Media Kesehatan Masyarakat Indonesia
Volume 18 Issue 4 2022
DOI : 10.30597/mkmi.v18i4.20154
Website : http://journal.unhas.ac.id/index.php/mkmi

Sleep Quality Profile of Mining Workers Based on Pittsburgh Sleep Quality Index (PSQI)

Leonardo Lubis[1,2], Tiara Kusumawiyanti[1*], Gita Tiara Dewi Nasution[1], Febi Dwirahmadi[3]
[1]Department of Biomedical Sciences, Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia
[2]Indonesian Society of Excercise Physiology
[3]Centre for Environment and Population Health, School of Medicine and Dentistry, Griffith University, Brisbane, Australia
[*]Authors Correspondence: 2018unpad@gmail.com/085294083992

ARTICLE INFO

Article History:
Received April, 11th, 2022
Accepted Oct, 14th, 2022
Published online Dec, 30th, 2022

Keywords:
Sleep quality;
PSQI;
mining workers;

ABSTRACT
The number of work accidents in Indonesia and in the world is quite high, particularly in the mining sector. One of the factors that cause occupational accidents is poor sleep quality. Therefore good quality sleep is needed to reduce the risk of accidents. This study aims to describe the sleep quality of mining workers based on age, occupational category, and Body Mass Index (BMI). The research uses a descriptive design with a cross-sectional method. Data was collected from PT Borneo Indobara in 2020, as many as 120 workers. PSQI (Pittsburgh Sleep Quality Index) is used as an instrument. Then, sleep quality was reported in age, BMI, and occupational categories. The result shows that workers at PT Borneo Indobara are dominated by the age range of 21-40 years old (80%), working as operators (70.83%), and having normal BMI (56.67%). Most of the poor sleep quality is experienced by the worker with age range 18-20 years old (90.91%), working as a leader/officer (100%), and obesity as a BMI category (88.89%). Most of PT. Borneo Indobara employees have poor sleep quality based on the PSQI score, so that the management of PT. Borneo Indobara can use this research as employee evaluation data and can prepare treatment for the employees.

INTRODUCTION

Sleep is an unconscious state that can be awakened by sensory or other stimuli.[1] Healthy sleep consists of many dimensions, including adequate duration, good quality of sleep, appropriate timing, and the absence of sleep disturbances.[2] Good sleep quality is one of the important factors that contribute to physical function, psychological well-being, and quality of life. Sleep quality can be divided into objective and subjective sleep quality. Indicators of good subjective sleep quality can be seen from shorter sleep latency, adequate total sleep time, reduced wake-up time after sleep onset, and wakefulness during the day. The good subjective sleep quality can be measured with various instruments, one of them is the Pittsburgh Sleep Quality Index (PSQI).[3] The PSQI consists of 19 questions, included in seven components to evaluate sleep quality and disturbances in the past month. The PSQI itself was developed by Buysse et al.[4] Various factors affect sleep quality including physiological, psychological, and environmental influences,[5] such as age, job category, and Body Mass Index (BMI).

In general, everyone needs adequate sleep about 7-8 hours per day as a homeostatic process. Lack of sleep at night is associated with daytime sleepiness, health problems, and safety concerns.[6] A survey in America shows that 26% of workers experience excessive sleepiness during the day that interferes their daily tasks. A study of the relationship between Obstructive Sleep Apnea (OSA) and occupational accidents showed that OSA was the cause of daytime sleepiness increasing the work accidents by twofold.[6] In the mining industry alone, according to data from the US Bureau of Labor Statistics (BLS) during 2010, there were fatal work accidents that caused 172 deaths and 15.500 accidents.[7] Based on the 2019 Performance Report of the Ministry of Energy and Mineral Resources, in 2019, mining accident data in Indonesia reached 157 cases with 24 cases causing death.[8] A study of sleep quality in truck drivers shows that good sleep quality is necessary and very important driving jobs, a kind of job that also exists in coal mining. Another study at a company in Kalimantan, Indonesia, shows that there is a relationship between sleep quality, fatigue, and work safety[9,10] where fatigue is most likely to cause accidental death since fatigue impare alertness and the ability to move safely.[11] These occupational accidents and work-related illnesses can have an impact on an individual's economic, physical and emotional well-being. In addition, work accidents also affect productivity, economy, and society at large.[12]

The data shows a high rate of work accidents, especially in mining workers, where one of the factors that can cause work accidents is poor sleep quality, there has been no research on the sleep quality profile of mining workers in Indonesia. Thus, this study aims to describe the sleep quality of mining workers based on age, job category, and Body Mass Index (BMI).

