

Original Article

Correlation of Restless Leg Syndrome and Sarcopenia with Function and Sleep Quality in Older Adults

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ABSTRACT

Background: Restless legs syndrome and sarcopenia-related functional limitation are common geriatric concerns that may adversely affect sleep quality, physical activity, mobility, and independence among older adults. Sleep disturbance in this population may coexist with reduced lower-extremity performance, but evidence from South Asian older adults remains limited. **Objective:** To determine the correlation of restless legs syndrome and suspected sarcopenia-related functional limitation with lower-extremity function and sleep quality among older adults. **Methods:** This observational cross-sectional study included 175 older adults recruited from tertiary care hospitals, geriatric outpatient departments, and community elderly centers in Lahore, Pakistan. Sleep quality was assessed using the Pittsburgh Sleep Quality Index, and lower-extremity function was measured using the Lower Extremity Functional Scale. Demographic and clinical variables were summarized using descriptive statistics, and Pearson correlation analysis was applied to assess associations between sleep-quality index and selected variables. **Results:** The mean age of participants was 67.54 ± 7.50 years, and females comprised 59.4% of the sample. Poor sleep quality was observed in 149 participants (85.1%), while 148 participants (84.6%) had moderate lower-extremity functional limitation. Mean PSQI score was 8.18 ± 2.79 , mean LEFS score was 53.97 ± 5.69 , and mean sleep duration was 6.55 ± 1.19 hours. Sleep-quality index showed strong positive correlations with sleep duration ($r = 0.715$, $p < 0.001$) and physical activity level ($r = 0.709$, $p < 0.001$), and a moderate inverse correlation with lower-extremity functional performance ($r = -0.540$, $p < 0.001$). **Conclusion:** Poor sleep quality and moderate lower-extremity functional limitation were highly prevalent among older adults with restless legs syndrome and suspected sarcopenia-related impairment. Sleep quality, sleep duration, physical activity, and lower-extremity function were closely interrelated, supporting the need for integrated geriatric assessment of sleep and mobility. **Keywords:** Restless Legs Syndrome; Sarcopenia; Sleep Quality; Lower Extremity Function; Older Adults; Physical Activity.

"Cite this Article" | Received: 06 October 2025; Accepted: 19 December 2025; Published: 31 December 2025.

Author Contributions: Concept: MAR, HSA; Design: HSA, MNT; Data Collection: SI, STS, MT; Analysis: MAR, HSA; Drafting: MAR, HSA, MNT. **Ethical Approval:** Research Ethical Committee of University of Lahore, Lahore, Pakistan. **Informed Consent:** Written informed consent was obtained from all participants; **Conflict of Interest:** The authors declare no conflict of interest; **Funding:** No external funding; **Data Availability:** Available from the corresponding author on reasonable request; **Acknowledgments:** N/A.

INTRODUCTION

Population aging has emerged as one of the most important public health challenges of the twenty-first century, with increasing numbers of older adults living with chronic geriatric syndromes that compromise mobility, sleep, independence, and quality of life. Among these age-associated conditions, restless legs syndrome and sarcopenia are clinically important because both may contribute to reduced physical function, disturbed sleep, daytime fatigue, and progressive functional dependency. Restless legs syndrome is a neurological sensorimotor disorder characterized by an urge to move the legs, usually accompanied by unpleasant sensations that worsen during rest and in the evening or night, leading to

difficulty initiating and maintaining sleep (1). Sarcopenia, defined by progressive loss of skeletal muscle strength, muscle quantity or quality, and physical performance, is similarly common in older populations and is strongly associated with impaired gait, reduced balance, falls, frailty, and limitations in activities of daily living (2,3).

Older adults with restless legs syndrome frequently experience fragmented sleep, reduced sleep duration, and poor perceived sleep quality because nocturnal sensory discomfort and motor restlessness interfere with normal sleep continuity. These sleep disturbances may extend beyond nighttime symptoms and contribute to daytime sleepiness, reduced participation in physical activity, mood changes, cognitive complaints, and diminished functional capacity (4,5). In parallel, sarcopenia is influenced by physical inactivity, nutritional insufficiency, chronic inflammation, hormonal changes, neuromuscular decline, and age-related metabolic alterations, all of which may worsen lower-extremity performance and increase vulnerability to disability (2,6). Sleep also plays an important role in muscle recovery, endocrine regulation, inflammatory balance, and protein metabolism; therefore, poor sleep may plausibly contribute to deterioration in muscle function, while functional limitation and reduced activity may further aggravate sleep disturbance (5,7).

