The Relationship Between Self-Reported Sleep Quality and Psychological Health in Undergraduates During the Home Quarantine of COVID-19

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The present study aimed to investigate self-reported sleep quality and psychological well-being, specifically anxiety, depression and stress, in undergraduate students during home quarantine. A total of 7,364 students participated and completed the PSQI and DASS-21 scales. The results showed that higher-grade students were more likely to have mental health problems compared to their lower-grade students. Additionally, male students reported better sleep quality than females, and high-grade students reported more sleep problems than low-grade students. Significant correlations were observed between PSQI scores and stress, anxiety and depression scores ($r=0.469, 0.458, 0.408, p<0.01$). Specifically, the PSQI score explained 22.0%, 21.0% and 16.6% of the variance in stress, anxiety and depression scores respectively. In conclusion, gender and grade differences in sleep and mental health were evident, with female students reporting lower sleep quality than males, and high-grade students experiencing worse sleep quality and mental health than their low-grade students.

Keywords: COVID-19, self-reported sleep quality, stress, anxiety, depression, home quarantine, undergraduates

INTRODUCTION

Sleep, which supports physical recovery, integration, and memory consolidation, is an essential indicator of life quality (Krueger, Frank et al. 2016). It is necessary to maintain one's physiological and psychological health (Lund, Reider et al. 2010). Studies show that chronic sleep problems can impair cognition (Okamura, Tsuda et al. 2010, Ahmad and Bashir 2017) and increase the risk of psychiatric disorders (LIU and PAN 2015). Also, it is closely associated with stress (Amaral, Soares et al. 2018), anxiety (Guo, Sun et al. 2016), depression, and a number of other psychological problems (Nofzinger, Buysse et al. 2004, Kanaan, Siengsukon et al. 2015). Sleep is becoming an increasing concern due to the importance of sleeping to human physical and mental health.

Good sleep is an important guarantee for students' physical and mental health. Self-reported sleep quality was positively correlated with individual psychological health (Qian, Sun et al. 2017, Seun-Fadipe and Mosaku 2017). And it has been found that poor quality sleep is linked to an increased risk of developing mental health problems (Pacheco, Giacomin et al. 2017). Besides, sleep problems had a far-reaching impact on individuals' academic achievement and life quality (Cao, Fang et al. 2020, Pragholapati 2020, Tasso, Hisli Sahin et al. 2021). In addition, sleep problems tend to cause negative emotions, and sleep is also affected by their negative emotions (Amaral, Soares et al. 2018). At the same time, depression and anxiety were critical external manifestations of psychological health problems. Some studies have found that stressful events were essential to depression and anxiety (Beiter, Nash et al. 2015). Stress was often one of the main factors causing sleep problems. Cognitive, emotional, and behavioral stress responses directly affect sleep quality (Beiter, Nash et al. 2015, Wallace, Boynton et al. 2017). Furthermore, sleep problems are more common among undergraduates, with approximately 12.92%-52.84% of undergraduates experiencing difficulty falling asleep, early awakening, lack of sleep, and low energy (Lund, Reider et al. 2010, Feng, Zhang et al. 2014, Jin, Zhou et al. 2018). It was reported that 41.77% of Chinese undergraduates had a total PSQI score above the critical score and 42.92% sleep less than 6 hours (Hongya, Shaoling et al. 2014). Therefore, undergraduate students often had sleep problems, especially in special periods, and they needed more good sleep quality to successfully cope with their challenges (Eslaminejad, Safa et al. 2017). Therefore, the quality of undergraduates' sleep needs more attention.

Although several researches have been conducted on the sleep problems of undergraduates, it is different that the sleep of undergraduates could be influenced by different periods (Yan-fen, Xiao-hua et al. 2012, Ling and Xin 2014). The rapid spread of the COVID-19 outbreak worldwide and its highly infectious and unknown nature have caused widespread psychological problems. Due to the pandemic, students in China have been forced to leave their dormitories and spend extended periods in isolation at home doing online learning activities. This sudden outbreak has severely threatened undergraduate students' physical and mental health.

Therefore, studying undergraduate students' sleep patterns and sleep problems during this period will help to explore the changing characteristics of their sleep. This will also be crucial for undergraduate administrators to find an appropriate and measurable indicator to monitor the psychological health status of undergraduate students to address the management challenges they face. Also, understanding the mental health responses of undergraduate students during an epidemic will help undergraduate administrators to effectively prepare for public health emergencies.

