International Journal of Public Health Excellence (IJPHE)
Vol. 4, Issue 1, June-December 2024, pp. 340~347
Journal Homepage: https://ejournal.ipinternasional.com/index.php/ijphe
ISSN: 2809-9826, DOI: 10.55299/ijphe.v4i1.1119

The Effectiveness of Sleep Hygiene on Sleep Quality in Patients with Congestive Heart Failure: A Randomized Controlled Trial Study

Priyo Hadi Prasetiyo Lofa[1,2], Ninik Yunitri[1,3], Fitrian Rayasari[1,4], Rohman Azzam[1,4], Dian Noviati Kurniasih[5]
[1] Faculty of Nursing Sciences, Universitas Muhammadiyah Jakarta
[2] Inpatient Installation RSPAD Gatot Soebroto, Jakarta
[3] Department of Psychiatric and Psychiatric Nursing, Faculty of Nursing Sciences, Universitas Muhammadiyah Jakarta
[4] Department of Medical-Surgical Nursing, Faculty of Nursing Sciences, Universitas Muhammadiyah Jakarta
[5] Intensive Care Unit RSPI Prof. Dr. Sulianti Saroso, Jakarta

Article Info

Article history:

Received October 11, 2024
Revised November 16, 2024
Accepted December 30, 2024

Corresponding Author:

Priyo Hadi Prasetiyo Lofa
Faculty of Nursing Sciences, Universitas Muhammadiyah Jakarta
Jakarta, Indonesia, 10510
Email priyolofa@gmail.com

ABSTRACT

Good sleep quality in congestive heart failure (CHF) patients helps repair heart muscle cells. Sleep hygiene is one of the non-pharmacological interventions to overcome sleep disorders. This study aims to determine the effectiveness of sleep hygiene on sleep quality in CHF patients. A Randomized Controlled Trial (RCT) with two groups was taken using probability sampling with block random sampling method. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) and sleep habits using the Sleep Hygiene Index (SHI). Outputs were measured based on the change in the mean between the measurement time using the paired t-test and the difference in the mean between groups using the independent t-test. A total of 30 respondents were involved in this study. The intervention group showed a significant improvement in sleep quality after sleep hygiene therapy with a mean difference (MD) of 4.20 (SE=0.70; p-value=<0.01). Sleep quality between the two groups showed a significantly greater difference in the intervention group than in the control group (MD=-2.13, SE=1.00, p-value=0.04, effect size (Cohens'd)=-0.77). Sleep hygiene is a non-pharmacological intervention that effectively improves sleep quality in patients with CHF.

Keywords: *congestive heart failure, sleep hygiene, sleep quality, sleep disorders, non-pharmacological interventions*

1. INTRODUCTION

Congestive Heart Failure (CHF) is a health problem with the highest incidence rate in the world [1]. The Global Health Data Exchange (2020) reported that the number of congestive heart failure cases in the world reached 64.34 million cases with 9.91 million deaths [2]. According to WHO (2021), the estimated death of patients with cardiovascular disease in 2019 was 17.9 million and accounted for 32% of the total deaths globally. As many as 38% of them are caused by heart failure [3]. In Indonesia, it is stated that as many as 1.5% or around 29550 people are diagnosed with heart failure [4].

Various clinical symptoms felt by CHF patients can cause nursing problems and interfere with basic human needs. One of them is the need for sleep. Sleep disturbances are most commonly reported in CHF patients and are felt by 75% of sufferers [5]. Patients with CHF need adequate sleep. Good sleep quality in CHF patients will improve their quality of life [6]. Adequate rest can reduce heart work, increase heart reserves, lower blood pressure, reduce respiratory muscle work, and oxygen use [7].

One of the non-pharmacological interventions to overcome sleep disorders is sleep hygiene. Sleep hygiene involves behavioral practices based on an understanding of sleep physiology to improve sleep quality. A person can achieve optimal sleep fulfillment by setting a regular sleep schedule, avoiding sleeping in a state of hunger, thirst or feelings of anxiety, and reducing caffeine intake [8]. Sleep hygiene can overcome sleep disorders and can improve sleep quality. Kamal (2019) reported that sleep hygiene can reduce poor sleep quality. Sleep hygiene has never been applied to patients with CHF [6]. Therefore, researchers are interested in further researching the effectiveness of sleep hygiene on the sleep quality of CHF patients.

2. METHOD

The research was conducted in the cardiac inpatient room at a government hospital in Jakarta, Indonesia from October to December 2023. The design used in the study was a Randomized Controlled Trial (RCT) study with two groups. In this study, the experimental group was given sleep hygiene therapy, while the control group was given a standard intervention of CHF without sleep hygiene therapy.

