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ORIGINAL ARTICLE

The effect of elderly exercise on sleep quality

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ABSTRACT

An elderly person will begin to experience changes in various aspects. The most frequently complained health problem among the elderly is nighttime sleep disturbances. Exercise is known to help improve sleep quality in the elderly. This study aims to examine the effect of exercise on sleep quality among elderly individuals at the Kota Batu Public Health Center, Bogor Regency. The research method used was cross-sectional. The research sample consisted of 27 respondents, obtained through random sampling, and included elderly individuals who actively participated in regular exercise programs at the health center. Sleep quality was measured using the *Pittsburgh Sleep Quality Index* (PSQI) questionnaire. The sleep quality scores were analyzed using the independent t-test, and the group comparison between individuals who engaged in regular exercise and those who did not was conducted using the Mann-Whitney test. The results showed that the majority of the elderly had good sleep quality (59%). A total of 14 respondents (52%) regularly exercised. There was a significant difference in sleep quality between those who regularly exercised and those who did not, with significant differences observed in the components of subjective sleep quality (p=0.007), sleep latency (p=0.019), sleep disturbances (p=0.021), and daytime dysfunction (p=0.002). This study found a significant effect of exercise on sleep quality among the elderly at the Kota Batu Public Health Center, Bogor Regency, with a p-value < 0.05 (p=0.00). This indicates a significant effect of elderly exercise on sleep quality in the elderly at the Kota Batu Public Health Center, Bogor Regency.

Keyword: elderly, exercise, sleep quality, Pittsburgh Sleep Quality Index

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INTRODUCTION

Indonesia is recognized as one of the nations with the largest populations of elderly individuals globally, with approximately 27 million persons aged 60 and above reported in 2020, constituting about 10% of the total population. According to data from the Indonesian Ministry of Health (2022), approximately 750 elderly individuals experience sleep disorders annually. The prevalence of insomnia among this demographic in Indonesia is estimated at 8.1%, indicating that over 28 million elderly individuals suffer from this condition.[1] On a global scale, the United States exhibited the highest prevalence of insomnia, recording 83,952 cases in 2017, whereas Mexico reported the lowest with 8,712 cases. In West Java, the elderly population was recorded at 2,340,250 in 2021, with Bogor Regency experiencing an increase from 377,790 elderly individuals in 2020 to 400,631 in 2021.[2] Elderly individuals are categorized into three groups based on age: young elderly (60-69 years), middle elderly (70-79 years), and old elderly (>80 years)2. The Indonesian Law Number 13 of 1998 defines elderly individuals as those aged over 60 years, during which they begin to undergo various social, psychological, and physiological transformations. One prevalent health issue among the elderly is sleep disorders, which reflect psychological changes adversely affecting sleep quality.[3]

Optimal sleep quality is characterized by satisfactory sleep experiences and a sense of rejuvenation upon awakening. However, the elderly often encounter prolonged sleep onset and diminished deep sleep duration.[4] A typical sleep cycle encompasses five stages, lasting approximately 90 minutes and involving both REM and NREM phases. For elderly individuals, the recommended sleep duration is 6-7 hours per day. While physiological alterations in sleep patterns are acknowledged as part of the aging process, more severe sleep disturbances may be correlated with pathological conditions that impact physical health, mental well-being, quality of life, as well as cognitive functioning and memory retention.[5] The decline in sleep quality among the elderly is attributed not only to age-related factors but also to various medical conditions, including cardiovascular diseases, diabetes, and hypertension, alongside psychological factors such as depression and anxiety. Environmental and lifestyle factors, including light exposure, temperature, dietary habits, and the consumption of caffeine or alcohol, also significantly influence sleep quality in this population.[5] Consequently, exploring effective interventions to enhance sleep quality in the elderly is imperative. Engaging in physical activities, such as tailored elderly exercise programs that integrate muscular movement with breathing techniques, has emerged as a viable solution.[6] Prior studies have demonstrated that participation in such exercises can lead to significant improvements in sleep quality among elderly individuals.[7]

