



**THE RELATIONSHIP BETWEEN NOISE LEVEL AND SLEEP QUALITY OF WOOD PROCESSING WORKERS**

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**ABSTRACT**

Wood processing generally involves the use of large machines for cutting and grinding. This process is customized according to consumer needs. During wood processing, workers are exposed to noise generated by machines, with an average level exceeding 85 dBA. These workers typically work eight hours a day with a one-hour break. The impact of this noise extends beyond hearing loss, as it also disrupts the workers' sleep quality. This study aims to examine the relationship between noise levels and sleep quality among wood processing workers, specifically at UD. Adhi Santa in Tabanan, Bali, which serves as the research site. The study design employed was a cross-sectional study with a sample population of 40 wood processing workers who met the inclusion and exclusion criteria. Noise levels were measured using a sound level meter in the work machine area, while sleep quality was assessed using the Pittsburgh Sleeping Quality Index (PSQI). The data were analyzed using computer software, utilizing Spearmans to determine the significant relationship between noise levels and sleep quality among workers in the wood processing factory. The results indicated that, out of the 40 workers, the analysis revealed a significant relationship between noise levels and sleep quality ( $p = 0.002$ ,  $p < 0.05$ ). In conclusion, it can be stated that there is indeed a significant relationship between noise levels and sleep quality among wood processing workers.

Keywords: noise; sleep quality; workers

<b>First Received</b> 19 January 2024	<b>Revised</b> 26 January 2024	<b>Accepted</b> 30 January 2024
<b>Final Proof Received</b> 11 March 2024		<b>Published</b> 01 April 2024
<b>How to cite (in APA style)</b> Haryawan, I. G. A., Biomi, A. A., & Suadnyana, I. A. A. (2024). The Relationship Between Noise Level and Sleep Quality of Wood Processing Workers. Indonesian Journal of Global Health Research, 6(2), 657-664. <a href="https://doi.org/10.37287/ijghr.v6i2.2954">https://doi.org/10.37287/ijghr.v6i2.2954</a> .		

**INTRODUCTION**

The development of industry in Indonesia today is in line with advances in science and technology. The process of industrialization of Indonesian society is accelerating with the establishment of many companies and diverse workplaces. Industrial development is accompanied by greater and more varied risks of danger due to the transfer of technology where the use of increasingly complex machines and work equipment to support the running of the production process. In this case it can cause occupational health and safety problems (Farid, 2010). According to Occupational Safety and Health legislation, namely Republic of Indonesia Law No. 1 of 1970 concerning Work Safety states that every worker has the right to receive safety protection in carrying out work for welfare and increasing national production and productivity. Technology and work equipment in industry, such as machines or tools, are now increasing and developing, from type to number. The use of machines and work equipment will cause noise which will cause disruption to communication, concentration and enjoyment of work, resulting in permanent loss of power.

Noise is a sound or sounds whose presence is unwanted (noise is unwanted sound). In the context of protecting the health of workers, noise is defined as all unwanted sounds/sounds originating from production process equipment and/or work tools which at a certain level can cause hearing problems. World Health Organization (WHO) in 2004, high levels of occupational noise are a problem in all regions of the world, in the United States more than 30 million workers are exposed to dangerous noise and in Germany 4-5 million people (12-15% of the workforce) are exposed to noise. Noise sources can come from machines such as textile factories, sawmills, the furniture industry, products that use metal raw materials and the automotive industry which can produce noise exposure of 90 dBA or more. According to the Minister of Manpower and Transmigration of the Republic of Indonesia Number PER.13/MEN 2011 concerning Threshold Values for Physical Factors and Chemical Factors in the Workplace, the Threshold Limit Value (NAB) for noise is 85 dBA.

Hearing loss is a partial or total inability to hear sounds in one or both ears. Noise-induced hearing loss is a sensorineural type of hearing loss, which is not noticed at first, because it does not interfere with daily conversations. One of the risk factors that influences the severity of deafness is noise intensity (Manoppo et al., 2014). In wood processing factories, large machines are used to process wood, whether it is cut or shaved according to the required requirements. The condition of workers when processing wood is exposure related to the noise generated by the machine. Noise exposure resulting from this work averages  $\leq 85$  dBA. Working hours are also long, up to 8 hours per day.