The number of respondents was calculated using the G*Power 3.1 application with an effect size of 1.65, power of 95%, a significance level of 5%, and drop out of 20%, a minimum sample of 28 respondents for two groups was obtained [10]. The sample was taken using probability sampling with the block random sampling method. Block randomization is used to allocate respondents to several groups with the same number. This method was used to achieve a balance of the number of respondents in all groups over time. This study used a block randomization combination of four. It is easier for researchers to control the balance of respondents by using smaller block sizes. Once the block size is determined, all possible combinations must be calculated and then randomly selected to determine the allocation of respondents to groups.

Researchers also carry out blinding to avoid bias (selection bias, performance bias, detection bias, and reporting bias). Randomizers, therapists, data assessors, and data analysts do not know the research hypothesis, sample allocation, and therapy given to the respondents.

Inclusion criteria include medical diagnosis of CHF (based on data in hospital medical records), sleep quality using the Pittsburgh Sleep Quality Index (PSQI) score of more than 5, being able to read and write well, and being willing to participate in research. Respondents with CHF Class IV, receiving sleep therapy, and unwilling to participate in the study were excluded from the study.

In this study, the experimental group was given sleep hygiene therapy, while the control group received standard therapy. Sleep hygiene is given 2 sessions per day for 10 minutes each for 6 days. The outcome measured was sleep quality and sleep habit quality. Measurement of sleep quality used PSQI Indonesian version that already validated [11]. Sleep habits quality is measured with the Sleep Hygiene Index (SHI) instruments in the Indonesian version that have been validated [12]. The outcomes measurement was carried out at the time before the intervention (pre-intervention), the third day (mid-intervention), and the sixth day (post-intervention).

The collected data was processed using Jamovi software version 2.3.26. Outputs were measured based on the change in the mean between the measurement of time using the paired t-test and the difference in the mean between groups (between/group effect) using the independent t-test. Outcomes are also evaluated based on the magnitude of the therapeutic effect (effect size) with categories <0.2 indicating a weak effect, 0.2-0.8 a moderate effect, and >0.8 a high effect (Cohens'd).

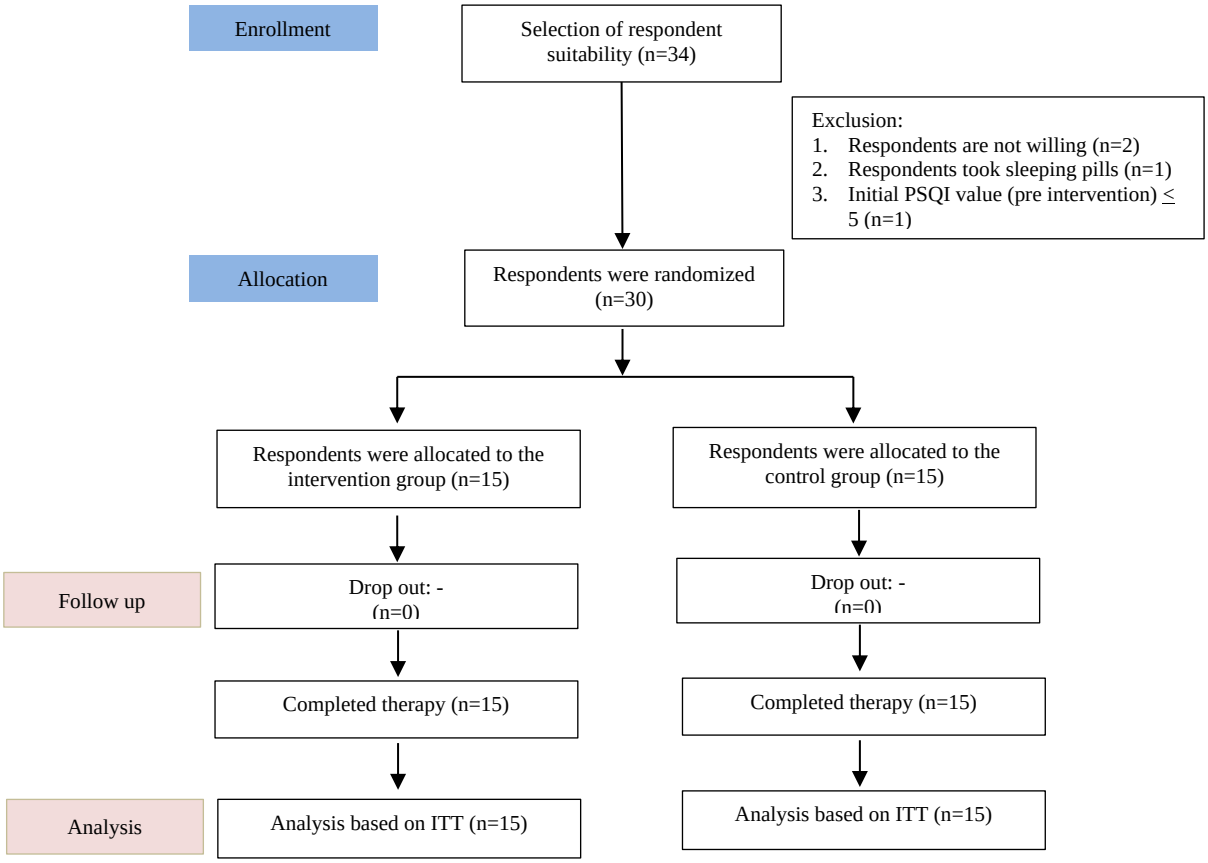
This research was conducted after going through an ethics review and approval from an independent ethics committee board on 29 November 2023 (Number 1667/F.9-UMJ/XI/2023). All respondents involved in the study were given an explanation of the research and the purpose of the study and signed informed consent.

