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Original Research

Exercise-Based Intervention and Its Impact on Sleep Quality Among Older Adults

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ABSTRACT

Background: *Poor sleep quality is one of the common problems in the elderly. Non-pharmacological interventions such as chair-based exercise (CBE) are considered effective in improving sleep quality. The study aimed to determine how CBE affects the sleep quality of older people at community-based health service posts in Central Java, Indonesia.*

Methods: *A pre-experimental one-group pretest-post test design was conducted at community-based health service posts in Central Java, Indonesia, with 30 elderly respondents selected through a purposive sampling technique. The intervention was performed for 4 weeks, twice a week. 30 minutes/session. Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI). Data analysis using the Wilcoxon test.*

Results: *The mean PSQI score before the intervention was 10.23 (SD = 1.80), with a maximum score of 15, and a minimum score of 7. After the intervention, the mean score decreased to 5.43 (SD =1.85), with a maximum score of 10 and a minimum score of 3. There was a significant decrease in PSQI scores after the intervention (Z= -4.583, p <0.001).*

Conclusion: *CBE can be an alternative non-pharmacological therapy that is effective, safe, and easy to implement in the elderly community, especially in the posyandu environment, which is the center of public health activities, especially to improve sleep quality. Its inclusion in posyandu lansia programs provides a useful way to enhance sleep quality and support health promotion and prevention initiatives, without the need for medication.*

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INTRODUCTION

Aging is a natural process characterized by a decline in organ function that affects physical, psychological, and social health (Dayaningsih et al., 2021). Badan Pusat Statistik (BPS) data shows that in 2023, the number of elderly people in Indonesia reached 11.75% and is projected to increase to 15.77% in 2035 (BPS, 2023). The increase in the elderly population is accompanied by a high risk of health problems, including sleep disorders (Kavousi et al., 2025).

A common health problem that negatively impacts older adults is sleep disturbance. Sleep disturbances cause nighttime discomfort and interfere with daytime functioning. Sleep deprivation is associated with an increased risk of falls, decreased physical stamina, difficulty performing daily tasks, and reduced focus. The most common sleep disturbances experienced by older adults are difficulty falling asleep, frequent nighttime awakenings, decreased sleep quality, and simply being in bed. All of these problems lead to a decline in quality of life and function in older age (Griffiths et al., 2023; Idalino et al., 2024). Factors that influence sleep disorders in the elderly include age-related physiological changes, psychological stress, chronic pain, side effects of several medications, and changes in daily activity patterns and routines (Jagadeesan et al., 2023; J. Li et al., 2021; Miner & Kryger, 2020). Left untreated, poor sleep quality can reduce overall quality of life.

There are two approaches to treating sleep disorders: pharmacological and non-pharmacological. Although the use of medication to treat sleep disorders is considered effective in the short term, it has negative effects on the elderly. Long-term effects include increased risk of dependency, the development of balance disorders, and potential cognitive impairment as a side effect of treatment. Therefore, caution is needed when using medication in the elderly population (Amari et al., 2022; León-Barriera et al., 2025; Tavares et al., 2021). Therefore, non-pharmacological approaches are more recommended, such as music therapy, aromatherapy, meditation, and light physical exercise (Widiana et al., 2020).

One form of light physical exercise that is safe for the elderly is Chair-Based Exercise (CBE), which is a light exercise performed while sitting in a chair. CBE is suitable for elderly people with physical limitations because it minimizes the risk of falling. This exercise includes stretching movements, muscle strengthening, and breathing exercises, which overall help improve relaxation and blood circulation (Saputra & Muzaffar, 2022). As such, CBE can be an effective and safe intervention option for improving the overall physical health of older adults.

Several studies have shown that community-based exercise and structured physical activity interventions can significantly improve sleep quality in older adults. Meta-analyses and randomized controlled trials have shown clinically meaningful improvements in subjective sleep measurements after regular exercise programs (Hasan et al., 2022; Solis-Navarro et al., 2023; Li et al., 2025), as well as providing additional benefits such as improved balance, flexibility, and reduced risk of falls (Furtado et al., 2021; Saputra & Muzaffar, 2022). These positive effects suggest that CBE is a promising therapeutic approach in elderly care. Although CBE is a promising therapeutic approach with positive impacts on the care of older adults, most research has been conducted in controlled or institutional settings. Research examining the effectiveness of CBE in real-world community contexts is still very limited.

This research aimed to more clearly assess how CBE influences the sleep quality of older adults at community-based health service posts in Central Java, Indonesia. This research is important because it has not been done much at the local community level and can be the basis for implementing similar intervention programs in other posyandus. It is therefore hoped that this study will contribute to the development of community-based interventions that are easy to implement and sustainable.

MATERIALS AND METHOD

This study used a quantitative design with a pre-experimental one-group pretest-posttest approach. A one-group pretest-post test design is often used for community-based interventions when randomization or a control group is not possible (Chang et al., 2022). The research was conducted at community-based health service posts in Central Java, Indonesia, from July to August 2024.

