

Determinants of sleep quality among older people

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ABSTRACT

Background: Sleep quality is a key indicator of health in later life, yet it often deteriorates as individuals age, particularly among those living in institutional settings. In nursing homes, biological changes interact with daily routines and limited physical activity, potentially aggravating sleep disturbances. Understanding these interactions is essential for developing feasible interventions for elderly residents.

Methods: This cross-sectional study was conducted among 288 older adults residing in nursing homes in Malang, Indonesia. Participants were selected using purposive sampling based on predefined criteria. Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ), sleep quality using the Pittsburgh Sleep Quality Index (PSQI), and anxiety using the Depression Anxiety Stress Scale (DASS). Multivariate linear regression was applied to examine associations between demographic factors, anxiety, physical activity, and sleep quality.

Results: The regression model explained 37.9% of the variance in PSQI scores ($R^2 = 0.379$). While higher physical activity levels significantly predicted better sleep quality ($\beta = -0.415, p < 0.001$), advanced age ($\beta = 0.043, p = 0.018$) and female sex ($\beta = 0.482, p = 0.003$) were significantly linked to worse sleep outcomes. Neither anxiety ($\beta = -0.069, p = 0.071$) and employment history ($\beta = -0.079, p = 0.086$) were not significantly associated with sleep quality.

Conclusion: Among the factors examined, physical activity demonstrated the strongest association with sleep quality in elderly nursing home residents. These findings highlight the potential value of activity-based programs as part of routine care, while also pointing to the need for sleep interventions that account for age-related and sex-specific differences.

Keywords: older people, sleep quality, physical activity, anxiety, nursing home.

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INTRODUCTION

Adequate sleep is fundamental for maintaining physical resilience and emotional stability. Nevertheless, sleep quality typically declines with advancing age. Older adults commonly experience reductions in slow-wave sleep, increased nocturnal awakenings, and more fragmented sleep patterns, largely as a result of physiological aging and the accumulation of chronic diseases.^{1,2} These problems tend to be amplified in nursing home environments, where exposure to noise, artificial lighting, and rigid daily routines can interfere with natural sleep-wake rhythms.^{2,3}

Although age-related sleep disturbances have been widely documented, fewer studies have explored how multiple determinants jointly influence sleep quality among institutionalized elderly

individuals. This gap limits our understanding of the complex regulation of sleep in this vulnerable population.⁴

At the global level, approximately 40-70% of older adults report sleep complaints.⁵ Local evidence from Central and East Java suggest that nearly half of elderly population has difficulty initiating or maintaining sleep, with even higher prevalence observed among residents of nursing homes in Malang.^{4,6} Sleep problems in this context are often accompanied by depressive symptoms, unfavorable environmental conditions, and limited engagement in physical activity, underscoring the multifactorial nature of sleep disturbances in later life.

Physical inactivity has consistently been identified as an important correlate of poor sleep quality in older adults.⁷ Regular movement contributes to sleep

regulation through neuroendocrine pathways, including serotonin modulation and stress hormone regulation. In contrast, prolonged inactivity is associated with heightened sympathetic nervous system activity and more fragmented sleep.⁸ Reduced activity may also disrupt metabolic homeostasis and circadian timing, further compromising sleep continuity.⁹

Given the rapid growth of the elderly population, addressing lifestyle-related sleep problems is increasingly important. The use of standardized instruments, such as the PSQI, DASS, and GPAQ provides a systematic approach to examining these relationships. This study therefore aimed to identify determinants of sleep quality among elderly nursing home residents in Malang.

METHODS

A quantitative observational study with a cross-sectional design was conducted among elderly residents of nursing homes in Malang, Indonesia, between November and December 2025. A purposive sampling method was applied to select participants who met the inclusion and exclusion criteria. From a total of 1,256 registered residents, 288 older adults were included in the analysis.

Eligible participants were aged 60 years or older, able to communicate in Indonesian, and willing to provide informed consent. Individuals with severe mental disorders, regular use of non-prescribed sleeping medication, severe sleep disorders unrelated to aging (such as diagnosed sleep apnea), or conditions that limited participation were excluded.

The study utilized the Global Physical Activity Questionnaire (GPAQ) to measure physical activity, the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, and the Depression Anxiety Stress Scale (DASS) to evaluate anxiety. Sociodemographic characteristics were obtained through a structured questionnaire. Data collection was conducted by trained research assistants with support from nursing home staff. Assistance was provided when needed to ensure accurate responses.

Descriptive statistics were used to summarize participant characteristics. To explore the determinants of sleep quality, the study employed multivariate linear regression analysis, with statistical significance determined at $p < 0.05$. All data analysis was performed utilizing SPSS version 20 (SPSS Inc., Chicago, IL, USA). Furthermore, ethical clearance for this research was granted by the Ethics Committee of Universitas Muhammadiyah Malang, Indonesia, under protocol number E.4.d/223/KEPK/FIKES-UMM/XII/2025.