From the conditions above, it is very necessary to provide an understanding of exposure to noise caused by machines during wood processing. This understanding needs to be given to managers and workers to better understand the risks of noise which will affect workers' health, including the quality of sleep of these workers. Workers will also be given an understanding of the importance of good quality sleep for smooth work and maximum work results. Based on the data and observations above, researchers want to know the level of noise caused by machines during wood processing which will be related to the quality of sleep for workers. In this research, working environmental conditions and work health and safety will also be looked at. This research aims to investigate the relationship between noise levels and sleep quality among wood processing workers at UD. Adhi Santa in Tabanan, Bali. This research will identify the impact of noise from wood processing machines on workers' sleep quality, as well as evaluate whether the noise levels are height contributes to sleep disorders. By using a cross-sectional research design and using the Pittsburgh Sleeping Quality Index (PSQI) to measure sleep quality, this study will provide a better understanding of the impact of the work environment on the sleep health of workers in wood processing factories. Research results "It is hoped that this will provide valuable input for factory management to improve working environmental conditions and workers' welfare."

## **METHOD**

This research is a research with a cross sectional observational study design which was carried out to explore information on people's knowledge and attitudes. Data regarding the independent variable and dependent variable are collected at one time only and at the same time. The research location is at the UD Wood Processing Factory. Adhi Santa, Tabanan Regency. This research was conducted in May – June 2023. The target population for this research was wood processing factory workers at UD. Adhi Santa, Tabanan Regency. The number of samples obtained was 40 workers. Noise measurements use a sound level meter and the PSQI sleep quality questionnaire to determine the sleep quality of workers. The PSQI questionnaire showed a Cronbachalpha result of 0.72, with variations for each element

ranging from 0.69 to 0.56 with  $p < 0.05$ . PSQI interpretation scores can be described as follows: scores 1-5 (good), scores 6-7 (mild), scores 8-14 (moderate) and scores 15-21 (bad) (Made et al., 2019). The data was processed using SPSS version 25 with Spearman rank test data processing to determine the relationship between noise and sleep quality at the Adhi Santa Tabanan wood factory. The validity and reliability of the PSQI questionnaire have been evaluated using Cronbach's alpha. The value given is 0.72 for Cronbach's alpha, indicating a fairly good level of reliability. In addition, a  $p$  value  $< 0.05$  indicates that the variation for each element of the PSQI questionnaire is also statistically significant. However, there is no specific information about the validity of the questionnaire in the description provided.

## RESULTS

### Respondent Characteristics

The respondents in this research were wood processing factory workers at UD. Adhi Santa, Tabanan Regency. Based on the sample size formula used, the number of respondents in this study was 40 people who met the inclusion and exclusion criteria. The characteristics of respondents based on age among factory workers can be seen in the following table:

Table 1.  
Respondent Characteristic

Variable	Kategori	f	%
Age (year)	41-49	14	35.0
	50-60	26	65.0
Education	SMA	35	87.5
	SMP	5	12.5

Distribution of data based on age with an age range of 41-49 years totaling 14 people (35.0%), an age range of 50-60 years totaling 26 people (65.0%). Age level greatly influences labor productivity because it is related to the physical abilities of a worker. Workers of productive age tend to be physically stronger than non-productive age workers. The higher the age of the workforce, the lower work productivity will be. Workers who are older tend to have lower productivity. The results of research from Haryawan I G. A. and Astiti Suadnyana I A. found that the age range for wood processing workers in Rana Bhumi Gianyar is between 36-60 years because this work requires a high level of skill which is only possessed by workers who are over 35 years old and have sufficient experience in processing wood to make ready-to-use wood. Workers must also understand the calculations for processing this wood, so that during the cutting process it matches the desired size (Haryawan et al., 2023). Data distribution based on high school education level was 35 people (87.5%), junior high school education was 5 people (12.5%). The average education level is at high school, because workers must also know mathematical calculations in the wood processing process and have sufficient experience.

### Sleep Quality and Noise Level Results

Table 2.  
Sleep Quality and Noise Level Results

Variable	Mean	SD	Range
Sleep Quality	30.3	3.8	23-39
Noise Level	91.9	3.8	85.7-97.4

Table 2, the results show that the average sleep quality of workers is 30.3 with a minimum range of 23 and a maximum of 39. And the average noise level is 91.9 dB with an average of

85.7-97.4. This means that the noise threshold value has exceeded the standard. Noise is all unwanted sounds originating from production process equipment or work tools which at a certain level can cause hearing loss. Based on PERMENAKER No.13/MEN/X/TAHUN 2011 concerning Threshold Limit Values (NAB) for physical and chemical factors in the workplace, it stipulates that the NAB for noise is 85 dBA as the highest intensity and is a value that can still be accepted by workers without causing illness. or health problems in daily work for a period not exceeding 8 hours a day or 40 hours a week (Permenakertrans, 2011); (Septiana et al., 2017); (Jaiswal, 2021).