The relationship between restless legs syndrome, sarcopenia, sleep quality, and lower-extremity function is biologically plausible but remains insufficiently clarified, particularly in older adults from South Asian settings. Existing evidence suggests that sleep disturbance, frailty, reduced physical activity, and impaired neuromuscular function may share overlapping mechanisms, including chronic low-grade inflammation, dopaminergic dysfunction, metabolic dysregulation, nutritional deficiencies, and reduced mobility (5,7,8). However, most previous studies have examined restless legs syndrome and sarcopenia separately rather than evaluating their combined clinical relevance for sleep and lower-limb function. This limits the development of integrated geriatric screening and rehabilitation strategies, especially in low- and middle-income countries where older adults may face underdiagnosis, limited access to geriatric care, and inadequate routine assessment of sleep and functional health (9,10).

In Pakistan, evidence regarding the coexistence of restless legs syndrome, suspected sarcopenia-related functional limitation, sleep quality, and lower-extremity performance among older adults remains limited. This gap is clinically important because early identification of poor sleep and functional impairment may help guide rehabilitation, physical activity counseling, sleep-focused interventions, and preventive geriatric care. Therefore, Objective was to determine the correlation of restless legs syndrome and suspected sarcopenia-related functional limitation with lower-extremity function and sleep quality among older adults.

MATERIALS AND METHODS

The study was conducted as an observational cross-sectional study to examine the association of sleep quality with lower-extremity functional performance, sleep duration, and physical activity among older adults with restless legs syndrome and suspected sarcopenia-related functional limitation. A cross-sectional design was appropriate because the objective was to assess the magnitude and direction of relationships between clinical and functional variables at a single point in time rather than to determine causality or treatment effect. The study was carried out in Lahore, Pakistan, over a three-month period from November 04, 2025, to January 17, 2026, after approval of the research synopsis and ethical clearance from the Institutional Research Ethics Board of the University of Lahore. Participants were recruited from tertiary care hospitals, geriatric outpatient departments, and community elderly centers, allowing inclusion of older adults from both clinical and community-based settings.

The target population comprised older adults aged 55 years and above who had restless legs syndrome and suspected or confirmed sarcopenia-related functional limitation. Participants of both sexes were eligible if they were within the specified older-adult age group, had a diagnosis of restless legs syndrome, and demonstrated suspected functional limitation consistent with sarcopenia. Individuals were excluded

if they had neurological conditions other than restless legs syndrome, debilitating musculoskeletal disorders, diagnosed psychiatric illness, terminal disease, or a history of major lower-extremity orthopedic surgery, because these conditions could independently affect sleep quality, mobility, lower-limb function, or the validity of self-reported functional assessment. A non-probability convenience sampling technique was used, and 175 eligible participants were enrolled after screening according to the inclusion and exclusion criteria. Written informed consent was obtained from all participants before data collection, and participation remained voluntary throughout the study, with confidentiality and non-maleficence maintained during all stages of recruitment and assessment.

Data were collected using a structured questionnaire that included sociodemographic characteristics, clinical variables, sleep-related information, physical activity status, and standardized outcome measures. Age, gender, body mass index, smoking status, physical activity level, sleep duration, sleep quality, and lower-extremity functional performance were recorded. Sleep quality during the previous month was assessed using the Pittsburgh Sleep Quality Index, a validated instrument that generates a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality and a score greater than five conventionally classified as poor sleep quality (11). Lower-extremity functional performance was measured using the Lower Extremity Functional Scale, a 20-item patient-reported measure in which each item is rated on a five-point scale and higher scores indicate better lower-limb functional ability during daily and mobility-related activities (12). In this study, lower-extremity function was operationally defined as the participant's ability to perform lower-limb mobility and daily activity tasks as assessed by the Lower Extremity Functional Scale, while sleep quality was operationally defined by the global Pittsburgh Sleep Quality Index score.