3. RESULTS AND DISCUSSION

3.1. Result

A total of 30 respondents were involved in this study. All respondents were randomly allocated to the intervention and control groups with a total of 15 people each. During the study process, no patients dropped out, so the same number was analyzed with the intention to treat (ITT) approach (Figure 1).

Based on the results of the descriptive analysis of respondent characteristics, the average age in the intervention group was 67 years (SD 15.3) and in the control group was 54 years (SD 15.0). Most of the respondents were male (70%), the most medical diagnosis was CHF class III (46.7%) while the education level was evenly distributed for both groups. The results of the homogeneity test analysis using the t-test and Fisher exact test of demographic characteristics and pre-intervention output values showed that there was no significant difference between the two groups. Outcomes in pre-intervention measurements were measured using an independent t-test. The results of the analysis showed that the data were homogeneous or there was no significant difference between the two groups with a p-value less than the alpha value (0.05). The results of the homogeneity test analysis of demographic characteristics and pre-intervention output values showed that there was no significant difference between the two groups with a p-value > 0.05 (Table 1).



Abbreviation: ITT, Intention to treat; n, number of samples; PSQI, Pittsburgh Sleep Quality Index

Figure 1. CONSORT flowchart

Table 1. Demographic characteristics of respondents (n=30)

Characteristics	Intervention group (n=15)	Control group (n=15)	p-value
Age, Mean (SD)	67 (15.3)	54 (15.0)	0.319
Gender, n (%)			
Male	13 (61.9)	8 (38.1)	0.109
Female	2 (22.3)	7 (77.7)	
Medical diagnosis, n (%)			
CHF Class I	3 (10.0)	2 (6.6)	0.865
CHF Class II	5 (16.6)	6 (20.0)	
CHF Class III	7 (23.4)	7 (23.4)	
Education, n (%)			
High school	15 (50.0)	15 (50.0)	-
Pre-intervention Sleep quality, Mean (SD)			
PSQI Total			
CHF Class I	9.7 (2.2)	9.4 (2.4)	0.754
CHF Class II	8.3 (1.5)	9.0 (0.0)	
CHF Class III	10.0 (3.6)	9.2 (1.5)	
	10.0 (1.4)	9.7 (3.4)	
SHI Total			
CHF Class I	28.3 (7.7)	27.9 (4.5)	0.841
CHF Class II	31.7 (7.6)	30.5 (3.5)	
CHF Class III	29.8 (8.0)	25.8 (3.9)	
	25.9 (7.8)	28.9 (5.7)	

Abbreviation: SD, Standard Deviation; n, number of samples; CHF, Congestive Heart Failure; PSQI, Pittsburgh Sleep Quality Index; SHI, Sleep Hygiene Index

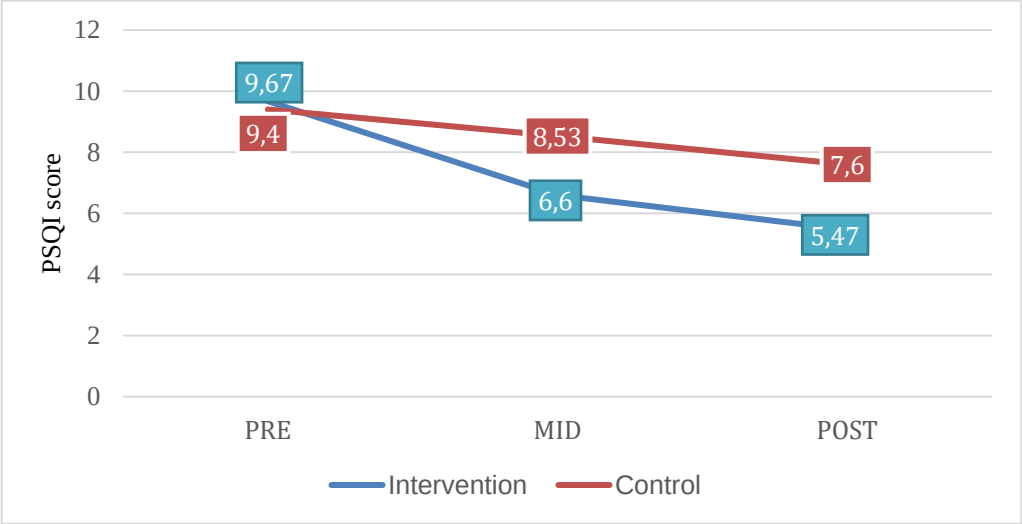
Respondents in the intervention group showed a significant improvement in sleep quality after receiving sleep hygiene therapy with a mean difference (MD) of 4.20 (Standard Error, SE=0.71; p-value =<0.01). Respondents in the control group also showed significant changes with MD 1.80 (SE=0.71; pvalue=0.02). The results of the analysis of sleep quality between the two groups also showed a significantly larger difference in the intervention group compared to