### Results of the Relationship Between Sleep Quality and Noise Level

Table 3.

Results Of The Relationship Between Sleep Quality And Noise Level

Variable		Sig
Sleep Quality – Noise Level	483	0.002

The Sig Value Obtained Was  $0.002 < 0.05$  So There Was A Significant Relationship Between Sleep Quality And Noise Levels From Wood Processing Workers At Ud. Adhi Santa, Tabanan Regency. Park et al.'s research (2017) stated that individuals with higher noise sensitivity tend to interpret noise negatively as a threat or disturbance and react emotionally compared to individuals who have low noise sensitivity. As a result, individuals with high sensitivity will have difficulty getting used to or adapting to noise, causing sleep disturbance problems. Noise sensitivity is also said to mediate the impact of noise on health (Park et al., 2017). Based on research by Heo et al. (2013), it was found that temperature in the workplace ( $p$  value  $< 0.001$ ) also had an effect on sleep quality compared to noise ( $p$  value = 0.005). In general, an increase in the hormone cortisol and the hypothalamic-pituitary-adrenal or hypothalamic-pituitary-adrenocortical (HPA) axis plays an important role in sleep, and disruption of these functions can cause sleep disorders. Therefore, it can be suspected that workplace temperature can directly affect the HPA axis and increase cortisol, and as a result, sleep disturbances occur. Apart from that, psychosocial factors of workers are also an important cause of sleep disorders. It was found that high work demands, lack of social support and appreciation in the work environment significantly influence the sleep quality of workers (Heo et al., 2013).

Adult humans in the age range of 26-64 years need 7-9 hours of sleep/day and should only be exposed to noise of 85 dB for 8 hours/day, lack of sleep and too much continuous exposure to high noise results in increased hormones cortisol in humans can cause psychological disorders such as stress and disturbed sleep patterns (Yul et al., 2020). Noise not only causes sleep disturbances or reduces a person's quality of life, but also contributes to increasing the prevalence of health problems because it affects the body's biological systems. Sleep disorders manifest in cardiovascular system disorders including coronary artery calcification, atherogenic lipid profile, atherosclerosis, obesity, type 2 diabetes, and hypertension. Psychiatric disorders such as anxiety and mood disorders may also occur. The minimum sound level recommended by WHO is expected to be a benchmark for a good environment for a population to live in in order to reduce the level of morbidity due to noise (Saputra & Rohmah, 2016).

Research by Gitanjali and Anath, (2003) revealed that workers who are exposed to noise during the day will have their sleep disrupted at night and can cause direct stress. Exposure to noise will change the REM sleep stage where REM sleep is very important to maintain mental and emotional balance which can cause stress (Gitanjali & Ananth, 2003).The results of

research from Haryawan I G A. and Astiti Suadnyana I A. show that there is a relationship between sleep quality and noise exposure received when carrying out wood processing work. Age level greatly influences labor productivity because related to the physical abilities of a worker. Workers who are on productive age workers tend to be physically stronger than non-productive age workers productive. Problems outside of work are also the cause of the decline in the quality of sleep of workers. Exposure to noise levels that exceed the threshold is very bad for the health of the ears and affects the quality of sleep less, so that the next day when they start work again, workers usually experience fatigue, drowsiness and loss of work concentration. Workers can work for 8 hours exposure time but must use personal protective equipment.

The personal protective equipment in the form of ear plugs, ear muffs or a combination between the ear plug and ear muff. In this case the company already provides ear plugs but Most workers don't use ears the plug properly within reason inconvenience and many find it that workers are more comfortable using leftovers cotton for ear protection only can reduce noise by 15 dBA (Haryawan et al., 2023). In addition, the psychosocial factors of workers are also a significant cause of sleep disturbances. It was found that high job demands, lack of social support, and appreciation in the work environment significantly affected workers' sleep quality (Heo et al., 2013);(Septiana et al., 2017). Sleep disturbances manifest as cardiovascular system disorders, including coronary artery calcification, atherogenic lipid profile, atherosclerosis, obesity, type 2 diabetes, and hypertension (Knutson, 2010). Based on research results from (Yul et al., 2020), there are four processes in the cycle boiling that has a noise level above NAB, namely deaeration, containment, peak blowdown 2 and final. Exposed noise in the working period 7-8 Hours/Days continuously result increased cortisol hormone in workers thereby causing disruption to quality workers sleep (Yul et al., 2020).