To reduce measurement bias, the same structured data collection approach was applied to all participants, and validated instruments were used for the main outcome variables. Eligibility criteria were defined before recruitment to minimize inclusion of participants whose sleep or lower-extremity function could be strongly affected by unrelated neurological, psychiatric, terminal, musculoskeletal, or major orthopedic conditions. Potential confounding was considered at the design and analysis stages by recording demographic and clinical variables such as age, gender, body mass index, smoking status, physical activity level, and sleep duration, as these variables may influence both sleep quality and functional performance. Data completeness was reviewed before statistical analysis, and questionnaire responses were checked for internal consistency to support data integrity and reproducibility. Because all enrolled participants had restless legs syndrome and suspected sarcopenia-related functional limitation, the analysis focused on the relationship of sleep-quality index with sleep duration, physical activity level, and lower-extremity functional performance within this clinical group.

Data were analyzed using SPSS version 25.0. Categorical variables, including gender, smoking status, physical activity category, functional limitation category, and sleep-quality category, were summarized as frequencies and percentages. Continuous variables, including age, body mass index, Pittsburgh Sleep Quality Index score, Lower Extremity Functional Scale score, and sleep duration, were summarized as mean and standard deviation. Normality of continuous variables was assessed before inferential testing. Because the analyzed variables were treated as normally distributed, Pearson correlation analysis was used to examine associations between sleep-quality index score and selected variables, including sleep duration, physical activity level, and lower-extremity functional performance. Statistical significance was determined using a two-sided p-value threshold of ≤ 0.05 . The analysis was conducted using coded and anonymized data, and results were reported in aggregated form to preserve participant confidentiality.

RESULTS

A total of 175 older adults with restless legs syndrome and suspected sarcopenia-related functional limitation were included in the analysis. The demographic profile showed a higher proportion of females than males, with 104 female participants (59.4%) and 71 male participants (40.6%). Regarding smoking

status, 90 participants (51.4%) had never smoked, 50 (28.6%) were former smokers, and 35 (20.0%) were current smokers. More than half of the participants were physically active, with 96 individuals (54.9%) reporting active physical activity status, while 79 participants (45.1%) were classified as inactive. The mean age of the participants was 67.54 ± 7.50 years, and the mean body mass index was 27.54 ± 5.58 kg/m², indicating that the sample was predominantly within the overweight range. The mean Pittsburgh Sleep Quality Index score was 8.18 ± 2.79 , exceeding the conventional threshold for poor sleep quality, while the mean Lower Extremity Functional Scale score was 53.97 ± 5.69 , indicating moderate functional limitation. Mean sleep duration was 6.55 ± 1.19 hours, suggesting reduced sleep duration in this older-adult sample.

Table 1. Demographic and Clinical Characteristics of Participants, N = 175

Variable	Category / Measure	Frequency (%) or Mean \pm SD
Age, years	Continuous variable	67.54 \pm 7.50
Body mass index, kg/m ²	Continuous variable	27.54 \pm 5.58
Gender	Male	71 (40.6%)
	Female	104 (59.4%)
Smoking status	Never smoker	90 (51.4%)
	Former smoker	50 (28.6%)
	Current smoker	35 (20.0%)
Physical activity status	Active	96 (54.9%)
	Inactive	79 (45.1%)
PSQI global score	Continuous variable	8.18 \pm 2.79
LEFS score	Continuous variable	53.97 \pm 5.69
Sleep duration, hours	Continuous variable	6.55 \pm 1.19

Functional limitation and sleep-quality categories are presented in Table 2. Most participants had moderate lower-extremity functional limitation, observed in 148 participants (84.6%), while 26 participants (14.9%) had mild limitation and only 1 participant (0.6%) had severe limitation. Sleep-quality classification demonstrated a high burden of disturbed sleep: 149 participants (85.1%) were categorized as having poor sleep quality, whereas only 26 participants (14.9%) had good sleep quality. These findings indicate that poor sleep quality and moderate lower-extremity functional limitation were highly prevalent in this study population.

