ORIGINAL ARTICLE

Relationship between Sleep Quality and Gait Speed in Geriatric Patients

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ABSTRACT

OBJECTIVE: To identify the relationship between sleep quality and gait speed in geriatric patients.
METHODOLOGY: This cross-sectional study involved 140 Geriatric patients (aged ≥65 years) who consecutively applied for the internal medicine outpatient clinic of an Education Research Hospital between July and September 2021 using a non-probability consecutive sampling technique. Participants with cancer, rheumatic or muscle disease, insomnia, amputations or motor dysfunction in the extremities, Parkinson's or Alzheimer's disease, who could not walk alone, and those with cognitive impairment who could not answer questions were excluded. The Pittsburgh Sleep Quality Index (PSQI) assessed participants' sleep quality. Gait speed for a 4-meter distance was measured. Parameters were compared concerning sleep quality and gait speed.
RESULTS: The gait speed of poor sleepers was significantly slower than good sleepers (p=0.012). Slow walkers were more prevalent among the poor than good sleepers (p=0.030). The median PSQI score of slow walkers was higher than that of normal walkers (p=0.009). The ratio of patients with poor sleep quality was significantly higher among slow walkers than among normal walkers (p=0.030). A significant positive correlation was found between the total PSQI score and gait speed time (r=0.250, p=0.003). The receiver operating characteristics curve of gait speed time was statistically significant for predicting poor sleep quality (AUC=0.629; p=0.012).
CONCLUSION: Gait speed was slower in geriatric patients with poor sleep quality. Poor sleep quality and gait speed time were positively correlated, and gait speed was a predictor of sleep quality in geriatric patients.

KEYWORDS: Aged; Gait speed; Geriatrics; Physical Performance; Sleep quality

INTRODUCTION

The geriatric population is increasing globally[1]. Early recognition of conditions that can predict age-related diseases and preventive treatments are practical steps for successful aging[2]. Sleep quality is an important parameter affecting daily life activities and health in elderly individuals. In various studies, sleep quality is associated with different clinical conditions. Good sleep quality, for example, was related to physical activity[3,4]. Sleep quality was linked to increased carotid intima-media thickness, primary hypertension, and depression[5–7]. In addition, sleep quality and duration were also associated with mortality[8,9].

Gait speed is a frequently used method for the health status of elderly individuals, and it has been associated with many clinical conditions in geriatric patients. For example, gait speed was a parameter for hospitalization and mortality in geriatric patients with heart failure[10]. In another pooled analysis report, gait speed was associated with survival in geriatric individuals[11]. It was reported that in elderly individuals, gait speed was a predictor of dependency on others for bathing and dressing, disability, and mortality[12].

There is little data about the relationship between sleep quality and gait speed in internal medicine outpatients, particularly in the geriatric population. Therefore, this research investigated the possible relationship between sleep quality and gait speed in geriatric internal medicine outpatients.

METHODOLOGY

This cross-sectional study involved 140 Geriatric patients (aged ≥65 years) who consecutively applied for the internal medicine outpatient clinic of an Education Research Hospital between July and September 2021 using a non-probability consecutive sampling technique. Participants with cancer, rheumatic or muscle disease, insomnia, amputations or motor dysfunction in the extremities, Parkinson's or Alzheimer's disease, who could not walk alone, and those with cognitive impairment who could not answer questions were excluded. The study's power analysis and sample size were performed with G power software[13]. When error type 1 (alpha) was set as 0.05, study power 0.80, and margin of error 0.50, the total sample size was calculated as a minimum of 102. Demographic, clinical, and biochemical data of the participants were recorded. In addition, sleep quality and gait speed were evaluated, and height and weight measurements were taken. Patients' complete blood count and biochemical results were retrospectively obtained from hospital records.

Participants sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI)[14]. PSQI is a survey which reports the quality and duration of within the last month. PSQI has seven components[14]. A score (0–21) is obtained by receiving 0–3 points for each question. A PSQI score of less than five is categorized as "good sleep quality," whereas a score of ≥5 reflects "poor sleep quality" [16]. The present study compared gait speed and other parameters between normal and poor sleep quality patients. Possible correlations between the PSQI total score and other variables were assessed.

The participants' gait speed was measured using a digital stopwatch based on how many seconds it took them to walk a flat distance of 4 m. Those with a gait speed of ≤0.8 m/s were named slow walkers[11]. Sleep quality and other parameters were compared between slow and normal walkers, and the predictive performance of gait speed time for poor sleep quality was evaluated. The same trained researchers took PSQI, gait speed, height, and weight measurements. All participants were informed about the study, and written consent was obtained. The study was carried out following the Helsinki Declaration. This study was approved by the Ethics Committee of Sakariya University Turkey (Approval No: E-16214662-050.01.04-6781).