Other factors besides noise affect sleep quality bad responders were fatigue and sleep disturbances. Dual roles as working mothers, problems Internal conflicts with colleagues and family, boredom from work are also other factors besides Noise can cause work stress (Safiu et al., 2023). This research is in line with Putri Maharani, 2022, that workers in the senior category tend to be more satisfied with their work due to the ability to adapt due to experience factors and is more stable in managing emotions so that they can work skillfully, smoothly and better (Maharani & Nugroho, 2022). Against working power, noise can reduces someone's working capacity causes errors to occur when working thereby reducing work performance work, otherwise noise may increase atigue (Maharja, 2015). The sound at work changes to one of the occupational hazards when its presence is felt to be disturbing or unwanted physically or psychic (Pradana, 2014). That noise happen can controlled order level the noise reaches the limit value permitted. Noise control is carried out at the sound source, at the sound transmission path, and noise control in humans (Handoko, 2010). Consequence noise on other health is increases blood pressure and pulse heart, in addition to noise health problems also give rise to disturbance emotion (Pangemanan et al., 2013). Psychological disorders caused by various factors, one of which is social factors psychology, namely work and life, social environment, life events events).

Physical environment that is too stressful, such as noise, temperature or heat too high, humid air, lighting on office there are also bad ones increase workers' psychological disorders like flavor No comfortable, disturbance concentration, emotional disturbances or irritability And sleep disorders. Level of seriousness a person's psychological disorders vary depending on the attitude in responding to it. If to four parts of this psychological disorder is inside someone, that person will experience very extreme stressors. One reaction to a fraught event stress is

unresponsive and aspects trauma. Complaints such as difficulty sleeping, staying asleep restlessness, difficulty staying asleep, often wake up in the middle night, and waking up more frequently beginning, it is likely that person disturbed sleep quality. Besides that, poor sleep quality too of course will show feelings of tiredness. Feelings of tiredness may be demonstrated with someone who is easily agitated, lethargic and apathetic, not enthusiastic in carrying out activities, and often yawning or sleepy.

## **CONCLUSION**

There is a significant relationship between noise levels and sleep quality of workers in the wood processing process at UD. Adhi Santa Tabanan Bali. So workers are expected to pay attention to working environmental conditions regarding exposure to noise in the workplace. Working hours can be arranged in such a way as to minimize exposure.

## **REFERENCES**

- Bart, S. (1994). Psikologi Kesehatan. Jakarta: PT. Gramedia Widiasarana Indonesia.
- Demirtaş H, Saygun M, B. M. N. (2022). Is there a relationship between occupational noise and the factory workers' hearing levels, sleep quality, and QoL? *Neurological Sciences*. 2022; 43(2): 1015–1023.
- Farid, N. (2010). Analisis Kecelakaan Dan Kesehatan Kerja Dan Upaya Pencegahannya Di Bagian Flooring dengan Pendekatan Risk Assesmentpt. Dharma Satya Nusantara Surabaya. UPN Jatim Repository.
- Gitanjali, B., & Ananth, R. (2003). Effect of acute exposure to loud occupational noise during daytime on the nocturnal sleep architecture, heart rate, and cortisol secretion in healthy volunteers. *Journal of Occupational Health*, 45(3). <https://doi.org/10.1539/joh.45.146>.
- Handoko, P. S. (2010). Pengendalian Kebisingan pada Fasilitas Pendidikan Studi Kasus Gedung Sekolah Pascasarjana UGM Yogyakarta Jarwa. *Jurnal Sains & Teknologi Lingkungan*, 2(1). <https://doi.org/10.20885/jstl.vol2.iss1.art4>
- Haryawan, I. G. A., Suadnyana, I. A. A., & Nilam Cahaya. (2023). The relationship between noise level and sleep quality in wood processing factory workers. *Physical Therapy Journal of Indonesia*, 4(2), 169–172. <https://doi.org/10.51559/ptji.v4i2.120>
- Heo, Y.-S., Chang, S.-J., Park, S.-G., Leem, J.-H., Jeon, S.-H., Lee, B.-J., Rhee, K.-Y., & Kim, H.-C. (2013). Association between Workplace Risk Factor Exposure and Sleep Disturbance: Analysis of the 2nd Korean Working Conditions Survey. *Annals of Occupational and Environmental Medicine*, 25(1). <https://doi.org/10.1186/2052-4374-25-41>
- Jaiswal, S. N. S. A. A. (2021). *Occu* 1. 1(3), 261–269
- Knutson, K. L. (2010). Best Practice & Research Clinical Endocrinology & Metabolism Sleep duration and cardiometabolic risk: A review of the epidemiologic evidence. *Best Practice & Research Clinical Endocrinology & Metabolism*, 24(5).
- Made, N., Sukmawati, H., Gede, I., & Putra, S. W. (2019). Reabilitas kuesioner pittsburgh sleep quality index (PSQI) versi bahasa indonesia dalam mengukur kualitas tidur lansia. *Jurnal Lingkungan & Pembangunan*, 3(2), 30–38.