Table 2. Distribution of Functional Limitation and Sleep Quality, N = 175

Variable	Category	Frequency (%)
Lower-extremity functional limitation	Mild	26 (14.9%)
	Moderate	148 (84.6%)
	Severe	1 (0.6%)
Sleep quality	Good sleep quality	26 (14.9%)
	Poor sleep quality	149 (85.1%)

Table 3. Correlation of Sleep-Quality Index With Sleep Duration, Physical Activity, and Lower-Extremity Function

Correlated Variable	Pearson Correlation Coefficient (r)	Strength / Direction	95% CI for r	p-value
Sleep duration	0.715	Strong positive correlation	0.631 to 0.781	<0.001
Physical activity level	0.709	Strong positive correlation	0.624 to 0.776	<0.001
Lower-extremity functional performance	-0.540	Moderate negative correlation	-0.638 to -0.426	<0.001

Correlation analysis showed statistically significant associations between the sleep-quality index and selected clinical variables. Sleep duration demonstrated a strong positive correlation with the sleep-quality index, with $r = 0.715$ and $p < 0.001$. Physical activity level also showed a strong positive correlation with the sleep-quality index, with $r = 0.709$ and $p < 0.001$. Lower-extremity functional performance showed a moderate negative correlation with the sleep-quality index, with $r = -0.540$ and $p < 0.001$. These findings suggest that sleep-related status was strongly associated with sleep duration and physical activity level, while lower-extremity functional performance had an inverse association with sleep-quality index values. Higher PSQI scores indicated poorer sleep quality; therefore, the direction of correlations was interpreted according to PSQI scoring.

The correlation profile indicates that sleep-quality index values were most strongly associated with sleep duration, followed closely by physical activity level. The association with lower-extremity functional performance was moderate and inverse, suggesting that poorer lower-limb functional status may coexist with worse sleep-related outcomes in older adults with restless legs syndrome and suspected sarcopenia-related limitation.

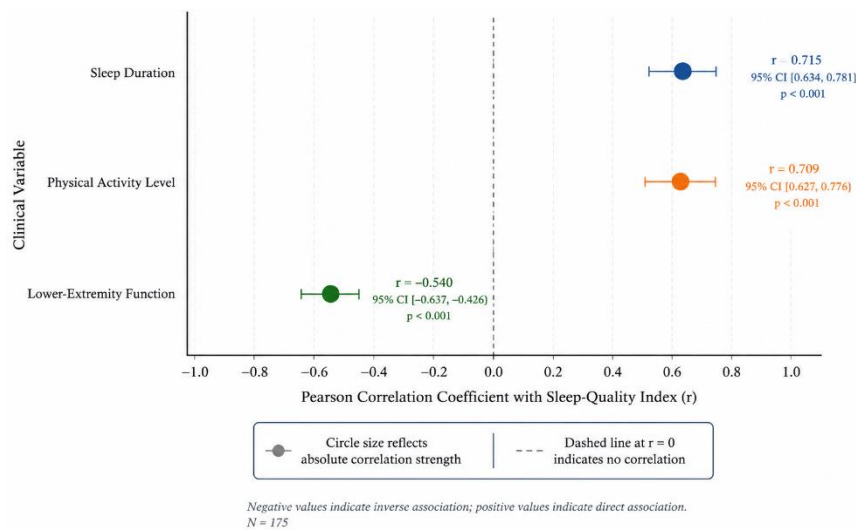


Figure 1. Strength and Direction of Clinical Correlates of Sleep-Quality Index

Sleep-quality index showed the strongest positive association with sleep duration ($r = 0.715$, 95% CI: 0.634 to 0.781), followed closely by physical activity level ($r = 0.709$, 95% CI: 0.627 to 0.776), indicating that sleep-related status clustered strongly with behavioral and rest-duration characteristics in this older-adult cohort. Lower-extremity function demonstrated a moderate inverse association with sleep-quality index ($r = -0.540$, 95% CI: -0.637 to -0.426), suggesting that poorer functional performance coexisted with less favorable sleep-related outcomes. The confidence intervals did not cross zero for any variable, supporting statistically meaningful relationships across all three clinical correlates in the sample of 175 older adults.

