Original Research

Association between depression, anxiety, and stress with sleep quality in Indonesian people during the COVID-19 pandemic

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Abstract

Background: To prevent the spread of COVID-19, authorities implemented health protocols such as quarantine, large-scale social restrictions, and lockdowns. Data on the psychological effects and sleep quality as a result of these health protocols are still limited.

Objective: This study was aimed to determine the association between depression, anxiety, and stress with sleep quality during the COVID-19 pandemic in Indonesia.

Methods: An online survey was used to do a cross-sectional study among students in Indonesia. Sociodemographic information, including age, gender, religion, level of education, and regions, was analyzed. Levels of depression, anxiety, and stress were measured using the DASS-21 questionnaire. Sleep quality was determined using Pittsburgh Sleeping Quality Index (PSQI) questionnaire. Chi-square was used to evaluate the variables for bivariate analysis and logistic regression for multivariate analysis.

Results: A total of 913 participants from across Indonesia included to this study. Adolescent (*OR*=0.367, 95% *CI*=0.199-0.679), female (*OR*=1.437, 95% *CI*=1.095-1.886), and high school students (*OR*= 0.737, 95% *CI*=0.544-0.999) had a higher risk for having poor sleep quality. In the multivariate analysis there were significant relationship between sleep quality with depression (*Adjusted OR*= 1.887, *95% CI*=1.330-2.679), anxiety (*Adjusted OR*=1.731, *95% CI*=1.221-2.455), stress (*Adjusted OR*= 2.577, *95% CI*=1.617-4.107), use of sleeping medication (*Adjusted OR*=9.070, *95% CI*=2.062-39.896) and age (*Adjusted OR*= 0.414, *95% CI*= 0.205-0.837).

Conclusion: There was an association between depression, anxiety, stress, consumption of sleeping medication, age, and poor sleep quality during the pandemic in Indonesia.

Keywords: COVID-19**;** anxiety; depression; sleep quality; stress; adolescent; Indonesia

Introduction

Corona Virus Disease (COVID-19) is an illness that affects the respiratory system. It will react severely to people with comorbidities, such as cardiovascular diseases, diabetes, chronic respiratory diseases (Jamie, 2020; World Health Organization, 2020a). COVID-19 has two modes of transmission, direct and indirect. The direct transmission includes droplets, aerosols, and body fluid which has the probability of transmitting within one-meter distance with an infected person. Indirect transmission covers surfaces like furniture with immediate contact with an infected person or other objects used by the infected person (Karia, Gupta, Khandait, Yadav, & Yadav, 2020). On March 11, 2020, WHO has declared COVID-19 as a pandemic (Tosepu, Effendy, & Ahmad, 2020; World Health Organization, 2020a). Since then, 1.528 cases have been confirmed in Indonesia (Setiati & Azwar, 2020). The Indonesian government did not take long to decide Indonesia needs to implement quarantine. On March 13, 2020, all social activities such as school and work were instructed to be done at home, and any event with a significant number of participants was postponed (Mien, Ananda, Indriastuti, & Tahiruddin, 2021; World Health Organization, 2020b). Indonesia's president, Joko Widodo, also chose to implement large-scale social restrictions (PSBB) that are more flexible to prevent the disruption of the economy in several regions (Apresian, 2020).

Some studies found that quarantine and pandemics are causing an increased prevalence of psychological conditions such as depression, stress, and anxiety (Duran & Erkin, 2021). The increase of psychological turbulence is caused by being in a space for an extended period as an obligatory act, losing freedom, worrying about uncertainty, or being apart from loved ones (Javed, Sarwer, Soto, & Mashwani, 2020). On the other hand, another study found that there might be a correlation between psychological situations with sleep quality (Duran & Erkin, 2021).

This study aimed to determine the association between depression, anxiety, and stress with sleep quality in Indonesian people during the COVID-19 pandemic.

Methods

Study Design
This study used a cross-sectional design.

Study Participants and Sampling
This study was conducted on February 4-6, 2021. An online survey has been distributed through *Instagram, WhatsApp* groups, *Line* groups, and other social media platforms.

Instruments
Demographic information
The survey included sociodemographic data such as age, gender, religion, level of education, and residential regions. Age was categorized into adolescence (10-24 years old) and adult (> 25 years old). The level of education was categorized into high school/diploma and respondents with a higher degree. Residential regions were divided into Java and non-Java areas.