the control group (MD=-2.13, SE=1.00, p-value =0.04, effect size=-0.77) (Table 2). The improvement in sleep quality in the intervention group was seen significantly on the third day and further increased on the sixth day (Figure 2).

Table 2. Effectiveness of sleep hygiene on sleep quality in patients with CHF (n=30)

Time Of Measurement	PSQI Mean (SE)		Between-group MD (SE) p-value	Effect size (cohens'd)
	Intervention group (n=15)	Control group (n=15)		
Pre-Intervention	9.7 (0.6)	9.4 (0.6)	-2.1 (1.0) p=0.04*	-0.78
Mid Intervention	6.6 (0.7)	8.5 (0.8)		
Post Intervention	5.5 (0.38)	7.6 (0.9)		
Within group, Mean (SE) p-value	4.2 (0.7) p=<0.01*	1.8 (0.7) p=0.02*		

Note: * significant, p-value < alpha 0.05
Abbreviation: MD, Mean difference; SE, Standard Error; p, p-value; n, number of samples; PSQI, Pittsburgh Sleep Quality Index



Abbreviation: PSQI, Pittsburgh Sleep Quality Index

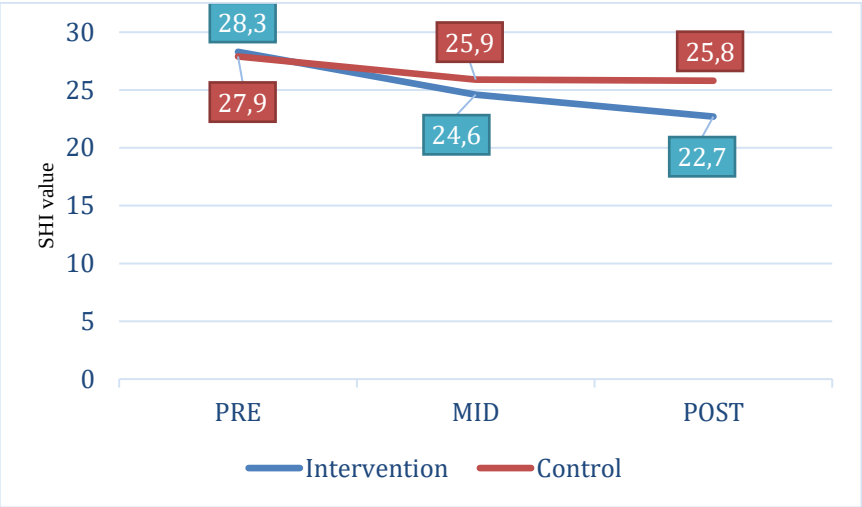
Figure 2. Graph of sleep hygiene effect on PSQI score

Respondents in the intervention group showed a significant improvement in good sleep habits after receiving sleep hygiene therapy with MD 5.67 (SE=1.71; p-value=0.05). Patients in the control group did not show significant changes with MD 2.07 (SE=1.92; pvalue=0.29). The results of the analysis of sleep habits between the two groups also showed a significant difference in the intervention group compared to the control group (MD=-3.13; SE=1.42; pvalue =0.03; effect size=-0.80) (Table 3). Changes in sleep habits in the intervention group were seen significantly on the third day and further increased on the sixth day (Figure 3).