DISCUSSION

Poor sleep quality was highly prevalent among the older adults included in this study, with 149 participants (85.1%) classified as having poor sleep quality on the Pittsburgh Sleep Quality Index. This finding indicates a substantial burden of sleep disturbance among older adults with restless legs syndrome and suspected sarcopenia-related functional limitation. Restless legs syndrome is characterized by unpleasant leg sensations and an urge to move, typically worsening during rest and at night, which can interfere with sleep initiation and maintenance. In older adults, repeated sleep disruption may contribute to daytime fatigue, reduced activity participation, impaired recovery, and diminished perceived health. The high frequency of poor sleep observed in the present study is therefore clinically meaningful and supports previous evidence that sleep disturbance is a common and functionally relevant problem in geriatric populations affected by neuromuscular and mobility-related disorders (13,14).

The mean Pittsburgh Sleep Quality Index score was 8.18 ± 2.79 , which exceeded the commonly used cutoff for poor sleep quality, while the mean sleep duration was 6.55 ± 1.19 hours. A strong positive correlation was observed between the sleep-quality index and sleep duration ($r = 0.715$, $p < 0.001$), suggesting that sleep-duration patterns were closely related to overall sleep-quality status in this cohort. This relationship is expected because sleep duration is one of the major components contributing to perceived sleep health, particularly in older adults who may experience fragmented nocturnal sleep, frequent awakenings, and reduced sleep efficiency. However, interpretation of this association depends

on the coding direction of the sleep-quality index. If the Pittsburgh Sleep Quality Index global score was used directly, higher scores indicate poorer sleep quality, and the direction of the association should be interpreted accordingly. Therefore, future reporting should explicitly state whether the sleep-quality variable was analyzed as the original Pittsburgh Sleep Quality Index score or as a reverse-coded sleep-quality index. Clear scoring interpretation is essential because misclassification of score direction can lead to clinically incorrect conclusions.

Physical activity level also demonstrated a strong positive correlation with the sleep-quality index ($r = 0.709$, $p < 0.001$). This finding suggests that sleep-related status and activity behavior were closely linked among participants. Physical activity may influence sleep through several mechanisms, including improved circadian regulation, reduced inflammatory activity, better mood regulation, enhanced muscle metabolism, and improved daytime energy expenditure. Conversely, disturbed sleep may reduce motivation and capacity for physical activity, especially in older adults with leg discomfort, fatigue, or functional limitations. Because this study used a cross-sectional design, the direction of this relationship cannot be determined. The association should therefore be understood as evidence of coexistence between sleep-related status and physical activity level rather than proof that physical activity caused better sleep or that poor sleep caused inactivity. Previous literature has similarly suggested that sleep quality, frailty, and physical activity are interconnected in older adults through overlapping biological and behavioral pathways (15,16).

Lower-extremity functional performance showed a moderate inverse correlation with the sleep-quality index ($r = -0.540$, $p < 0.001$), indicating that worse sleep-related status was associated with poorer lower-limb function when interpreted in relation to the scoring direction of the functional and sleep measures. The mean Lower Extremity Functional Scale score was 53.97 ± 5.69 , and most participants, 148 individuals (84.6%), were classified as having moderate functional limitation. This finding is clinically important because lower-extremity function is central to walking, balance, transfers, stair negotiation, and independence in activities of daily living. In older adults with suspected sarcopenia-related impairment, reduced muscle strength and performance may interact with poor sleep through fatigue, reduced recovery, fear of falling, lower activity tolerance, and progressive deconditioning. At the same time, nocturnal symptoms of restless legs syndrome may independently reduce sleep continuity and contribute to daytime tiredness, which may further compromise functional performance. These results support the concept that sleep and mobility should be assessed together in geriatric rehabilitation rather than treated as isolated clinical domains (17,18).