Briefly, this study attempted to investigate the relationship between self-reported sleep quality and stress, anxiety, and depression in undergraduates during home isolation and the validity of self-reported sleep quality as an indicator of the psychological well-being of undergraduates during this particular period. In addition, this study seeks to provide research support for the prevention and management of epidemic-related psychological crises by providing some scientific research evidence for assessing undergraduates' psychological health during the epidemic.

METHODS

Sample

A random sample of 9,318 undergraduate students from 31 provinces and cities across China were tested in this study during the home isolation period of COVID-19. Finally, 7364 valid data were collected with a 79.03% effective rate, of which 3422 (46.5%) were male and 3942 (53.5%) were female, representing a more balanced distribution. The average age of the participants was 19.71(SD=1.51) years. All of them were from the undergraduate college, of which 34418 (60.0%) were freshmen, 1517 (20.6%) were sophomores, 1030 (14.0%) were juniors, and 399 (5%) were seniors.

Instruments

Pittsburgh Sleep Quality Index (the Pittsburgh Sleep Quality Index, PSQI): It was compiled by Buysse (Buysse, Reynolds III et al. 1989), and Liu translated it into Chinese in 1996 (Liu, Tang et al. 1996), which including 18 self-assessment items, 7 dimensions. This scale uses a 4-point scale (each factor is scored from 0 to 3), "0" means no difficulty, "3" means very difficult, and the total score ranges from 0-21. The higher the score, the worse the sleep quality. Previous studies showed that it could be useful for measuring sleep quality. Furthermore, it has been proven to have a good internal consistency (α= 0.845) (Lu, Li et al. 2014).

Depression-Anxiety-Stress Scale (Depression Anxiety Stress Scale-21, DASS-21) (Lovibond and Lovibond 1996), It was composed of three subscales: depression, anxiety, and stress, each of which consisted of 7 questions, which mainly described the subjects' recent negative emotional experience or corresponding physiological reactions. The participants made corresponding choices according to their actual situation. The scale used a 4-point score. According to the manual guide, multiply the scores of each subscale by 2 to accommodate the original 42 items. The score of each subscale ranged from 0 to 42, and the higher the score, the worse the subject's status (Lovibond and Lovibond 1996). For the depression subscale, a score of 9 or less was considered "normal," a score of 10-13 was "mild," a score of 14-20 was "moderate", a score of 21-27 was "severe", and a score greater than 28 was considered "extremely severe". For the anxiety subscale, a score below 7 was considered "normal," 8-9 as "mild", 10-14 as "moderate", 15-19 as "severe," and above 20 as "extremely severe". For the stress subscale, the score below 14 was "normal," 15-18 was "mild," 19-25 was "moderate," 26-33 was "severe," more than 34 was "extremely severe" (Lovibond and Lovibond 1996).

Data Collection

During the home quarantine period of the epidemic, an online questionnaire was distributed to university students in Sichuan, China. To collect the data, the author sent an invitation message to the counsellor and distributed an online link to the survey. And the counselors of each class in the school sent the online questionnaire through some Chinese social media platforms (WeChat and QQ), providing access to the students. Furthermore, the process of filling and collecting the questionnaire followed academic ethics, and the respondents were informed in advance of the basic situation, use, and information confidentiality commitment of the questionnaire in the instructions. Only after the respondents confirmed and agreed could they enter the answer interface.

Statistical Processing

The data were analyzed by SPSS21. Descriptive statistics were used to analyze the self-reported sleep quality, stress, anxiety, and depression among undergraduates. The t-test and ANOVA were used to examine the gender differences and grade differences in sleep and emotional symptoms among undergraduate students. In addition, correlation analysis and regression analysis were used to examine the relationship between different sleep problems and stress, depression, and anxiety symptoms and the predictive effect on stress, depression, and anxiety symptoms.

RESULTS

Difference Between Stress, Anxiety and Depression, and PSQI in Sex

The gender test indicated that female students were positively higher than male students in the scores of PSQI($p < 0.01$) (Table 1).

TABLE 1
DIFFERENCE BETWEEN STRESS, ANXIETY AND DEPRESSION, AND PSQI IN GENDER

Item	Sex: ($\bar{x}$±SD)		*t*	*p*
	male(*n*=3422)	female(*n*=3942)		
Stress	6.64±6.55	6.86±6.54	-1.424	0.154
Anxiety	4.45±4.83	4.61±4.84	-1.386	0.166
Depression	5.57±6.17	5.55±6.01	0.145	0.885
PSQI	3.61±2.58	4.03±2.60	-6.913	0.000

Difference Between Stress, Anxiety and Depression, and PSQI in Grade

The grade difference test suggested that there were significant grade differences in stress, depression and PSQI, senior and junior students' scores were significantly higher than first- and second-year students' scores ($p < 0.05$) (Table 2).