Table 3. Effectiveness of sleep habits on sleep quality in patients with CHF (n=30)

Time of measurement	Sleep Hygiene Index (SHI) Mean (SE)		Between-group MD (SE) p-value	Effect size (cohens'd)
	Intervention group (n-15)	Control group (n=15)		
Pre-Intervention	28.3 (2.0)	27.9 (1.2)	-3.13 (1.42) p=0.03*	-0.80
Mid Intervention	24.6 (1.5)	25.9 (1.1)		
Post Intervention	22.7 (0.8)	25.8 (1.2)		
Within group, Mean (SE) p-value	5.7 (1.7) p=0,005*	2.1 (1.9) p=0.29		

Note: * significant, p-value < alpha 0.05
Abbreviation: MD, Mean difference; SE, Standard Error; p, p-value; n, number of samples



Abbreviation: SHI, Sleep Hygiene Index

Figure 3. Graph of sleep hygiene effect on SHI

3.2. Discussion

The results of this study show that sleep hygiene effectively improves the sleep quality of CHF patients. Sleep hygiene has been proven to be effective in improving sleep quality in patients with congestive heart failure (CHF) [6]. In line with previous research showing that sleep hygiene can reduce poor sleep quality [9].

Based on the results of the initial PSQI assessment, there was a higher score of CHF patient class III. This means that the quality of the respondents' sleep was poorer compared to the CHF respondents in grades II and I. This can be understood because the majority of respondents were CHF class III patients. Apart from that, patients with CHF class III have more severe clinical disorders than CHF class I and II [3]. This causes CHF class III patients to potentially experience more severe sleep disorders than CHF class I and II [5]. The results of this study showed a change in the improvement of good sleep quality on the third day and a significant increase on the sixth day after receiving sleep hygiene interventions.

Sleep hygiene not only makes the environment comfortable but also changes the patient's sleep habits. Good sleep habits have an impact on improving the quality of a patient's sleep [13]. By implementing sleep hygiene, the patient's behavior and sleep habits will change more regularly than before, thereby reducing sleep disorders which will improve sleep quality [14]. Sleep quality has a good impact on the body, both physically and psychologically [7], [13].

Sleep hygiene refers to daily behavioral and environmental modifications to optimize sleep quality [15]. Sleep habits in this study consist of personal habits and bed environment modification. Personal habits consist of setting bedtimes, setting a comfortable sleeping position, body cleaning before bed, using clean sleeping clothes, and stretching before bed. While bed environment modification consists of cleaning the bed, keeping the room away from noise, keeping electronics away from the bed, dimming the room lighting, and listening to relaxing sounds.

Consistent sleep pattern regularity is associated with improved health [16]. Setting a sleep time of 22:00-23:00 with a sleep duration of 6 to 7 hours at night can optimize the cognitive abilities of adults [17]. The habit of delaying bedtime or staying up late has been reported to have a negative effect on sleep quality and is associated with sleep disorders [18].

Personal hygiene can affect sleep quality. Self-cleaning habits such as brushing teeth, washing face, hands, and feet, and using clean and appropriate sleepwear are good sleep habits. A clean body condition will make the body feel comfort [19]. Using clothes made of wool will be more effective than those made of polyester [20]. Uncomfortable sleepwear can increase body temperature and cause sweating while sleeping. This condition can reduce sleep quality [21]

A good sleeping position affects sleep quality and health. This is in accordance with research that reports that improving the sleeping position in patients with heart problems can improve their sleep quality [22]. This is because a good sleeping position (according to the clinical needs of heart sufferers) can reduce shortness of breath. The semi-fowler position with the head positioned 30-45 degrees higher can improve tidal volume. This position can reduce pressure on the diaphragm due to intra-abdominal pressure. This position can also improve drainage of the upper lobes of the lungs and reduce venous return to the heart so that the heart's workload is reduced [23]. Recent research also reveals that the left or right lateral position can increase the Functional Residual Capacity (FRC) of the lungs by up to 21% compared to the supine position [24].

Relaxation can calm the mind and stretching can help reduce muscle tension. Relaxation and stretching can improve the quality of sleep [25]. A stretching program carried out for more than 12 weeks is said to improve the subjective sleep quality of Obstructive Sleep Apnea (OSA) sufferers [26]. Other research says that stretching is beneficial for CHF sufferers to increase cardiac endurance and prevent clinical worsening due to heart failure [27]. Physical activity can improve heart muscle metabolism which affects improving heart contractility, vasodilation, and cardiac output [28]. The type and duration of relaxation and stretching must be adjusted to the clinical condition of CHF sufferers so as not to cause dangerous side effects.

The sleeping environment also influences a person's sleep quality. The ideal sleep environment includes environmental modifications that are comfortable for the senses of sight, touch, hearing, and smell [29]. A clean and tidy bed environment makes a person more comfortable. It affects the quality of their sleep [30]. Another study reported that a dirty environment is associated with poor sleep quality. Likewise, bad odors and cold temperatures in the sleeping environment [31].

Noisy environments trigger biological changes as a result of stress responses. These responses will affect sleep patterns and subjective sleep quality [32]. Not only noise when sleeping at night, but noise received throughout the day also affects a person's sleep quality [33]. This research was conducted in a cardiac inpatient room. It was difficult to control the environment from noise. There were two to three patients in one room and not all of them received sleep hygiene interventions. Some patients also receive pharmacological therapy at night. The sound such as doors opening, people talking, or nurses' activities can make noise. This can affect patients who are receiving sleep hygiene therapy.