DASS-21
Levels of depression, anxiety, and stress were measured using the DASS-21 questionnaire. There are five scales for each category, ranging from normal (not having any depression, anxiety, and stress symptoms), mild, moderate, severe, and extremely severe. This questionnaire measured the conditions of respondents over the past week (Psychology Foundation of Australia, 2018). In analysis, the classification of depression, anxiety, and stress were grouped into two: having depression, anxiety, stress, or not. A study examining the psychometric properties and generalizability of DASS-21 across cultures, including Indonesia, has shown that out of 18 items in DASS-21, the acceptable Cronbach's alpha value was 0.91 with value for DASS-depression = 0.86, DASS-anxiety = 0.81 and DASS-stress = 0.70 (Oei, Sawang, Goh, & Mukhtar, 2013). Another study provides evidence that the Indonesian version of DASS-21 is internally consistent and has predictive value (Onie, Kirana, Mustika, Adesla, & Ibrahim, 2020).

PSQI
Pittsburgh sleep quality index (PSQI) is a self-rated questionnaire that measures sleep quality over the past month. The PSQI contains seven components that measured sleeping quality, such as sleep duration, sleep disturbance, sleep latency, sleep

efficiency, daytime dysfunction, subjective sleep quality, and the use of sleeping medication. These components will give a global PSQI score, ranging from 0 to 21, that determines sleep quality. The higher the score, the worse the quality (Zhong, Gelaye, Sánchez, & Williams, 2015). In the analysis, sleep quality was classified into good and poor sleep quality. The PSQI-Indonesian Version (PSQI-I) has Cronbach's alpha value of 0.72 and ranges from 0.69 to 0.72 for each item. This study revealed that PSQI-I has adequate reliability and validity (Setyowati & Chung, 2020).

Data Analysis

data were showed descriptively. The variables were analyzed using chi-square for bivariate analysis and binary logistic regression for multivariate analysis.

Significant value was determined as a p-value less than <0.25.

Ethical Consideration

The Ethics Committee of the Faculty of Medicine, Pelita Harapan University, has approved the protocol for this study. An approval letter has been issued with the number 082/K-LJK/ETIK/II/2021.

Results

A total of 913 people from across Indonesia contributed to this study. Most of the respondents are high school students (74.5%) living in Java island (68.9%). There are 60.9% females, with an average age of 18.70 years old. Table 1 shows the sociodemographic characteristics of respondents.

Table 1 Sociodemographic characteristics of participants

		Frequency (*n*=913)	Percentage (%)
Age (years)		18.70*	
	15-24	867	93.8
	25-55	46	5.0
Gender			
	Male	350	37.9
	Female	563	60.9
Education			
	High School	688	74.5
	University	225	24.4
Religion			
	Islam	122	13.2
	Christian	477	51.6
	Catholic	200	21.6
	Buddha	83	9.0
	Hindu	9	1.0
	Kong Hu Cu	2	0.2
	Others	12	1.3
Region			
	Java Island	637	68.9
	Non-Java Island	276	29.9

*Mean

There are 43.5% of participants depressed, 43.3% are anxious, and 25.2% are stressed during the pandemic. Table 2 shows the distribution of DASS-21 results among 913 respondents.

Table 2 Severity of depression, anxiety, and stress in adolescents during the pandemic

Severity of Depression	Frequency (*n*=913)	Percentage (%)
Normal (0-9)	522	56.5
Mild (10-13)	175	18.9
Moderate (14-20)	151	16.3
Severe (21-27)	48	5.2
Extremely Severe (≥28)	27	2.9

Table 2 (*Cont.*)

Severity of Anxiety	Frequency (*n*=913)	Percentage (%)
Normal (0-7)	524	56.7
Mild (8-9)	95	10.3
Moderate (10-14)	180	19.5
Severe (15-19)	63	6.8
Extremely Severe (≥20)	61	6.6
Severity of Stress	**Frequency (*n*=913)**	**Percentage (%)**
Normal (0-14)	691	74.8
Mild (15-18)	96	10.4
Moderate (19-25)	60	6.5
Severe (26-33)	60	6.5
Extremely Severe (≥34)	17	1.8

More than half of respondents (59.5%) have poor sleep quality during this pandemic. Table 3 shows the PSQI components results and the global scores.