The study group consisted of elderly people who were registered and actively involved in an integrated health post (Posyandu). Purposive sampling was used in this study. A sample of 30 individuals was selected based on inclusion criteria: (1) Elderly aged ≥ 60 years; (2) having a PSQI score> 5; (3) able to communicate and understand instructions; and (4) willing to follow all intervention sessions. The exclusion criteria for this study included older adults with severe cognitive impairment, those experiencing acute or unstable medical conditions, and those with physical limitations that hindered their ability to perform the exercises. In pre-experimental one-group studies with pretest-post test methods, a sample size of 30 is generally adequate for assessing initial intervention effects as this number meets the minimum threshold for statistical analysis to detect changes before and after the intervention and is sufficiently representative for a preliminary study at community level (Chang et al., 2022).

The CBE intervention was conducted over a period of four weeks, twice a week—on Fridays and Saturdays—with each session lasting 30 minutes. The researchers structured the exercise programme into three phases: warm-up, main exercise, and cool-down. The researchers used chairs as the primary medium, alongside music and verbal instructions from the facilitator to guide participants throughout the activity. This intervention was delivered by students on the D-4 Occupational Therapy programme under the direct supervision of an Occupational Therapy doctor to ensure procedural compliance and safety. Consequently, the implementation of this intervention met standard operating procedures and guaranteed safety and effectiveness for participants.

The measurement instrument in this study used the Pittsburgh Sleep Quality Index (PSQI), which is a standardized questionnaire used to assess subjective sleep quality over the past month. The PSQI has been extensively tested and employed in a variety of clinical and community research. The PSQI assessment includes 19 questions divided into seven categories, which are: perceived sleep quality, time taken to fall asleep, total sleep time, sleep efficiency, sleep interruptions, use of sleep aids, and overall sleep-related issues. Each category is rated from 0 to 3. The overall PSQI score is calculated by adding together the scores from the seven categories, resulting in a total that ranges from 0 to 21. A higher score indicates poorer sleep quality. A score greater than 5 suggests inadequate sleep quality, whereas a score of 5 or less indicates satisfactory sleep quality (Chehri et al., 2020; Zhang et al., 2020).

This questionnaire was filled out directly by the individual, with the researcher assisting as necessary to clarify any question items. The PSQI has been tested for validity (item-total correlation coefficients between 0.30 and 0.72) and for reliability (internal consistency with Cronbach's alpha values ranging from 0.68 to 0.81) in the elderly population. The PSQI instrument therefore demonstrates sufficient validity and reliability for use in measuring sleep quality in older adults (Chehri et al., 2020; Zhang et al., 2020).

Data were assessed employing the Wilcoxon test to evaluate the variation in PSQI scores prior to and following the intervention, as the data were ordinal and did not follow a normal distribution. The Wilcoxon test serves as a non-parametric method applicable to

two related samples. This test was chosen because it is suitable for analysing changes in paired data that are not normally distributed.

The researcher submitted an application for ethical approval to the ethics committee of Dr. Moewardi General Hospital. The study was reviewed to ensure compliance with established ethical standards. This research has met all ethical requirements under approval number No. 1.706/VII/HREC/2024. The approval was officially issued on July 3, 2024. All research procedures were conducted in accordance with ethical guidelines to protect the rights and safety of the participants.

RESULTS

After the chair-based exercise intervention for four weeks, data were collected and analyzed to determine changes in the quality of sleep of the elderly. The assessment was conducted using the PSQI before and after the intervention. The analysis showed that there was a significant change in the respondents' PSQI scores. The following is a breakdown of the respondents' characteristics as well as a comparison of the scores before and after the intervention:

Table 1. Socio-Demographic Characteristics of the Study Participants (n = 30)

Variable	Category	Frequency (n)	Percentage (%)
Age	60 – 74 years	27	90.0
	≥ 75 years	3	10.0
Education	Elementary/middle/secondary school	24	80.0
	Not in school	6	20.0
Jobs	Laborer	13	43.3
	Not working	17	56.7

It showed that most of the respondents were in the age range of 60-74 years (90%), had primary education (80%), and were not working (56.7%). This reflects the general characteristics of older adults in the community, who have the potential for decreased physical and social activity, as well as sleep disturbances. Advanced age and low levels of education may affect understanding of the importance of healthy sleep patterns, while being unemployed may lead to decreased social engagement, which impacts sleep cycles.

Table 2. Changes in Pittsburgh Sleep Quality Index (PSQI) Scores Before and After the Intervention (n =30)

Variable	Min	Max	Mean ± Standard Deviation	Mean Difference
Pre-test	6	9	10.4 ± 2.1	4.2
Post-test	2	7	6.2 ± 1.7	

The results demonstrate a substantial decrease in the mean PSQI score following the chair-based exercise intervention, declining from 10.4 ± 2.1 at baseline to 6.2 ± 1.7 post-intervention, with a mean difference of 4.2 points. This decrease in score indicates an overall improvement in sleep quality in respondents. This suggests that light physical exercise is consistently able to provide a relaxing effect and improve the effectiveness of

night sleep in the elderly. In addition, the decrease in standard deviation signifies an increase in the uniformity of sleep experience among respondents.