Relaxing sounds such as water flows, birds chirping, or music before going to bed will improve the quality of sleep [34]. A meta-analysis study said that music can improve the sleep quality of the elderly, especially in the components of sleep latency, sleep duration, and sleep effectiveness [35]. Although the mechanism of action is still unclear, some researchers believe that the effect of music on the limbic system in the central nervous system can improve a person's emotional mood [36]. Its effect on the endocrine system and autonomic nervous system can reduce levels of cytokines, catecholamines, and cortisol so that it can reduce heart rate and respiration rate [37]. So, music can help a person become calmer and help initiate sleep.

Using electronic devices before bed has an impact on sleep quality and is a major health problem [38]. In their study, Pham et al. (2021) reported that using electronic devices two hours before bed for more than 30 minutes was associated with poor sleep quality. As many as 98.1% of respondents who had poor sleep quality used smartphones before going to bed. Some tend to have nightmares after watching shows that contain violence and mysticism before going to bed [13]. Watching movies using social media during bedtime and leaving electronic devices on during sleep are associated with various types of sleep disorders [39]

Dim light during sleep is beneficial for the body. Light affects the production of the melatonin hormone. Melatonin is a hormone that regulates the body's circadian rhythm. Melatonin production begins to increase at the beginning of darkness, peaks at midnight and decreases towards morning. At night this hormone works more actively to induce deep sleep. The presence of light can interfere with the work of melatonin. As a result, a person cannot sleep soundly [40]. A study in the Intensive Care Unit (ICU) reported that dimming the lights at night can improve patient physiological functions such as body temperature, blood pressure, respiration, and pulse [41]. Managing the lighting in the inpatient room is another challenge in this study. The lighting system in the inpatient room works centrally. So, it is difficult to create dim or dark lighting conditions. In this study, modifications were made using eye patches to create a dim or dark atmosphere.

3.3. Limitations

The intervention lasted for six days while to evaluate a person's behavior patterns and habits took longer so that it would appear to be a permanent habit. The research was conducted in the inpatient room. It was a challenge for the researchers to create an ideal sleep environment, especially to control noise and lighting. We use eye patches and headset as an alternative to control the sleep environment.

4. CONCLUSION

Sleep hygiene therapy has been proven to be effective in improving the quality and sleep habits of CHF patients. The results of this study can be used as one of the non-pharmacological interventions in CHF patients as an effort to repair their heart muscle cells. Further research is needed to analyze the effects of sleep hygiene on the clinical condition of CHF patients.

ACKNOWLEDGEMENTS

The researcher is grateful to all parties and all respondents involved in this study.

REFERENCES

[1] S. Kaptoge *et al.*, "World Health Organization cardiovascular disease risk charts: revised models to estimate risk in 21 global regions," *Lancet Glob Health*, vol. 7, no. 10, pp. e1332–e1345, Oct. 2019, doi: 10.1016/S2214-109X(19)30318-3.