TABLE 2
DIFFERENCE BETWEEN STRESS, ANXIETY AND DEPRESSION AND PSQI IN GRADE

Item	Grade ($\bar{x}$±SD)				*F*	*LSD*
	Freshman (*n*=4418)	Sophomore (*n*=1517)	Junior (*n*=1030)	Senior (*n*=399)		
Stress	6.66±6.31	6.42±6.56	7.52±7.31	7.09±6.72	6.717	3>1***;3>2***
Anxiety	4.52±4.68	4.33±4.77	4.85±5.34	4.67±5.36	2.472	
Depression	5.35±5.83	5.57±6.25	6.19±6.56	6.17±6.83	6.742	3>1***;4>1**;3>2*
PSQI	3.67±2.55	3.83±2.53	4.36±2.74	4.24±2.81	23.206	1<2*,1<3***,1<4***,2<3***,2<4**

*p<0.05, **p<0.01, ***p<0.001

A Test of the Differences in the Emotional State of Undergraduate Students of Different Genders and Grades

Among the people surveyed, 1.8% of participants reported severe stress symptoms, 3.9% showed severe anxiety, and 3% indicated severe depressive symptoms.

Analysis of the Correlation between the Total Score of PSQI and the Scores of Various Dimensions and the Scores of Stress, Anxiety and Depression in Undergraduates

The stress, anxiety and depression scores of undergraduates were positively associated with the score of PSQI (r=0.047-0.928, $p < 0.01$) (Table 3).

TABLE 3
THE CORRELATION COEFFICIENT BETWEEN THE PSQI AND DEPRESSION, STRESS, AND ANXIETY OF UNDERGRADUATE STUDENTS (r)

Item	M	SD	1	2	3	4
Stress (1)	6.755	6.542	1			
Anxiety (2)	4.536	4.834	0.759**	1		
Depression (3)	5.556	6.088	0.742**	0.706**	1	
PSQI (4)	3.832	2.599	0.469**	0.458**	0.408**	1

*p<0.05, **p<0.01

Analysis of the Difference Between the PSQI and the Stress, Anxiety, and Depression in Undergraduate Students

According to the total score of PSQI, there were three levels: ①PSQI ≤ 4, ②5 ≤ PSQI ≤ 7, and ③PSQI ≥ 8 (Li and Tao 2003). Then, the scores of different self-reported sleep quality were compared with stress, anxiety, and depression, and it was found that there were significant differences in stress, anxiety, and depression at the three levels (p＜0.001), and all showed 1 ＜ 2＜3 (Table 4).

TABLE 4
COMPARISON OF DEPRESSION, STRESS AND ANXIETY SCORES OF UNDERGRADUATE STUDENTS WITH DIFFERENT PSQI LEVELS ($\bar{x}$±SD)

Factors	PSQI≤4 ① n=4740	5≤PSQI≤7 ② n=1980	PSQI≥8 ③ n=644	F	P	LSD
Stress	5.00±5.24	8.76±6.68	13.50±8.42	722.62	0.000	①＜②＜③
Anxiety	3.28±3.68	5.91±4.96	9.62±6.98	712.240	0.000	①＜②＜③
Depression	4.14±4.86	7.04±6.26	11.40±8.46	557.220	0.000	①＜②＜③

Regression Analysis of Total PSQI Scores and Stress, Anxiety, and Depression Scores of Undergraduate Students

Taking the PSQI as an independent variable and depression, anxiety, and stress as dependent variables, regression analysis was carried out, and the results were compared (Table 5). The results revealed that the PSQI was positively correlated with stress, anxiety, and depression to some extent, which could explain the mutation rate of 16.6%-26.9% (p＜0.01).