Further investigation at the Kota Batu Health Center in Bogor Regency has identified distinct differences in sleep quality between elderly individuals who engage in regular exercise and those who do not. The physical activity implemented at the Kota Batu Health Center is specifically designed as a "healthy heart exercise" program for the elderly.[6] This program typically commences with a warm-up phase lasting 8-10 minutes, followed by core movement exercises lasting 10-20 minutes, and concludes with a cool-down period of approximately 8-10 minutes, resulting in a total session duration of 26-40 minutes[8]. This exercise regimen is designed to enhance blood circulation, thereby improving cerebral blood flow. Additionally, optimal melatonin secretion is anticipated to occur, contributing positively to the sleep quality of elderly participants.[9]

Assessment of sleep quality is conducted utilizing the Pittsburgh Sleep Quality Index (PSQI) as a measurement tool, which has indicated that participation in elderly exercise programs can facilitate improvements in sleep patterns, enhance overall sleep quality, and subsequently elevate quality of life.[6] This exercise initiative not only confers physical health benefits upon the elderly but also assists in addressing psychological challenges that may contribute to sleep disorders. The findings from this research bear significant implications for elderly health services in Indonesia. The integration of elderly exercise programs within community health facilities, such as those implemented at the Kota Batu Health Center, represents an effective intervention strategy for addressing sleep disorders among the elderly population. Through comprehensive education and the application of this program, families of elderly individuals and the broader community can gain insights into the critical role of physical activity in preserving sleep quality and promoting the overall health of the elderly.

METHODS AND SUBJECT

This research employed a cross-sectional design involving elderly participants at the Kotabatu Community Health Center in Bogor Regency. A random sampling method was utilized, with a minimum sample size of 20 individuals, calculated based on a hypothesis testing formula for comparing two means, incorporating a dropout factor of 20%. The dependent variable for this study was sleep quality, while the independent variable pertained to the exercise activities of the elderly. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), which had undergone rigorous validation and reliability testing. Data analysis was conducted using SPSS version 18.0. Normality was assessed through the Shapiro-Wilk test, suitable for small sample sizes ($n < 50$), and subsequent statistical analysis was performed using the independent t-test. The research protocol received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine at General Achmad Yani University, under ethical approval number 005/UM1.01/2024. The duration of this study spanned from January to March 2024.

RESULTS AND DISCUSSION

The present study commenced with an introduction, obtaining informed consent from respondents, and the administration of a paper-based questionnaire designed to assess the influence of exercise on the elderly population. Out of the initial 30 registered respondents, 3 were excluded due to the consumption of medications that could potentially affect sleep, resulting in a final sample of 27 respondents who completed the study. The data collected will be computed, analyzed, and discussed to evaluate the impact of elderly exercise on sleep quality in Kotabatu, Bogor Regency, during the year 2023.

Overview of Subject Characteristics

According to the World Health Organization (WHO), the global population of elderly individuals is projected to increase from 1 billion in 2020 to 2.1 billion by 2050. In Indonesia, the percentage of elderly individuals has also demonstrated a significant upward trend, rising from 4% in 2010 to 11.75% in 2022. West Java Province is identified as one of the regions with a prevalence of elderly individuals exceeding 10%, as reported by the Central Statistics Agency (BPS). Furthermore, BPS indicates that a substantial proportion of elderly individuals in Indonesia are aged between 60 and 69 years, categorizing them as young elderly. As delineated in Table 1, all respondents in this study were female, which is consistent with BPS data indicating that the majority of the elderly population in Indonesia is female (52.28%).[10]

Table 1. Characteristics of Respondents

Characteristics	Routine Elderly Exercise		Irregular Elderly Exercise	
	n	%	n	%
Age				
60-64 years	13	48	7	26
65-69 years	3	11	4	15
Gender				
Male	0	0	0	0
Female	16	59	11	41

Overview of PSQI Scores Among Study Subjects

The findings (Table 2) indicate a significant difference in Pittsburgh Sleep Quality Index (PSQI) scores between subjects who engage in regular versus irregular elderly exercise. The observed differences suggest that the sleep quality of subjects participating in regular elderly exercise is superior to that of their counterparts who do not engage in such activities. These results substantiate the hypothesis that the sleep quality of individuals participating in regular elderly exercise is better than that of those who engage in irregular exercise.