[2] S. D. Prahasti and L. Fauzi, “Risiko Kematian Pasien Gagal Jantung Kongestif (GJK): Studi Kohort Retrospektif Berbasis Rumah Sakit,” *Indonesian Journal of Public Health and Nutrition*, vol. 1, no. 3, pp. 388–395, 2021.
[3] V. L. Roger, “Epidemiology of Heart Failure,” *Circ Res*, vol. 128, no. 10, pp. 1421–1434, May 2021, doi:10.1161/CIRCRESAHA.121.318172.
[4] Ministry of Health of Republic of Indonesia, “Laporan Nasional Riskesdas.,” Jakarta, 2018.
[5] G. Parati, C. Lombardi, F. Castagna, P. Mattaliano, P. P. Filardi, and P. Agostoni, “Heart failure and sleep disorders,” *Nat Rev Cardiol*, vol. 13, no. 7, pp. 389–403, Jul. 2016, doi: 10.1038/nrcardio.2016.71.
[6] L. Handayani, U. Rahayu, and H. Platini, “Kualitas Tidur Pasien Gagal Jantung,” *Medika Cendikia*, vol. 7, no. 1, pp. 35–39, 2020.
[7] E. Miletínová and J. Bušková, “Functions of Sleep,” *Physiol Res*, vol. 70, no. 2, pp. 177–182, Apr. 2021, doi: 10.33549/physiolres.934470.
[8] S. K. Malone, “Early to Bed, Early to Rise?,” *The Journal of School Nursing*, vol. 27, no. 5, pp. 348–354, Oct. 2011, doi: 10.1177/1059840511410434.
[9] M.- Kamal, “Potential effectiveness of sleep hygiene and relaxation Benson in improving the quality of sleep in patients with heart failure: Literature review,” *International Journal of Nursing and Health Services (IJNHS)*, vol. 2, no. 1, pp. 101–107, Apr. 2019, doi: 10.35654/ijnhs.v2i1.69.
[10] A. Kaku *et al.*, “Randomized Controlled Trial on the Effects of a Combined Sleep Hygiene Education and Behavioral Approach Program on Sleep Quality in Workers with Insomnia,” *Ind Health*, vol. 50, no. 1, pp. 52–59, 2012, doi: 10.2486/indhealth.MS1318.
[11] A. Setyowati and M. Chung, “Validity and reliability of the Indonesian version of the Pittsburgh Sleep Quality Index in adolescents,” *Int J Nurs Pract*, vol. 27, no. 5, Oct. 2021, doi: 10.1111/ijn.12856.
[12] A. Setyowati, M.-H. Chung, Ah. Yusuf, and S. Haksama, “Psychometric Properties of Sleep Hygiene Index in Indonesian Adolescents,” *J Public Health Res*, vol. 9, no. 2, Jul. 2020, doi: 10.4081/jphr.2020.1806.
[13] F. Nashori and E. D. Wulandari, *Psikologi Tidur dari Kualitas Tidur Hingga Insomnia*. Universitas Islam Indonesia, 2017.
[14] I. Puspita Dewi, “KUALITAS TIDUR PASIEN GAGAL JANTUNG DAN PENANGANANNYA,” *Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)*, vol. 3, no. 1, pp. 18–24, Nov. 2017, doi: 10.33755/jkk.v3i1.80.
[15] R. Winegar, “Promoting healthy sleep among older adults,” *Geriatr Nurs (Minneap)*, vol. 58, pp. 298–303, Jul. 2024, doi:10.1016/j.gerinurse.2024.05.032.
[16] J.-P. Chaput *et al.*, “Sleep timing, sleep consistency, and health in adults: a systematic review,” *Applied Physiology, Nutrition, and Metabolism*, vol. 45, no. 10 (Suppl. 2), pp. S232–S247, Oct. 2020, doi: 10.1139/apnm-2020-0032.
[17] M. Ouyang *et al.*, “The association between sleep duration, bedtime, and cognitive ability in Chinese adults: Evidence from the China family panel studies,” *Heliyon*, vol. 10, no. 9, p. e30009, May 2024, doi: 10.1016/j.heliyon.2024.e30009.
[18] S. E. Carlson, K. G. Baron, K. T. Johnson, and P. G. Williams, “The thief of (bed)time: Examination of the daily associations between bedtime procrastination and multidimensional sleep health,” *Sleep Health*, vol. 9, no. 6, pp. 903–909, Dec. 2023, doi:10.1016/j.sleh.2023.08.002.
[19] O. Troynikov, C. G. Watson, and N. Nawaz, “Sleep environments and sleep physiology: A review,” *J Therm Biol*, vol. 78, pp. 192–203, Dec. 2018, doi: 10.1016/j.jtherbio.2018.09.012.
[20] C. M. Chow, “Sleep Hygiene Practices: Where to Now?,” *Hygiene*, vol. 2, no. 3, pp. 146–151, Sep. 2022, doi: 10.3390/hygiene2030013.
[21] Y. Wang, Y. Liu, C. Song, and J. Liu, “Appropriate indoor operative temperature and bedding micro climate temperature that satisfies the requirements of sleep thermal comfort,” *Build Environ*, vol. 92, pp. 20–29, Oct. 2015, doi: 10.1016/j.buildenv.2015.04.015.
[22] D. Merdekawati, F. Susanti, and M. Maulani, “Peningkatan Kualitas Tidur Klien Kardiovaskuler dengan Pengaturan Posisi Tidur,” *Jurnal Endurance*, vol. 4, no. 2, p. 382, Jul. 2019, doi: 10.22216/jen.v4i2.3841.
[23] S. C. Smeltzer, B. G. Bare, J. L. Hinkle, and K. Cheever, *Brunner & Suddarth’s Textbook of Medical-surgical Nursing*. Wolters Kluwer Lippincott William & Wilkins., 2016.
[24] G. D. Pinna *et al.*, “Postural changes in lung volumes in patients with heart failure and Cheyne-Stokes respiration: Relationship with sleep apnea severity,” *Sleep Med*, vol. 101, pp. 154–161, Jan. 2023, doi: 10.1016/j.sleep.2022.10.026.
[25] W. Xie, D. Lu, S. Liu, J. Li, and R. Li, “The optimal exercise intervention for sleep quality in adults: A systematic review and network meta- analysis,” *Prev Med (Baltim)*, vol. 183, p. 107955, Jun. 2024, doi: 10.1016/j.ypmed.2024.107955.
[26] J.-H. Chen, J.-Y. Chen, and Y.-C. Wang, “The effects of exercise programs on sleep architecture in obstructive sleep apnea: a meta-analysis of randomized controlled trials,” *J Sci Med Sport*, vol. 27, no. 5, pp. 293–301, May 2024, doi: 10.1016/j.jsams.2024.01.012.
[27] A. P. Lumi, V. F. F. Joseph, and N. C. I. Polii, “Rehabilitasi Jantung pada Pasien Gagal Jantung Kronik,” *Jurnal Biomedik:JBM*, vol. 13, no. 3, p. 309, Apr. 2021, doi: 10.35790/jbm.v13i3.33448.