RESULTS

A total of 288 elderly residents from nursing homes in Malang were included in this study. Most participants were women (68.8%), and the age range was 60-81 years (Table 1). Very severe anxiety was the most common category (27.8%). More than half

Table 1. Characteristics of the 288 subjects

| Characteristics | N or mean | % or SD |
|--------------------------|-----------|---------|
| Sex | | |
| Male | 90 | 31.3 |
| Female | 198 | 68.8 |
| Age (years) | 65.7 | 4.0 |
| Range | 60 – 81 | |
| Anxiety level (DASS) | | |
| Normal | 71 | 24.4 |
| Mild | 42 | 14.6 |
| Moderate | 42 | 14.5 |
| Severe | 53 | 18.4 |
| Very severe | 80 | 27.8 |
| Physical activity (GPAQ) | | |
| Light | 132 | 45.8 |
| Moderate | 156 | 54.2 |
| Employment history | | |
| SME worker | 144 | 50.0 |
| Retired teacher | 57 | 19.8 |
| Trader | 30 | 10.4 |
| Housewife | 24 | 8.3 |
| Farmer | 15 | 5.2 |
| Catering | 12 | 4.2 |
| Entrepreneur | 3 | 1.0 |
| Unemployed | 2 | 0.7 |

DASS, depression anxiety stress scales; GPAQ, global physical activity questionnaire; N, frequency; SD, standard deviation; SME, small and medium-sized enterprises.

Table 2. Model summary of multivariate linear regression

| R | R ² | p-value |
|-------|----------------|---------|
| 0.616 | 0.379 | <0.001 |

Table 3. Multivariate linear regression analysis of factors associated with sleep quality of Pittsburgh sleep quality index

| Variable | β | p-value |
|--------------------|---------|---------|
| Age | 0.043 | 0.018 |
| Sex | 0.482 | 0.003 |
| Anxiety | -0.069 | 0.071 |
| Physical activity | -0.415 | 0.001 |
| Employment history | -0.088 | 0.086 |

β = Standardized regression coefficient

of the participants reported moderate physical activity (54.2%), and employment history was mainly dominated by small and medium enterprise workers (50.0%) (Table 1).

Multivariate linear regression showed that the model explained 37.9% of the variance in sleep quality ($R^2 = 0.379$) and demonstrated a moderate correlation between the predictors and PSQI scores ($R = 0.616$). The overall model was statistically significant ($p < 0.001$) (Table 2).

Further analysis indicated that age ($\beta = 0.043$, $p = 0.018$) and female gender ($\beta = 0.482$, $p = 0.003$) were positively associated with poorer sleep quality. Physical activity was negatively associated with PSQI scores ($\beta = -0.415$, $p < 0.001$), indicating better sleep quality with higher activity levels. Anxiety ($\beta = -0.069$, $p = 0.071$) and employment history ($\beta = -0.079$, $p = 0.086$) were not significantly associated with sleep quality (Table 3).

DISCUSSION

This study provides evidence that sleep quality among elderly nursing home residents is shaped by a combination of biological aging and lifestyle-related factors, with physical activity emerging as the most influential determinant. The findings reinforce the idea that sleep in later life is not merely a passive process but one that remains responsive to behavioral inputs.

The association between advancing age and poorer sleep quality is consistent with well-documented age-related changes in circadian regulation and sleep architecture.^{10,11} Declining melatonin secretion and increased nocturnal cortisol levels may help explain why older adults experience lighter, more fragmented sleep.^{12,13} Female participants reported poorer sleep quality than their male counterparts. This finding aligns with previous research highlighting a higher burden of sleep disturbances among postmenopausal women.^{14,15} Hormonal changes, particularly estrogen deficiency, may disrupt hypothalamic regulation of the sleep-wake cycle and increase vulnerability to insomnia symptoms.¹⁶⁻¹⁸

Although anxiety did not reach statistical significance, its borderline association with sleep quality deserves attention. Chronic anxiety is known to activate the hypothalamic-pituitary-adrenal axis, elevating nighttime cortisol levels and interfering with restorative sleep.^{19,20} In nursing home environments, psychosocial stressors such as social isolation and loss of autonomy may amplify these effects.²¹

Physical activity stood out as the strongest predictor of better sleep quality. Regular activity likely promotes sleep through multiple pathways, including improved thermoregulation, enhanced circadian stability, and increased production of serotonin and melatonin.^{22,23} Importantly, physical activity represents a modifiable factor that can be addressed even in institutional settings through low-intensity, supervised programs. The absence of a significant association between employment history and sleep quality may reflect the homogenizing effect of nursing home routines, where past occupational patterns exert less

influence on daily rhythms.

There are a number of limitations to this study that should be noted. First off, this study is unable to show actual causal links between anxiety, physical activity, and sleep quality because it used a cross-sectional design that collected data at a particular point in time. Additionally, as staff and research assistants helped participants with their responses, the use of self-reported questionnaires such as the PSQI, GPAQ, and DASS raises the possibility of recall and social desirability bias. Finally, the sample might not accurately reflect the total registered population of the institutions because selective sampling was used instead of random selection. Lastly, the results have limited generalizability to older people who live in the community or in other locations because the data was limited to institutionalized older adults in Malang, Indonesia.

CONCLUSION

This study demonstrates that physical activity, age, and sex were key determinants of sleep quality among older adults living in nursing homes. Higher levels of physical activity were associated with better sleep quality, reinforcing the role of exercise as a modifiable factor for improving sleep health in institutionalized elderly populations.

Differences in sleep quality across age groups and between sexes highlight the need for interventions that account for physiological aging and sex-specific factors, particularly among postmenopausal women. Overall, integrating structured physical activity programs with targeted sleep hygiene interventions into routine nursing home care may substantially improve sleep quality and overall well-being among older residents.

ETHICAL CLEARANCE

The study has been declared exempt from ethical review by the Health Research Ethics Committee of the Universitas Muhammadiyah Malang, Indonesia, with permit number of E.4.d/223/KEPK/FIKES-UMM/XII/2025 issued on December 18th, 2025.

CONFLICT OF INTEREST

All the authors declare that there are no conflicts of interest.

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AUTHOR CONTRIBUTION

AS conceived the study design, collected and processed the data, and drafted the initial manuscript. NMY, AH, and S contributed to study design and manuscript revision.

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