The findings also emphasize the need to view restless legs syndrome, suspected sarcopenia-related functional limitation, and sleep disturbance as interconnected geriatric problems rather than isolated conditions. In older adults, poor sleep quality, reduced physical activity, and impaired lower-extremity performance may share overlapping biological and behavioral pathways, including low-grade inflammation, dopaminergic dysfunction, nutritional insufficiency, metabolic changes, neuromuscular decline, and progressive inactivity. Reduced mobility may limit daytime activity and accelerate functional decline, while disturbed sleep may impair recovery, muscle repair, inflammatory regulation, and daytime performance. However, the cross-sectional nature of the present study prevents any conclusion regarding temporal sequence or causality. Therefore, these findings should be interpreted as evidence of association within older adults with restless legs syndrome and suspected sarcopenia-related impairment. Future longitudinal studies using objective sarcopenia measures, validated restless legs syndrome severity scales, and objective sleep assessment are needed to determine whether poor sleep contributes to functional decline, whether functional impairment worsens sleep, or whether both arise from shared geriatric risk factors (19,20).

A major strength of this study is that it addresses an underexplored clinical problem in a South Asian older-adult population, where evidence regarding the combined relevance of restless legs syndrome, suspected sarcopenia-related functional limitation, sleep quality, and lower-extremity performance

remains limited. The use of standardized patient-reported instruments, including the Pittsburgh Sleep Quality Index and Lower Extremity Functional Scale, allowed systematic assessment of sleep and functional outcomes in a relatively large sample of 175 older adults. The inclusion of participants from tertiary care hospitals, geriatric outpatient departments, and community elderly centers also improved the clinical relevance of the sample by capturing older adults from both healthcare and community settings.

Several limitations should be considered when interpreting these findings. First, the cross-sectional design prevents causal inference and does not allow determination of whether sleep disturbance contributed to functional limitation or whether impaired function worsened sleep quality. Second, sarcopenia was assessed indirectly through suspected functional limitation rather than confirmed using objective diagnostic criteria such as handgrip strength, chair-stand performance, gait speed, calf circumference, bioelectrical impedance analysis, or dual-energy X-ray absorptiometry. This limits diagnostic precision and may have led to misclassification. Third, restless legs syndrome severity, symptom frequency, duration, medication use, iron status, renal disease, diabetes, neuropathy, vitamin D status, nutritional status, depression, pain, and inflammatory markers were not analyzed, although these factors may influence both sleep and lower-extremity function. Fourth, physical activity was self-reported, making the findings vulnerable to recall and reporting bias. Finally, convenience sampling from selected centers in Lahore may limit generalizability to the wider older-adult population of Pakistan.

Despite these limitations, the study provides clinically relevant evidence that poor sleep quality and moderate lower-extremity functional limitation commonly coexist among older adults with restless legs syndrome and suspected sarcopenia-related impairment. The observed associations suggest that routine geriatric assessment should include both sleep-quality screening and lower-limb functional evaluation. In clinical practice, older adults presenting with restless legs symptoms, reduced sleep duration, or poor sleep quality may benefit from concurrent assessment of mobility, physical activity, and sarcopenia risk. Similarly, rehabilitation programs for older adults with lower-extremity functional limitation should consider sleep disturbance as a potential barrier to physical recovery and participation. Future research should use longitudinal designs, validated diagnostic criteria for sarcopenia and restless legs syndrome, objective sleep measures, and multivariable models adjusting for relevant confounders to better define the direction and clinical significance of these relationships.

CONCLUSION

This study concludes that poor sleep quality and moderate lower-extremity functional limitation were common among older adults with restless legs syndrome and suspected sarcopenia-related impairment. The findings indicate a clinically relevant coexistence of sleep disturbance, reduced sleep duration, physical activity-related factors, and lower-limb functional limitation in this population. Sleep-quality index values were significantly associated with sleep duration, physical activity level, and lower-extremity functional performance, suggesting that sleep health and mobility-related function are closely interrelated in older adults. However, due to the cross-sectional design, these findings should be interpreted as associations rather than causal relationships. Early screening for sleep disturbance, functional limitation, and sarcopenia risk may support integrated geriatric rehabilitation strategies aimed at improving sleep, mobility, independence, and overall quality of life.

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