[28] S. M. S. Al-Ezzi *et al.*, "The role of exercise training and dietary sodium restriction in heart failure rehabilitation: A systematic review," *Disease-a-Month*, vol. 70, no. 10, p. 101781, Oct. 2024, doi: 10.1016/j.disamonth.2024.101781.
[29] N. D. Dautovich, J. M. Dzierzewski, and A. MacPherson, "Bedroom environment and sleep health," in *Foundations of Sleep Health*, Elsevier, 2022, pp. 239–264. doi: 10.1016/B978-0-12-815501-1.00006-5.
[30] C. P. Hoyniak *et al.*, "The physical home environment and sleep: What matters most for sleep in early childhood.," *Journal of Family Psychology*, vol. 36, no. 5, pp. 757–769, Aug. 2022, doi: 10.1037/fam0000977.
[31] K. Kallawicha, S. Boonvisut, H. J. Chao, and T. Nitmetawong, "Bedroom environment and sleep quality of apartment building residents in urban Bangkok," *Build Environ*, vol. 188, p. 107474, Jan. 2021, doi: 10.1016/j.buildenv.2020.107474.
[32] D. Halperin, "Environmental noise and sleep disturbances: A threat to health?," *Sleep Science*, vol. 7, no. 4, pp. 209–212, Dec. 2014, doi: 10.1016/j.slsci.2014.11.003.
[33] S. Yazdanirad, A. H. Khoshakhlagh, S. Al Sulaie, C. L. Drake, and E. M. Wickwire, "The effects of occupational noise on sleep: A systematic review," *Sleep Med Rev*, vol. 72, p. 101846, Dec. 2023, doi: 10.1016/j.smrv.2023.101846.
[34] D. V. Petrovsky, P. Ramesh, M. V. McPhillips, and N. A. Hodgson, "Effects of music interventions on sleep in older adults: A systematic review," *Geriatr Nurs (Minneap)*, vol. 42, no. 4, pp. 869–879, Jul. 2021, doi: 10.1016/j.gerinurse.2021.04.014.
[35] C. Wang *et al.*, "Effects of music intervention on sleep quality of older adults: A systematic review and meta-analysis," *Complement Ther Med*, vol. 59, p. 102719, Jun. 2021, doi: 10.1016/j.ctim.2021.102719.
[36] S. Koelsch, "Towards a neural basis of music-evoked emotions," *Trends Cogn Sci*, vol. 14, no. 3, pp. 131–137, Mar. 2010, doi: 10.1016/j.tics.2010.01.002.
[37] K. Okada *et al.*, "Effects of Music Therapy on Autonomic Nervous System Activity, Incidence of Heart Failure Events, and Plasma Cytokine and Catecholamine Levels in Elderly Patients With Cerebrovascular Disease and Dementia," *Int Heart J*, vol. 50, no. 1, pp. 95–110, 2009, doi: 10.1536/ihj.50.95.
[38] H. T. Pham, H.-L. Chuang, C.-P. Kuo, T.-P. Yeh, and W.-C. Liao, "Electronic Device Use before Bedtime and Sleep Quality among University Students," *Healthcare*, vol. 9, no. 9, p. 1091, Aug. 2021, doi: 10.3390/healthcare9091091.
[39] J. M. Nagata *et al.*, "Bedtime screen use behaviors and sleep outcomes: Findings from the Adolescent Brain Cognitive Development (ABCD) Study," *Sleep Health*, vol. 9, no. 4, pp. 497–502, Aug. 2023, doi: 10.1016/j.sleh.2023.02.005.
[40] C. Blume, C. Garbazza, and M. Spitschan, "Effects of light on human circadian rhythms, sleep and mood," *Somnologie*, vol. 23, no. 3, pp. 147–156, Sep. 2019, doi: 10.1007/s11818-019-00215-x.
[41] K. Pamuk and N. Turan, "The effect of light on sleep quality and physiological parameters in patients in the intensive care unit," *Applied Nursing Research*, vol. 66, p. 151607, Aug. 2022, doi: 10.1016/j.apnr.2022.151607.