Table 3 Components of Pittsburgh Sleep Quality Index

Variable	Score	Frequency (*n*=913)	Percentage (%)
Subjective Sleep Quality	Very Good (0)	63	6.9
	Fairly Good (1)	496	54.3
	Fairly Bad (2)	287	31.4
	Very Bad (3)	67	7.3
Sleep Latency	0	102	11.2
	1	413	45.2
	2	296	32.4
	3	102	11.2
Sleep Duration	>7 Hours (0)	472	51.7
	6-7 Hours (1)	318	34.8
	5-6 Hours (2)	77	8.4
	<5 Hours (3)	46	5.0
Sleep Efficiency	>85% (0)	871	94.3
	75% - 84% (1)	46	5.0
	65% - 74% (2)	5	0.5
	<65% (3)	2	0.2
Sleep Disturbance	0	84	9.1
	1	760	82.3
	2	73	7.9
	3	6	0.7
Use of Sleeping Medication	Not During the Past Month (0)	871	95.4
	Less Than Once A Week (1)	23	2.5
	Once or Twice A Week (2)	10	1.1
	Three or More Times A Week (3)	9	1.0
Daytime Dysfunction	0	110	11.9
	1	304	32.9
	2	359	38.9
	3	151	16.3
Global PSQI Score	Good Sleep Quality (0-5)	374	40.5
	Poor Sleep Quality (>5)	550	59.5

There was a significant relationship between sleep quality and the respondent's sociodemographic such as age (*p*=0.001), gender (*p*=0.009), and education level (*p*=0.049). Other variables such as depression, anxiety, stress, and medication also have a very significant relationship with sleep quality (p<0.001). Adolescent (*OR*=0.367, *95% CI*=0.199-0.679), female (*OR*=1.437, *95% CI*=1.095-1.886), and high school students (*OR*= 0.737, *95% CI*=0.544-0.999) have a higher risk for having poor sleep quality. While respondents with depression are four times odds more likely to have poor sleep quality (*OR*=4.092, *95% CI*=3.059-5.474), people with anxiety are 3.7 times odds more likely to have poor

sleep quality (*OR*= 3.776, *95% CI*=2.829-5.039), and people with stress are 5.6 times odds more likely to have poor sleep quality. The use of sleeping medication also increases the risk of having poor sleep quality by 14 times the odds than those who did not use it. Table 4 showed the results of the full bivariate analysis.

Table 4 Bivariate analysis between sociodemographic characters of participants, depression, anxiety, stress, and sleep quality

Variable		Sleep Quality		Total	OR (CI 95%)	p-value
		Good	Poor	(*n*=913)		
Age (Years)					0.367 (0.199-0.679)	0.001
	15-24	334 (38.5%)	533 (61.5)	867		
	25-55	29 (63.0%)	17 (37%)	46		
Gender					1.437 (1.095-1.886)	0.009
	Male	158 (45.1%)	192 (54.9%)	350		
	Female	205 (36.4%)	358 (63.6%)	563		
Education					0.737 (0.544-0.999)	0.049
	High School	261 (37.9%)	427 (62.1%)	688		
	University	102 (45.3%)	123 (54.7%)	225		
Region					0.932 (0.699-1.243)	0.631
	Java Island	250 (39.2%)	387 (60.8%)	637		
	Outside Java Island	113 (40.9%)	163 (59.1%)	276		
Depression					4.092 (3.059-5.474)	<0.001
	No	283 (54.2%)	239 (45.8%)	522		
	Yes	90 (22.4%)	311 (77.6%)	401		
Anxiety					3.776 (2.829-5.039)	<0.001
	No	280 (53.4%)	244 (46.6%)	524		
	Yes	93 (23.3%)	306 (76.7%)	399		
Stress					5.670 (3.827-8.400)	<0.001
	No	340 (49.2%)	351 (50.8%)	691		
	Yes	34 (14.6%)	199 (85.4%)	233		
Using of Sleeping Medication					14.157 (3.400-58.951)	<0.001
	No	361 (41.4%)	510 (58.6%)	871		
	Yes	2 (4.8%)	40 (95.2%)	42		

Multivariate analysis using logistic regression results are shown in Table 5 – Table 8. A *p*-value of more than 0.05 was removed in every variable in each table with different models. In Table 5, depression, anxiety, stress, use of sleeping medication have a *p*-value <0.05, while age, education, province, and gender have a *p*-value >0.05.