MATERIAL AND METHOD

This study uses a descriptive design with a cross-sectional method on 120 mining workers of PT Borneo Indobara. The data used is a population sample. The inclusion criteria of the data are male workers with a minimum work duration of one month and filling out a complete questionnaire. The type of work carried out by mining workers at PT. Borneo Indobara is an exploration to find new mining points. After excavation, mining products are delivered to ports until they are distributed via large ships. All types of work use heavy equipment such as excavators, dump trucks, heavy dump trucks, and truck loads. All the work is made in two shifts, morning and night with three days of every week with one day off when changing shifts (each shift last for about eight to eleven hours per day).

The instrument used in this study was the Indonesian version of the PSQI (Pittsburgh Sleep Quality Index) questionnaire which has been validated. The questionnaire consists of 19 self-answered questions. These nineteen questions have seven components in which each component has a value ranging from 0-3 (0 = no difficulty, 3 = severe difficulty). This component contains subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping pills, and daily function disturbances. After that, the score for each component will be calculated to produce a global PSQI score with a range of 0-21.[3,4] Data were analyzed using Microsoft Excel software in which the results are grouped into two, a total score of ≤5 (good sleep quality) and a total score of > 5 (poor sleep quality) based on gender, age, occupational category, and BMI. Also, this study

got approval from the Health Research Ethics of Universitas Padjajaran with ethical number 939/UN6.C.6.1/TU.00/2021.

RESULTS

This study involved 120 mining workers at PT Borneo Indobara as research subjects. Information on respondent characteristics used in this study was age, job category, and BMI. The description of the characteristics and sociodemography of the respondents is presented in Table 1. The Table 1 shows that the mining workers at PT Borneo Indobara are dominated by men with the highest age range 21-40 years old (96 people or 80%), followed by 18-20 years old (11 people or 9.17%), then > 40 years old (13 people or 10.83%). Based on the job category, there are 85 people (70.83%) worked as operators, 18 people (15%) as mechanics, 13 people (10.83%) as supervisors, and 4 people worked as leaders/officers (3.33%). For the BMI group, more than half of the workers have a normal BMI (68 people) and the fewest are workers with obesity with 9 people (7.50%).

The PSQI data were obtained based on 19 questions: usual bedtime, the time needed to fall asleep (less than 30 minutes or not), usual waking up time, hours of actual sleep, waking up in the middle of the night, waking up to use the bathroom, unable to breathe comfortably, coughing or snoring loudly, feeling too cold or too hot, having bad dreams, having pain, self-rate of the overall sleep quality, using medicine to sleep, trouble to stay awake while doing a daily activity, less motivated to get things done, and having a bed partner/roommate or not. The results displayed are based on the PSQI scoring system. In this study, we only describe sleep quality based on the PSQI scoring system.[4] Based on Table 2, the result represents the mining workers at PT. Borneo Indobara are dominated by poor sleep quality workers that is as many as 92 people, while workers with a total PSQI score of > 5 who have good sleep quality are only 28 people.

From Table 3, it is clear that all age range categories have poor sleep quality based on the age distribution. The age range of 18-20 years old has the highest percentage of poor sleep quality (90.91%) compared to the other age categories. Meanwhile, those with age > 40 years old have the highest percentage of good sleep quality (30.77%) compared to the age range of 18-20 years old or 21-40 years old. It is also found that all occupation categories are dominated by poor sleep quality. The highest percentage of bad sleep quality is in the leader/officer category compared to operator, mechanic, or supervisors where all of them have poor sleep quality (100%). The occupation category that has the highest percentage of good sleep quality is the supervisor's job category (30.77%). Based on the Body Mass Index (BMI), all BMI categories are mostly dominated by poor sleep quality worker in which the percentage of poor sleep quality is mostly owned by obese workers (88.89%), while the percentage of good sleep quality is mostly in the overweight category of workers (28.13%).