Table 2. PSQI Score Overview of Elderly Individuals at Kotabatu Community Health Center, Bogor Regency

Global PSQI Score	Routine Elderly Exercise		Irregular Elderly Exercise	
	n	%	n	%
≤5 (Good Sleep Quality)	14	52	2	7
>5 (Poor Sleep Quality)	2	7	9	33

These findings are consistent with research conducted by Miasa, NW, et al. in 2020, which yielded comparable results. In their investigation, chi-square analysis indicated a p-value of 0.005, suggesting a significant relationship between elderly exercise activities and sleep quality. This study affirms that an increased frequency of elderly exercise can positively contribute to enhanced sleep quality, thereby highlighting the significant role of physical activity in ameliorating sleep conditions among the elderly.[6]

Differences in Sleep Quality Between Regular and Irregular Elderly Exercise Subjects

As illustrated in Table 3, seven components were evaluated to determine the PSQI scores for study participants. Analysis of these components revealed significant differences in subjective sleep quality (p=0.007), sleep latency (p=0.019), sleep disturbances (p=0.021), and activity dysfunction (p=0.002). Conversely, no significant differences were observed in the remaining three components: sleep duration,

use of sleep medications, and sleep efficiency. These results align with the findings of the Mann-Whitney test conducted by Nurdianingrum, B., & Purwoko, Y. in 2016, which similarly found no significant differences in sleep duration and use of sleep medications (p>0.05) but significant differences in subjective sleep quality, sleep latency, and activity dysfunction.[11]

Table 3. Differences in Sleep Quality Scores Among Subjects with Regular and Irregular Elderly Exercise

Component	Routine Elderly Exercise		Irregular Elderly Exercise		p-value
	Mean ± SD	Median (Min-Max)	Mean± SD	Median (Min-Max)	
Subjective Sleep Quality	0.43 ± 0.12	0.00 (0-1)	1.1 ± 0.16	1.00 (0-2)	0,007
Sleep Latency	0.56 ± 0.15	0.50 (0-2)	1.18 ± 0.18	1.00 (0-2)	0.019
Sleep Duration	1.18 ± 0.13	1.00 (0-2)	1.45 ± 0.15	1.00 (1-2)	0.220
Use of Sleep Medications	0.06 ± 0.06	0.00 (0-1)	0.09 ± 0.09	0.00 (0-1)	0.786
Sleep Disturbances	0.75 ± 0.17	1.00 (0-2)	1.36 ± 0.15	1.00 (1-2)	0.021
Sleep Efficiency	0.37 ± 0.12	0.00 (0-1)	0.54 ± 0.15	1.00 (0-1)	0.390
Activity Dysfunction	0.31 ± 0.15	0.00 (0-2)	1.00 ± 0.13	1.00 (0-32)	0.002
(*Mann-Whitney Test)					

Impact of Elderly Exercise on Sleep Quality

The findings presented in Table 4 indicate a significant effect of elderly exercise on sleep quality among elderly individuals at the Kotabatu Community Health Center, Bogor Regency. These results are corroborated by research conducted by Subakti, RT., in 2022 at the Tresna Werdha Natar Lampung Nursing Home. This conclusion is supported by t-test analysis, which yielded a calculated t-value of 7.948 compared to a critical t-value of 1.761, with a p-value of 0.000 (<0.05). This suggests a significant influence of elderly exercise on sleep quality, with an average increase in sleep quality observed among elderly participants after engaging in exercise, measured at 2.6835.[9]