Table 5 Multivariate analysis between sociodemographic characters of participants, depression, anxiety, stress and sleep quality, Model I

Risk Factors	B	p	Adjusted OR	95% CI		R²
				Lower	Upper	
Depression	0.644	**<0.001**	1.905	1.341	2.706	
Anxiety	0.537	**0.003**	1.711	1.202	2.434	
Stress	0.914	**<0.001**	2.495	1.561	3.989	
Use of Sleeping Medication	2.251	**0.003**	9.494	2.147	41.976	0.212
Age	-0.824	**0.030**	0.439	0.209	0.923	
Education	-0.085	0.638	0.919	0.645	1.308	
Province	0.080	0.616	1.084	0.792	1.482	
Gender	0.156	0.304	1.169	0.868	1.574	

In the final model presented in Table 8 showed that there were significant relationships between sleep quality with depression (*Adjusted OR*= 1.887, *95% CI*=1.330-2.679), anxiety (*Adjusted OR*=1.731, *95% CI*=1.221-2.455), stress (*Adjusted OR*= 2.577, *95% CI*=1.617-4.107), use of sleeping medication (*Adjusted OR*=9.070, *95% CI*=2.062-39.896) and age (*Adjusted OR*= 0.414, *95% CI*= 0.205-0.837). The R^2 value was 0.210, which explains 21% of the variance in sleep quality explained by variables such as depression, anxiety, stress, consumption of sleeping medication, and age.

Table 6 Multivariate analysis between sociodemographic characters of participants, depression, anxiety, stress and sleep quality, Model II

Risk Factors	*B*	*p*	*Adjusted OR*	95% CI		R^2
				Lower	Upper	
Depression	0.642	**<0.001**	1.900	1.338	2.698	
Anxiety	0.540	**0.003**	1.716	1.206	2.440	
Stress	0.921	**<0.001**	2.512	1.573	4.012	
Use of Sleeping Medication	2.242	**0.003**	9.413	2.131	41.584	0.212
Age	-0.880	**0.014**	0.415	0.205	0.840	
Province	0.083	0.604	1.086	0.794	1.486	
Gender	0.154	0.212	1.167	0.866	1.571	

Table 7 Multivariate analysis between sociodemographic characters of participants, depression, anxiety, stress, and sleep quality, Model III

Risk Factors	*B*	*p*	*Adjusted OR*	95% CI		R^2
				Lower	Upper	
Depression	0.638	**<0.001**	1.900	1.333	2.686	
Anxiety	0.533	**0.003**	1.716	1.199	2.420	
Stress	0.927	**<0.001**	2.512	1.583	4.036	0.212
Use of Sleeping Medication	2.232	**0.003**	9.413	2.110	41.148	
Age	-0.885	**0.014**	0.415	0.204	0.835	
Gender	0.150	0.322	1.167	0.863	1.564	

Table 8 Multivariate analysis between sociodemographic characters of participants, depression, anxiety, stress, and sleep quality, Model IV

Risk Factors	*B*	*p*	*Adjusted OR*	95% CI		R^2
				Lower	Upper	
Depression	0.635	**<0.001**	1.887	1.330	2.679	
Anxiety	0.549	**0.002**	1.731	1.221	2.455	
Stress	0.947	**<0.001**	2.577	1.617	4.107	0.210
Use of Sleeping Medication	2.205	**0.004**	9.070	2.062	39.896	
Age	-0.881	**0.014**	0.414	0.205	0.837	

Discussion

To our knowledge, this is the first study in 2021 to assess the association between depression, anxiety, and stress during the COVID-19 pandemics with quality of sleep in Indonesian people. In this study, it was shown that depression, anxiety, and stress were associated with sleeping quality. A study from Italy supports this result by saying, "Those who have high levels of stress, anxiety, and depression had a higher probability of having sleep problems." (Franceschini et al., 2020). COVID-19 pandemic restricts interaction and requires people to stay at home that can cause negative emotions such as fear, loneliness, and uneasiness. Another factor that might be relevant to those psychological conditions is associated with quarantine and COVID-19 itself,

such as the uncertain duration people must endure, the fear of getting infected or even spread the virus, feelings of boredom, stress, the inability to do regular activities, and so much more (Brooks et al., 2020).