Table 1. Charachteristics of PT. Borneo Indobara Workers

Variable	n = 120	%
Gender		
Male	120	100
Age		
18-20 Years Old	11	9.17
21-40 Years Old	96	80
> 40 Years Old	13	10.83
Type of Occupation		
Operator	85	70.83
Mechanic	18	15
Supervisor	13	10.83
Leader/Officer	4	3.33
Body Mass Index (BMI)		
Underweight (<18.5)	11	9.17
Normal (18.5-24.9)	68	56.67
Overweight (25-29.9)	32	26.67
Obese (≥30)	9	7.50

Source: Primary Data, 2020

Table 2. Sleep Quality Distribution Based on PSQI Score

PSQI	n = 120	%
Good (≤5)	28	23.33
Poor (>5)	92	76.67

Source: Primary Data, 2020

Table 3. Sleep Quality Frequency Distribution of Mining Workers Based on Gender, Age, Type of Occupation, and BMI

Variable	Sleep Quality			
	Good (PSQI Total Score ≤ 5)		Poor (PSQI Total Score > 5)	
	n	%*	n	%*
Age				
18-20 Years Old	1	9.09	10	90.91
21-40 Years Old	23	23.96	73	76.04
> 40 Years Old	4	30.77	9	69.23
Type of Occupation				
Operator	21	24.71	64	75.29
Mechanic	3	16.67	15	83.33
Supervisor	4	30.77	9	69.23
Leader/Officer	0	0	4	100
Body Mass Index (BMI)				
Underweight (< 18.5)	2	18.18	9	81.82
Normal (18.5-24.9)	16	23.53	52	76.47
Overweight (25-29.9)	9	28.13	23	71.88
Obese (≥ 30)	1	11.11	8	88.89

Source: Primary Data, 2020

*Notes: In Table 3, the result of the percentage is obtained based on segmental calculation. For example, in BMI, the percentage of obese respondents with poor sleep quality is calculated by:

$$\frac{\text{Number of Obese Respondents with Total Score } > \text{ 5 or Having Poor Sleep Quality}}{\text{All Obese Respondents}} \times 100\%$$

then the calculation becomes $\frac{8}{9} \times 100\% = 88.89\%$. Likewise for other variables, it is also used the same calculation.

DISCUSSION

The results show that the majority of PT Borneo Indobara workers have poor sleep quality. This is due to various factors, some of them are age, job category, and BMI which can be seen in Table 3. Regarding the age category, the highest percentage of poor sleep quality is in the age range of 18-20 years old. This result is consistent with the research conducted by Song et.al in which the percentage of poor sleep quality is higher in the age category of ≤ 29 years old rather than in the age category of > 40 years old.[13] Although it requires further research, one of the possible factors of these workers having poor sleep quality is due to electronic media used. Adolescents and young adults live in the digital era in which the use of electronic devices can interfere sleep, either directly or indirectly. Teenagers or young adults stay up late just enjoying their life with gadgets like chatting, playing games, or being online.[14] The using of electronic device at 8-10 hours or close to bedtime indicates that teenagers and young adults are exposed to light from gadgets before bedtime. Exposure to blue-light, which is short-wavelength light from electronic devices such as smartphones, tablets, or computers, is similar to exposure of the sunlight in the morning.[15] When a person used electronic devices at the wrong time, such as when going to sleep, it can disrupt circadian rhythm by causing melatonin suppression due to exposure to light, causing a person to take longer to fall asleep and reduce total sleep time.[15] The more time spent on electronic devices, the greater the decline in sleep duration and quality.[15] Other studies state that people with 46 years old have a higher percentage of poor sleep quality than those with 18-45 years old.[16] Sleep quality generally declines with age, especially in terms of sleep efficiency. Poor sleep is most common in older adults.[17] Older people are likely to experience all the symptoms of poor sleep except daytime dysfunction. Since older adults may have reached retirement age, they tend to be more flexible to adjust daytime activities to their