- Maharani, P., & Nugroho, B. Y. S. (2022). Dampak Kelelahan Kerja Dan Kualitas Tidur Terhadap Pengaruh Produktivitas Kerja. *Journal of Industrial Hygiene and Occupational Health*, 7(1), 69. <https://doi.org/10.21111/jihoh.v7i1.8442>
- Maharja, R. (2015). Analisis Tingkat Kelelahan Kerja Berdasarkan Beban Kerja Fisik Perawat Di Instalasi Rawat Inap Rsu Haji Surabaya. *The Indonesian Journal of Occupational Safety and Health*, 4(1). <https://doi.org/10.20473/ijosh.v4i1.2015.93-102>
- Manoppo, F. N., Supit, W., & Danes, V. R. (2014). Hubungan Antara Kebisingan Dan Fungsi Pendengaran Pada Petugas Pt. Gapura Angkasa Di Bandar Udara Sam Ratulangi Manado. *Jurnal E-Biomedik*, 2(1). <https://doi.org/10.35790/ebm.2.1.2014.3620>.
- Organization, W. H. (2017). Occupational Noise. Geneva: Protection of The Human Environment WHO [Online] 2004; Available at [www.who.int/quantifying\\_ehimpacts/.../ebd9.pdf](http://www.who.int/quantifying_ehimpacts/.../ebd9.pdf). Diakses pada tanggal 23 November 2017.
- Pangemanan, D. H. C., Engka, J. N. A., & Sapulete, I. M. (2013). Pengaruh Paparan Bising Terhadap Pendengaran Dan Tekanan Darah Pada Pekerja Game Center Di Kota Manado. *Jurnal Biomedik (JBM)*, 4(3). <https://doi.org/10.35790/jbm.4.3.2012.1220>
- Park, J., Chung, S., Lee, J., Sung, J. H., Cho, S. W., & Sim, C. S. (2017). Noise sensitivity, rather than noise level, predicts the non-auditory effects of noise in community samples: A population-based survey. In *BMC Public Health* (Vol. 17, Issue 1). <https://doi.org/10.1186/s12889-017-4244-5>
- Permenakertrans. (2011). Peraturan Menteri Tenaga Kerja dan Transmigrasi Nomor Per.13/Men/X/2011 Tentang Nilai Ambang Batas Faktor Fisika dan Faktor Kimia di Tempat Kerja Tahun 2011. Menteri Tenaga Kerja Dan Transmigrasi.
- Pradana, A. (2014). Hubungan antara kebisingan dengan stres kerja pada pekerja bagian gravity PT. Dua kelinci. *Unnes Journal of Public Health*, 2(3).
- Rizqi Septiana, N., Widowati Kesehatan dan Keselamatan Kerja, E., Ilmu Kesehatan Masyarakat, J., & Ilmu Keolahragaan Universitas Negeri Semarang, F. (2017). 73 Higeia 1 (1) (2017) Gangguan Pendengaran Akibat Bising. 1(1), 73–82. <http://journal.unnes.ac.id/sju/index.php/higeia>
- Safiu, D., Suryadi, I., Nur, N. H., & Abdillah, M. N. (2023). The Indonesian Journal of Health Promotion MPPKI Media Publikasi Promosi Kesehatan Indonesia The Effect of Noise Exposure on Stress Level and Sleep Quality of Workers in the Earth Processing Industry in Gowa District Open Access. 6(2), 353–357. <https://doi.org/10.31934/mppki.v2i3>
- Saputra, O., & Rohmah, W. (2016). Gangguan Tidur Akibat Kebisingan Lingkungan Malam Hari dan Pengaruhnya Terhadap Kesehatan. *Majority*, 5(3).
- Suma'mur, 2013. (2013). *Hygiene Perusahaan dan Kesehatan Kerja*. CV Sagung Seto. Jakarta.
- Tamher and Noorkasiani, *Kesehatan usia lanjut asuhan dengan pendekatan keperawatan*. Salemba Medika, 2009.

Yul, F. A., Dermawan, D., & Aldiyanti, F. P. (2020). Analisis Pengaruh Tingkat Kebisingan Pada Stasiun Sterilizer Terhadap Kualitas Tidur Operator. *Jurnal Surya Teknik*, 7(2). <https://doi.org/10.37859/jst.v7i2.2387>.