While psychological conditions affect sleeping quality, other sociodemographic factors such as age, gender, and education also take part in sleeping quality. Another significant thing to point out is the consumption of sleeping medications or sleeping pills during the pandemics.

This study found that age 15-24 years were at more risk of having poor sleep quality. But many international studies declared more varieties in the result that is also related to education or work status. For instance, one study from Italy found that the lockdown has a considerable impact on students than workers (Marelli et al., 2021). However, a study in Spain proved how poor sleep quality increases gradually with age and may be related to menopause (Madrid-Valero, Martínez-Selva, Couto, Sánchez-Romera, & Ordoñana, 2017). With gender, females and women suffered the most in the pandemic, conforming to a study in Canada. This result correlates with the data shown. This also could associate with the understanding of COVID-19 (Adella Halim et al., 2020). Having a role as a caregiver gives women a lot more to worry about and responsibilities to reconsider dwelling on their family's health, including the risk of exposure to COVID-19 (Guadagni, Umilta, & Iaria, 2020).

Another crucial point to this study is the consumption of sleeping medications during the pandemic. This study has shown that using sleeping medication also affects sleeping quality. A study from Spain stated how consumption of sleeping medications resulted in a greater prevalence of sleep problems (Madrid-Valero et al., 2017). Another international study also acknowledged this matter (Mandelkorn et al., 2021). Interestingly, both studies showed how consumption of sleeping medications is also associated with gender, females in particular.

With all this information aside, as evident as it might sound, having a good sleep quality is overriding. Sleep disruption affects children, adolescents, and adults in short-term health consequences or psychological issues such as having a weekly headache, pain, emotional distress, performance deficits, mood disorder, poor mental health, risk-

taking behaviors, and maybe contributing to depression. It also affects people's health in a long-term consequence. Several examples that may occur to people with sleep disruption are the increased risk of having cardiovascular disease, hypertension, diabetes, weight-related issues, cancer, and if its severity has gone to the peak, sleep disruption could increase mortality rate in men (Medic, Wille, & Hemels, 2017). Another study from Indonesia that analyses medical students also discovered how anxiety and sleep disruption are closely correlated, which increases the prevalence of irritable bowel syndrome (Fernanda & Kurniawan, 2020).

After knowing what poor sleep quality may do to health, we can conclude how having satisfactory sleep quality would mean having a lower risk of getting diseases in the long run. For students, longer sleep duration and better sleep quality may affect class performance and academic category (Okano, Kaczmarzyk, Dave, Gabrieli, & Grossman, 2019). Having good sleeping quality, in general, enables us to think, be more alert, vigilant, reducing stress, and also improve our mood (U.S. Department of Health and Human Service, 2020).

Being at home constantly, unable to meet friends or relatives like how we were used to, always being aware of personal hygiene, and consistently updating concerning COVID-19 numbers going up or down every day sure put a toll on our mental health. Having to know ways to cope and keep track of our feelings becomes more necessary than ever. Some healthy ways to cope and manage your emotions during this pandemic include having a personal break from the news related to COVID-19 and screen time in general. Doing exercises, eating healthy, getting enough sleep, connect with others, or through a community may also help vent out all concerns and worries (Center for Disease Control and Prevention, 2021).

Additionally, trying to remind ourselves of how this pandemic is temporary, trying to change perspectives, and understanding the current situation might also help relieve stress bit by bit. Most importantly, having to seek help when necessary, sticking to treatment plans, and taking medications as told are points to be considered and noticed (Michigan Medicine Department of Psychiatry, 2020).

Despite having to obtain data, this study had limitations. All data and results are from a cross-sectional method that does not have any further cause-and-effect explanations regarding the data and variables present in this research. This study uses questionnaires distributed online and is a part of a self-report questionnaire that may not be valid because of its subjectivity. Other factors associated with sleeping quality are still limited because this study only discusses the correlations of depression, anxiety, and stress with sleep quality.

Conclusion

We can conclude that depression, anxiety, stress, age, and consumption of sleeping medication were associated with sleep quality in Indonesian people during the pandemic.

Author Contributions
Designing research studies (JL, TA, JS, RM, NS, AK, DR), acquiring data (JL, TA, JS, RM, AK, LA), analyzing data (JL, TA, JS, RM, AK), interpreting the results (JL, TA, JS, RM, AK), and writing the manuscript (JL, TA, JS, RM, AK, DR, BW). All authors approved the final version of the article.

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