari, N. Rawal, P. Budhathoki, S. Pokharel, Y. Adhikari, P. Rokaya and U. Raut, "Sleep quality among undergraduate students of a medical colege in Nepal during COVID-19 pandemic: an online survey [version 2; peer review: 2 approved]," *F1000 Research*, vol. 10, no. 505, pp. 1-16, 2021.

[7] L. D. Renzo, P. Gualtieri, F. Pivari, L. Soldati, A. Attina, G. Cinelli, C. Leggeri, G. Caparello, L. Barrea, F. Scerbo, E. Esposito and A. D. Lorenzo, "Eating habits and lifstyle changes during COVID-19 lockdown: an Italian

survey," *Journal of Translational Medicine*, vol. 18, no. 229, pp. 1-15, 2020.

[8] S. Tabatabai, "COVID-19 Impact and Virtual Medical Education," *Journal of Advances in Medical Education & Professionalism*, vol. 8, no. 3, pp. 140-143, 2020.

[9] M. Sekartaji, M. Irsan, R. P. Sari, M. Adnan, L. P. Aquaira, S. R. Farahiya and F. Hafidz, "Relationship between Anxiety and Insomnia in Clinical Clekship Students during COVID-19 Pandemic," *Journal of Community Empowerment for Health*, vol. 4, no. 1, pp. 21-28, 2021.

[10] R. Khare, J. Mahour, R. Ohary and S. K. , "Impact of online classes, screen time, naps on sleep, and assessment of sleep-related problems in medical college students during lockdown due to coronavirus disease-19 pandemic," *National Journal of Physiology, Pharmacy and Pharmacology*, vol. 11, no. 1, pp. 56-61, 2020.

[11] C. Zhang, H. Zhang, M. Zhao, Z. Li, C. E. Cook, D. J. Buysse, Y. Zhao and Y. Yao, "Reliability, Validity, and Factor Structure of Pittsburgh Sleep Quality Index in Community-Based Centenarians," *Frontiers in Psychiatry*, vol. 11, pp. 1-11, 2020.

[12] M. R. Dolsen, A. D. Crosswell and A. A. Prather, "Links between stress, sleep, and inflamation: are there sex differences?," *J Health Soc Behav*, vol. 21, no. 2, pp. 1-10, 2020.

[13] J.-H. Chen, L. J. Waite and D. S. Lauderdale, "Marriage, Relationship Quality, and Sleep among U.S Older Adults," *J Health Soc Behaviour*, vol. 56, no. 3, pp. 356-377, 2015.

[14] A. A. Nabila, I. N. N. Mahmuda, S. and A. Herdaetha, "Anxiety Levels of Undergraduate and Clerkship Medical Students during the COVID-19 Pandemic," *The Malaysian Journal of Ismlamic Sciences*, vol. 3, pp. 91-102, 2021.

[15] Ho C, Chee YC, and Ho RB, "Mental Health Strategies to Combat the Psychological Impact of COVID-19 Beyond Paranoia and Panic," *Annals of the Academy of Medicine*, vol. 49, no. 1, pp. 1-3, 2020.

[16] K. Gandhi, Y. Godaria and R. G, "Evaluation of sleep pattern due to stress in undergraduate medical students and its impact on health and academic performance: A cross-sectional study from tertiary health center of Central India," *CC-BY-NC 4.0 International license*, vol. 1, pp. 1-21, 2021.

[17] C. Du, W. Wang, P. Y. Hsiao, M.-J. Ludy and R. M. Tucker, "Insufficient Sleep and Poor Sleep Quality Completely Mediate the Relationship between Financial Stress and Dietary Risk among Higher Education Students," *Behavioral science*, vol. 11, no. 29, pp. 1-18, 2021.

[18] M. I. Qadir and A. Tahir, "A prospective study on the co-relation between blood group and sleeping hours," *Peertech*, vol. 3, no. 1, p. 1, 2018.

[19] S. Iqbal, R. Akram, S. Akram, H. M. I. Afzal, M. S. ullah and Q. u. l. Fatima, "Association between ABO Blood Group Phenotype and Reaction to Academic Stress in Young Medical Students," *International Journal of Contemporary Medical Research*, vol. 6, no. 11, pp. 1-4, 2019.

[20] S. Faulkner and C. S. Gibbons, "Use of the Pittsburgh Sleep Quality Index in People with Schizophrenia Spectrum Disorders; A Mixed Methods Study," *Front Psychiatry*, vol. 10, no. 284, pp. 1-9, 2019.

[21] R. N. Azmi, D. N. C. Hanifa, n. S. A. Fernando and M. R. Putri, "Description of the Quality of Pharmacy Student Sleep in the Pandemic Period of Corona Virus Disease (COVID-19)," *Jurnal Ilmu Kesehatan*, vol. 9, no. 1, pp. 72-80, 2021.

[22] M. L. Zeek, M. J. Savoie, M. Song and L. M. Kennemur, "Sleep Duration and Academic Performance among Students Pharmacists," *American Journal of Pharmaceutical Education*, vol. 79, no. 5, pp. 1-8, 2015.

[23] L. M. Endee, Sprigg's Essentials of Polysomnograph: A Training Guide and Reference for Sleep technician, 1st ed., New York: jones 7 Barleett Learning, 2021.

[24] B. Yan, j. Yang, B. Zhao, Y. Fan, W. Wang and X. Ma, "Objective Sleep Efficiency Predicts Cardiovascular Disease in a Community Population; the Sleep Heart Health Study," *AHAjournals*, vol. 1, pp. 1-8, 2021.

[25] M. D. Casement, K. M. harrington, M. W. Mille and P. A. Resick, "Associations between

Pittsburgh Sleep Quality Index Factors and Health Outcomes in Women with Posttraumatic Stress Disorder," *Sleep Med.*, vol. 13, no. 6, pp. 752-758, 2012.

[26] S. p. Becker, M. A. Jarrett, A. M. Luebbe, A. A. Garner, G. L. Burns and M. J. Koefler, "Sleep In A Large, Multi-university Sample of College Students; Sleep Problem Prevalence, Sex Differences, and Mental Health Correlates," *Florida State University Libraries*, vol. 4, pp. 1-25, 2018.