energy levels compared to working individuals.[18] One of the hormones that play an important role in maintaining circadian rhythms and sleep is melatonin.[19] Melatonin itself begins to appear about 2-3 months after the baby is born where the peak of its production at the age of 2-4 years old. The concentration of melatonin in the blood then declines until puberty, when there is a signal to start of puberty. The steady decline in melatonin reaches levels in adults starting after puberty until late adolescence. Melatonin levels are stable at the age of 21-40, then there is a significant decline at the age of 40. People with age > 90 have melatonin level less than 20% compared to young adults.[20,21]

Based on BMI, people with obesity have the highest percentage of poor sleep quality. These results are consistent with research conducted on hospital employees in Turkey,[22] where the percentage of poor sleep quality is high in the obesity category. The study also explains the BMI value of respondents with poor sleep quality is higher. Other studies have also shown that increasing BMI is associated with poor sleep quality and short sleep duration and poor sleep quality is associated with obesity.[23] It is because lack of sleep can disrupt hormone levels such as leptin and ghrelin that affect glucose homeostasis and hunger regulation.[23,24] Individuals with poor sleep quality are more likely to eat or snack when they wake up at night because their wake-sleep cycle is disturbed so it will cause an increase in BMI following the rising energy intake.[22] In obesity, there are fat deposits in the upper respiratory tract which narrow the respiratory tract which can cause collapse and a decrease in muscle activity that causes hypoxia and susceptibility to Obstructive Sleep Apnea (OSA). This hypoxia will result in a decrease of oxygen in tissues and blood vessels and can cause sleep disturbances during breathing.[25,26] Weight gain can increase the risk of OSA in healthy people and can accelerate the development of OSA, especially in overweight patients.[27]

In the type of occupation category, it was found that the leader/officer has poor sleep quality with the highest percentage compared to operators, mechanics, and supervisors. The type of worker itself is divided into white-collar and blue-collar. Blue-collar workers have physically demanding jobs and work in unfavorable conditions such as monotonous and repetitive work. They also require to lift heavy loads and to work in shifts. On the other side, white-collar workers have jobs that are mentally and emotionally demanding and usually do not work in harsh conditions and psychosocial stress, such as irregular and long working hours, full of pressure, and others. According to Sun et al, blue-collar workers have shorter sleep duration and decreased sleep quality than the white collar one.[28] Other research also states that white-collar workers are more physically inactive because their jobs tend to be sedentary passive behavior compared to blue-collar workers in which physically active workers have lower stress levels[29] and high work stress can cause poor sleep quality.[30,31] All of these work requires high concentration and good physical fitness physically, emotionally, and to some extent, spiritually. That is why good quality sleep will greatly support the physiological process of recovery after doing the work.

The limitation of this study is that the number of respondents' sociodemographic distribution is not evenly distributed so it cannot describe the overall sleep quality of mining workers. Also, since this is a descriptive study, the information that leads to the conclusion of why mining workers have poor sleep quality is not really adequate. Thus, it still requires further analytical research on the specific factors that cause poor sleep quality in mining workers.

CONCLUSION AND RECOMMENDATION

Workers at PT. Borneo Indobara in 2020 majority has poor sleep quality. Most of the poor sleep quality is experienced by those who are 18-20 years old, working as the leader/officer, and having obese. For this reason, the management can use this research as employee evaluation data and prepare treatment for employees at PT. Borneo Indobara that has poor sleep quality, so the risk of occupational accidents can be reduced. It is necessary to conduct further studies on the analysis of factors that affect sleep quality and its relationship to productivity, health, and safety.

ACKNOWLEDGMENTS

The authors are grateful to the mining workers who are voluntarily participating in the study as a respondent and to PT. Borneo

Indobara that allowed the data collection process in the company, supporting financially and providing security during the research.