TABLE 5
MULTIPLE LINEAR REGRESSION BASED ON EMOTIONAL SCORES AS DEPENDENT VARIABLES (n=7364)

Dependent Variable	Independent Variable	B	SE	t	p	β	R^2	R^2_{adj}
Stress	PSQI	0.590	0.013	45.610	0.000	0.469	0.220	0.220
Anxiety	PSQI	0.430	0.010	44.240	0.000	0.458	0.210	0.210
Depression	PSQI	0.480	0.012	38.310	0.000	0.408	0.166	0.166

DISCUSSION

This study described undergraduate students' psychological health and self-reported sleep quality in response to the COVID-19 home quarantine. This study found that few undergraduate students suffered from psychological and sleep problems, especially low-grade ones. During the home quarantine period, sleep quality was strongly associated with the severity of stress, anxiety, and depression symptoms. Moreover, self-reported sleep quality could predict psychological health.

Previous research showed that infectious disease outbreaks correlated to negative psychological problems (Brooks, Webster et al. 2020). Also, the bad psychological effects could last many months to many years during the mandatory quarantine (Liu, Kakade et al. 2012). An investigation indicated that being quarantined was significantly correlated with increasing depression after three years of SARS (Liu, Kakade et al. 2012). And previous studies also showed that the COVID-19 epidemic adversely affected communities throughout China (Cao, Fang et al. 2020, Duong, Luo et al. 2020), and they needed urgent psychological interventions (Huang, Xu et al. 2020) .

However, this investigation found that 1.8% of Chinese undergraduates had symptoms of stress, 3.9% had anxiety symptoms, and 3% reported depressive symptoms while isolated in their homes. Previously published samples investigated that the proportion of Chinese medical undergraduates with severe anxiety was 0.9% (Cao, Fang et al. 2020). Consistently, a previously published study explored the psychological health with DASS-21 among communities in China and revealed no significant changes in the anxiety and depression scores during the epidemic period (Wang, Pan et al. 2020). Another Previous study similarly indicated that the severity of depression, anxiety and stress showed no significant difference from the initial outbreak to three months after COVID-19 (Lu, Yang et al. 2021). In this study, these findings might be due to the sampling period. Another reason might be that the study participants were undergraduates who usually had fewer social responsibilities and economic burdens than independent adults.

The test of PSQI scores in the sex indicated that males had better self-reported sleep quality than females, consistent with the previous findings (Ling and Xin 2014). Former studies have found that females needed more time to sleep than males, and at the same time, females were more likely to have sleep disorders. Besides, they had less efficient sleep than males, used more hypnotic medicine, and had worse daytime functioning (Becker, Jarrett et al. 2018). The gender differences in self-reported sleep quality might be because the improving status of women and their characters. With society's development, women's status has increased, becoming more and more economically independent. At the same time, social pressure has increased, which, together with the physiological characteristics of women, might be the main reason affecting the sleep of females (Ham, Kim et al. 2017).

The test of PSQI scores in the grade indicated the self-reported sleep quality of high-grade undergraduates was worse than that of low-grade undergraduates. A study found that a higher grade predicted a higher detection rate of sleep disorders (Wang, Rao et al. 2016). In addition, compared with first- and second-year students, high-grade undergraduates also had higher stress, anxiety, and depression. Previous research has indicated that high-grade students were more likely to be depressed (Bostanci, Özdel et al. 2005, Naushad, Farooqui et al. 2014). It might be because junior students faced more academic and employment pressures than low-grade undergraduates. However, previously published data believed that first- and second-year students had the highest levels of depression, anxiety, and stress (Bayram and Bilgel 2008). Furthermore, comparing their PSQI scores with stress, anxiety, and depression scores showed that sleep quality was sensitive to stress, anxiety, and depression, which was consistent with previous work (Varma, Junge et al. 2021). It has been implicated that sleep problems were a significant risk factor for depression, anxiety, and stress (Bacaro, Chiabudini et al. 2020, Fu, Wang et al. 2020). The regression analysis of this study showed that the total PSQI score explained 22.0% and 16.6% of the stress and depression scores, respectively; the total PSQI score explained 21.0% of the anxiety score.

SUMMARY

According to the results of this research, the sleep and psychological health of undergraduate students differed in gender and grade, and the self-reported sleep quality was significantly correlated with stress, anxiety, and depression among undergraduates. Besides, self-reported sleep quality was also able to predict stress, anxiety, and depression.

The results of this research reiterate the importance of paying close attention to the psychological and sleep problems of undergraduates in the home quarantine of the COVID-19 epidemic. To better control the epidemic and prevent the potential occurrence of psychological health problems in undergraduate students, it is better to establish robust psychological health support for undergraduate students. Furthermore, healthcare centers and professional psychological counselors should find ways to meet the basic daily needs of undergraduate students in psychological disorders and spread positive information about epidemic prevention.

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