Table 3. Wilcoxon Signed-Rank Test Results for Pittsburgh Sleep Quality Index PSQI Scores Before and After Intervention (n = 30)

Comparison	Z	p-value
Pre-test vs post-test	-4.583	**<0.001**

The Wilcoxon test showed a negative Z value and p-value <0.05, indicating a significant difference between PSQI scores before and after the intervention. The very low p-value (p-value <0.001) indicates that this result is highly unlikely to have occurred by chance and strengthens the evidence that chair-based exercise is an effective method to improve sleep quality in the elderly.

DISCUSSION

The results showed that after attending the Chair-Based Exercise program for four weeks, the elderly experienced a significant improvement in their sleep quality. The PSQI score decreased significantly from poor to good category, indicating that this exercise is effective in overcoming sleep disorders in the elderly. This finding proves that CBE can be used as an alternative non-pharmacological intervention to improve the sleep quality of the elderly.

The decrease in PSQI scores indicates that CBE helps improve several important aspects of sleep, such as accelerating the time to fall asleep (latency), increasing sleep duration and efficiency, and reducing sleep disturbances at night. Physiologically, low-to-moderate intensity physical activity has been shown to enhance parasympathetic activity and reduce sympathetic arousal, leading to decreased heart rate and blood pressure and promoting physiological relaxation conducive to sleep (Horiuchi et al., 2023; Myllymäki et al., 2021). On the other hand, physical activity has been shown to enhance serotonin availability and stimulate endorphin release, which contributes to relaxation, mood regulation, and rhythm modulation, thereby supporting improved sleep quality in older adults (Kredlow et al., 2021; Stutz et al., 2022).

The present findings are consistent with recent studies demonstrating that structured exercise interventions significantly reduce sleep disturbance among older adults, including those with functional limitations (Reid et al., 2020; Yang et al., 2022). A study by Aurangabadkar and Deo (2020) also showed that CBE can reduce depressive symptoms that are closely related to poor sleep quality. This is important because sleep disturbances and mental health are closely related to the elderly population. Furthermore, improvements in mental health through mild physical interventions can have long-term effects on the quality of life of older people. Consequently, a holistic approach that combines physical activity and psychological support is essential in efforts to improve sleep quality in older people.

In addition to physiological and psychological effects, the implementation of CBE in groups in the posyandu environment also has positive social effects. Elderly people feel valued, involved in the community, and receive social support from others. This has been shown to increase motivation, life satisfaction, and indirectly improve sleep quality. Furthermore, the social interactions that take place during these activities can help alleviate feelings of loneliness and social isolation among older people. This, in turn,

contributes to improved emotional well-being, which ultimately supports better sleep quality (Furtado et al., 2021).

The findings of this study have important practical implications for the development of interventions for older adults. CBE can be implemented as a simple, low-cost programme that is easy to apply at the community level, such as in elderly health posts. This intervention not only focuses on increasing physical activity but also has the potential to improve sleep quality and overall well-being. Therefore, healthcare workers and health centre volunteers are advised to integrate CBE into routine elderly care programmes as part of promotive and preventive efforts (Furtado et al., 2021).

Furthermore, a holistic approach combining physical activity, social engagement, and emotional support should be prioritised in the planning of elderly health programmes. This combination has been shown to provide dual benefits, both physical and psychosocial, thereby enhancing the quality of life of older adults in a sustainable manner. Consequently, CBE not only has a short-term effect on sleep patterns but also has the potential to serve as a long-term intervention strategy in maintaining the physical and cognitive function of older adults in their daily lives (Y. Li et al., 2025).

This study has several limitations. The use of purposive sampling and a relatively small sample size may have introduced selection bias and limited the generalizability of the findings. The absence of a control group limits causal inference about the intervention's effectiveness. Sleep quality was assessed using the self-reported PSQI, which is susceptible to recalling and reporting bias. Additionally, other factors that may have influenced sleep quality during the four-week intervention period were not systematically controlled.

Therefore, the findings should be interpreted with caution. Future research should employ randomized controlled designs, larger samples, objective sleep measurements, and extended intervention and follow-up periods to strengthen the robustness of the evidence. Despite these limitations, the results provide preliminary support for the feasibility of integrating structured community-based exercise into routine geriatric health services, especially improving sleep quality in the elderly.

CONCLUSION

There is a significant effect of chair-based exercise intervention on improving sleep quality in the elderly. This intervention is able to improve sleep quality by significantly reducing PSQI score, as well as having a positive impact on the physical, psychological, and social aspects of the elderly. Chair-based exercise is a form of non-pharmacological intervention that is safe, inexpensive, and can be done routinely by the elderly, both individually and in groups. This programme has the potential to be integrated into healthcare services for older people at community health posts and primary healthcare facilities as part of promotive and preventive efforts to improve the quality of life of older people. This intervention can also be recommended as a component of older people's health programmes, particularly in efforts to improve sleep quality at community health posts and primary healthcare facilities.

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DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

AI tools were used solely for grammar and language editing. The authors take full responsibility for the content and integrity of the manuscript.

CONFLICT OF INTERESTS

The authors declare that there are no financial or non-financial interests that could influence the results of this study.

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