AUTHOR CONTRIBUTIONS

LL and TK managed the ethical clearance; LL designed the research design and conducted data collection; LL, TK, GTDN, and FD analyzed the data and write the manuscript. FD proofreading the manuscript. LL = Leonardo Lubis; TK = Tiara Kusumawiyanti; GTDN = Gita Tiara Dewi Nasution. FD = Febi Dwirahmadi.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

REFERENCES

1. Hall JE. Guyton and Hall Textbook of Medical Physiology. 13th ed. Philadelphia: Elsevier, Inc; 2015.
2. Chaput JP, Dutil C, Sampasa-Kanyinga H. Sleeping hours: What is the Ideal Number and How Does Age Impact This?. *Nat Sci Sleep*. 2018;10:421–430. 10.2147/NSS.S163071
3. Farah NMF, Yee TS, Rasdi HFM. Self-Reported Sleep Quality Using The Malay Version of the Pittsburgh Sleep Quality Index (PSQI-M) in Malaysian Adults. *Int J Environ Res Public Health*. 2019;16(23):1–10. 10.3390/ijerph16234750
4. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a New Instrument for Psychiatric Practice and Research. *Psychiatry Res*. 1989;28:193–213. 10.1016/0165-1781(89)90047-4
5. Potter, PA; Perry, AG; Stockert, PA; Hall A. Fundamentals of Nursing. 10th ed. Philadelphia: Elsevier Inc; 2020.
6. Gharibi V, Mokarami H, Cousins R, Jahangiri M, Eskandari D. Excessive Daytime Sleepiness and Safety Performance: Comparing Proactive and Reactive Approaches. *Int J Occup Environ Med*. 2020;11(2):95–107. 10.34172/ijoem.2020.1872
7. Of USB, Statistics L. Injuries, illnesses, and Fatal Injuries in Mining in 2010. 2013;2(1):1–8.
8. Kementerian ESDM. Laporan Kinerja DJMB Tahun 2019. Jakarta: Kementerian Energi dan Sumber Daya Mineral. 2020; Available from: https://www.esdm.go.id/id/publikasi/lakip
9. Fletcher A. Staying Safe in the Jungles of Borneo: Five Studies of Fatigue and Cultural Issues in Remote Mining Projects. *Ind Health.* 2010;48(4):406–415. 10.2486/indhealth.mssw-04
10. Mutifasari RS, Ramdhan DH. Association Between Sleep Quantity and Quality with Occupational Stress Among Truck Driver. *Malaysian J Med Heal Sci*. 2019;15(SP4):153–158.
11. Widanarko B, Modjo R, Rantetampang J. Risk Factors Associated with Work-Related Fatigue Among Indonesian Mining Workers. Vol. 825, Advances in Intelligent Systems and Computing. Springer International Publishing; 2019: 1029–1037. https://doi.org/10.1007/978-3-319-96068-5_115
12. International Labour Organization. Safety and Health at the Heart of the Future of Work. Building on 100 Years of Experience. 2019:75.
13. Song TJ, Yun CH, Cho SJ, Kim WJ, Yang KI, Chu MK. Short Sleep Duration and Poor Sleep Quality among Migraineurs: A Population-Based Study. *Cephalalgia*. 2018;38(5):855–864. 10.1177/0333102417716936
14. Das-Friebel A, Perkinson-Gloor N, Brand S, Dewald-Kaufmann JF, Grob A, Wolke D, et al. A Pilot Cluster-Randomised Study to Increase Sleep Duration by decreasing Electronic Media Use at Night and Caffeine Consumption in Adolescents. *Sleep Med*. 2019;60:109–115. 10.1016/j.sleep.2018.11.010
15. Pham HT, Chuang HL, Kuo CP, Yeh TP, Liao WC. Electronic Device Use Before Bedtime and Sleep Quality Among University Students. *Healthc.* 2021;9(9):1–12. https://www.mdpi.com/2227-9032/9/9/1091
16. Songkham W, Deeluea J, Suksatit B, Chaiard