Table 4. The Impact of Elderly Exercise on Sleep Quality Among the Elderly at Kota Batu Community Health Center, Bogor Regency

	Routine Elderly Exercise		Irregular Elderly Exercise		p-value
	Mean (SD)	Median (Min-Max)	Mean (SD)	Median (Min-Max)	
PSQI Sleep Quality Score	3.68 (0.37)	4.00(1.00-7.00)	6.72(0.38)	7.00(5.00-9.00)	0.000
(*Independent T-test)					

Elderly exercise, as defined by the Minister of Youth and Sports (MENPORA, 2020), aims to enhance the physical fitness of older adults. This form of exercise can be conducted in various environments, including nursing homes, community health centers, and health posts. Elderly exercise is characterized by its simplicity, low intensity, and low-impact nature, rendering it suitable for this demographic. Moreover, it comprises a combination of muscle movements and regulated breathing techniques performed with conscious awareness, facilitating optimal thoracic expansion and enhancing cerebral blood flow. Consequently, this optimization of cerebral metabolism includes the secretion of melatonin, which is crucial for improving sleep quality among the elderly.[11]

Increased cerebral blood flow also stimulates parasympathetic activity, resulting in reduced levels of catecholamines, such as adrenaline and norepinephrine, thereby promoting bodily relaxation. This enhanced relaxation process contributes to improved sleep quality among the elderly.[12]

Elderly exercise constitutes a moderate-intensity physical activity that is easily performed by older adults. As such, it stimulates lipolysis, leading to an increase in free fatty acid levels in plasma. Free fatty acids exhibit low solubility and can bind with albumin. Consequently, these fatty acids will compete with tryptophan for binding with albumin, resulting in an increased concentration of tryptophan in plasma. Tryptophan serves as a precursor for serotonin synthesis in the brain. Moreover, elderly exercise contributes to a decrease in levels of branched-chain amino acids (valine, isoleucine, and leucine), which alters the ratio of tryptophan to branched-chain amino acids. This alteration is linked to serotonin synthesis, which is subsequently released into the diencephalon and cerebrum, thus initiating sleep in the elderly.[13]

The practice of elderly exercise also leads to a reduction in inflammatory activity, resulting in decreased levels of inflammatory markers such as interleukin-6 (IL-6), C-reactive protein (CRP), and fibrinogen. These inflammatory markers are recognized as influential in the physiological regulation of sleep within the central nervous system. An increase in inflammatory markers within the body may provoke biphasic alterations in sleep patterns, impacting both NREM and REM sleep stages.[12]

Limitations of the Study

This study is subject to several limitations, including challenges in controlling various factors that may influence the sleep quality of the elderly. These factors encompass the sleep environment, the use of herbal medications, and physical activities outside the designated exercise program, all of which are constrained by the limited sample size. Furthermore, time limitations during the data collection phase may have impacted the comprehensiveness of the findings.

CONCLUSION

The findings of this research indicated that a significant proportion of elderly individuals experience satisfactory sleep quality, with 16 out of 27 respondents (59%) meeting established criteria for good sleep. Among these respondents, 14 individuals (52%) reported regular participation in elderly exercise programs, while 2 individuals (7%) engaged in such activities inconsistently. Statistically significant differences were identified in sleep quality between participants who engaged regularly in exercise and those who did not, particularly in the areas of subjective sleep quality ($p=0.007$), sleep latency ($p=0.019$), sleep disturbances ($p=0.021$), and dysfunction in daily activities ($p=0.002$). These results substantiate the hypothesis that participation in elderly exercise exerts a significant positive influence on sleep quality among seniors at the Kotabatu Health Center in Bogor District, as indicated by a p-value of < 0.05 ($p=0.00$).

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DECLARATION OF INTERESTS

We hereby declare that there is no conflict of interest in the scientific articles we have authored.

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