J. Sleep Quality Among Industrial Workers: Related Factors and Impact. *J Heal Res*. 2019;33(2):119–26. 10.1108/JHR-08-2018-0072

17. Dong X, Wang Y, Chen Y, Wang X, Zhu J, Wang N, et al. Poor Sleep Quality and influencing Factors Among Rural Adults in Deqing, China. *Sleep Breath*. 2018;22(4):1213–1220. 10.1007/s11325-018-1685-8
18. Gadie A, Shafto M, Leng Y, Kievit RA, Cam-CAN. How are Age-Related Differences in Sleep Quality Associated with Health Outcomes? An Epidemiological Investigation in a UK Cohort of 2406 adults. *BMJ Open*. 2017;7(7). 10.1136/bmjopen-2016-014920
19. Ostrin LA. Ocular and Systemic Melatonin and the Influence of Light Exposure. *Clin Exp Optom*. 2019;102(2):99–108. https://doi.org/10.1111/cxo.12824
20. Aulinas A. Physiology of the Pineal Gland and Melatonin. Endotext. 2000.
21. Bubenik GA, Konturek SJ. Bubenik and Konturek. 2011;13–19.
22. Arslan M, Aydemir İ. Relationship Between Emotional Appetite, Eating Attitudes, Sleep Quality, and Body Mass Index in Healthcare Workers: a Multi-Centre Study. *Psychiatry Clin Psychopharmacol.* 2019;29(3):346–353. https://doi.org/10.1080/24750573.2019.1627694
23. Mirdha M, Nanda R, Sharma HB, Mallick HN. Study of Association Between Body Mass Index and Sleep Quality Among Indian College Students. *Indian J Physiol Pharmacol.* 2019;63(1):8–15. 10.1016/j.sleep.2019.11.724
24. Park SK, Jung JY, Oh CM, McIntyre RS, Lee JH. Association Between Sleep Duration, Quality and Body Mass Index in the Korean Population. *J Clin Sleep Med*. 2018;14(8):1353–1360. 10.5664/jcsm.7272
25. Dong Z, Xu X, Wang C, Cartledge S, Maddison R, Shariful Islam SM. Association of Overweight and Obesity with Obstructive Sleep Apnoea: A Systematic Review and Meta-Analysis. *Obes Med*. 2020;17(January):100185. https://doi.org/10.1016/j.obmed.2020.100185
26. Sekhar Reddy, Parvaiz A. Koul, Moomin Hussain Bhat, Sanaullah Shah, Ganie MA. Comparison of Clinical, Biochemical, and Polysomnographic Parameters Between Obese and Nonobese Obstructive Sleep Apnea. *Lung India*. 2022;39(3):261–266. 10.4103/lungindia.lungindia_699_21
27. Tuomilehto H, Seppä J, Uusitupa M. Obesity and Obstructive Sleep Apnea - Clinical Significance of Weight Loss. *Sleep Med Rev*. 2013;17(5):321–329. 10.1016/j.smrv.2012.08.002
28. Kim B, Yoon S, Kim J, Woo K-H, Cho S, Lee H, et al. Factors Related with Quality on Sleep of Daytime Workers. *Ann Occup Environ Med*. 2018;30(1):1–9. 10.1186/s40557-018-0271-7
29. Dėdelė A, Miškinytė A, Andrušaitytė S, Bartkutė Ž. Perceived Stress Among Different Occupational Groups and the Interaction with Sedentary Behaviour. *Int J Environ Res Public Health*. 2019;16(23). 10.3390/ijerph16234595
30. Gu B, Tan Q, Zhao S. The Association Between Occupational Stress and Psychosomatic Wellbeing Among Chinese Nurses: A Cross-Sectional Survey. *Med (United States).* 2019;98(22):1–6. 10.1097/MD.0000000000015836
31. Xiao H, Zhang Y, Kong D, Li S, Yang N. The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Med Sci Monit.* 2020;26:1–8. 10.12659/MSM.923549