Continuous parameters were described as mean±SD or mean (25th-75th percentiles). The numerical values between the groups (poor and good quality sleepers; slow and normal walkers) were evaluated with Student's t-test and Mann-Whitney U test. The diagnostic value of gait speed for sleep quality was determined with receiver operating characteristic curve analyses. The Spearman correlation was used to analyze the correlations between PSQI scores and other parameters, and a p-value < 0.05 was considered significant. Analyses were concluded with the Software Package for Social Sciences (SPSS) for Windows (version 22.0).

RESULTS

The study included 140 patients (91 (65%) were women, and the mean age was 73.9±5.8 years). Thirty-five percent of the participants (n=49) had poor sleep quality. The comparison of various parameters according to sleep quality was shown in **Table I**. Poor sleepers had significantly slower gait speed than good sleepers (5.1±1.6 sec/4m vs 4.5±1.4 sec/4m, p=0.012) (**Table I**). The ratio of slow walkers was higher in poor sleepers (51% vs 30.8%, p=0.030) (Table I). The comparison of the parameters according to the gait speed is shown in **Table II**. Fifty-three patients (37.8%) were slow walkers. The median PSQI score of slow walkers was significantly higher than normal walkers (4 (2–6) vs 5 (3–7), p=0.009) (**Table II**). The ratio of patients with poor sleep quality was significantly higher among slow walkers than normal walkers (47.1% vs 27.5%, p=0.030) (**Table II**). A positive correlation was found between the total PSQI score and gait speed time (r=0.250, p=0.003) (**Figure I**). The receiver operating characteristics curve of gait speed time was statistically significant for predicting poor sleep quality (AUC=0.629; p=0.012; 95% confidence interval, 0.533–0.724) (**Figure II**). The optimum cut-off value of gait speed ≥4.86 s/4 m had 51% sensitivity and 69.2% specificity for predicting poor sleep quality. Binary logistic regression analysis revealed that gait speed time alone was an independent predictor of good sleep quality (odds ratio, 1.327; 95% CI, 1.047–1.683; p=0.019).

TABLE I: CLINICAL AND LABORATORY DATA OF THE PARTICIPANTS ACCORDING TO SLEEP QUALITY

Parameters	All patients (n = 140)	Good quality sleepers (n = 91)	Poor sleepers (n = 49)	P-value
Age (years)	73.9±5.8	74±6	73.8±5.4	0.981
Gender, Female/Male	91/49	54/37	37/12	0.084
Gait speed (sec/4m)	4.7±1.5	4.5±1.4	5.1±1.6	0.012
Slow walkers n, (%)	53 (37.8)	28 (30.8)	25 (51)	0.030
PSQI* total score	4.8±2.5	3.2±1.3	7.6±1.6	<0.001
Diabetes mellitus, n (%)	49 (35)	31 (34.1)	18 (36.7)	0.897
Coronary artery disease, n (%)	15 (10.7)	10 (11)	5 (10.2)	0.886
Hypertension, n (%)	92 (65.7)	57 (62.6)	35 (71.4)	0.391
Cerebral vascular accident, n (%)	11 (7.8)	7 (7.7)	4 (8.2)	0.921
Hemoglobine (g/dL)	12.8±1.2	13±1.3	12.9±1.3	0.579
White blood cells (K/uL)	6.9±1.8	6.9±1.7	7±1.9	0.936
Platelets (K/uL)	259±64	253±58	270±74	0.183

*PSQI: Pittsburgh Sleep Quality Index.

TABLE II: CLINICAL AND LABORATORY DATA OF THE PARTICIPANTS ACCORDING TO GAIT SPEED

Parameters	Normal walkers (n = 87)	Slow walkers (n = 53)	P-value
Age (years)	72.1±4.6	77±6.2	<0.001
Gender, Female/Male	51 / 36	40 / 13	0.065
Gait speed (sec/4m)	3.80±0.58	6.24±1.24	<0.001
Poor sleepers n, (%)	24 (27.5)	25 (47.1)	0.030
PSQI* total score	4 (2-6)	5 (3-7)	0.009
Diabetes mellitus, n (%)	28 (32.1)	21 (39.6)	0.476
Coronary artery disease, n (%)	8 (9.2)	7 (13.2)	0.103
Hypertension, n (%)	53 (60.9)	39 (73.6)	0.178
Cerebral vascular accident, n (%)	4 (4.6)	7(13.2)	0.130
Hemoglobine (g/dL)	12.9±1.2	12.5±1.2	0.079
White blood cells (K/uL)	6.9±1.7	6.9±1.7	0.733
Platelets (K/uL)	260±64	257±64	0.674

*PSQI: Pittsburgh Sleep Quality Index

FIGURE I: CORRELATION BETWEEN PITTSBURGH SLEEP QUALITY INDEX AND GAIT SPEED (R = 0.250, P = 0.003)

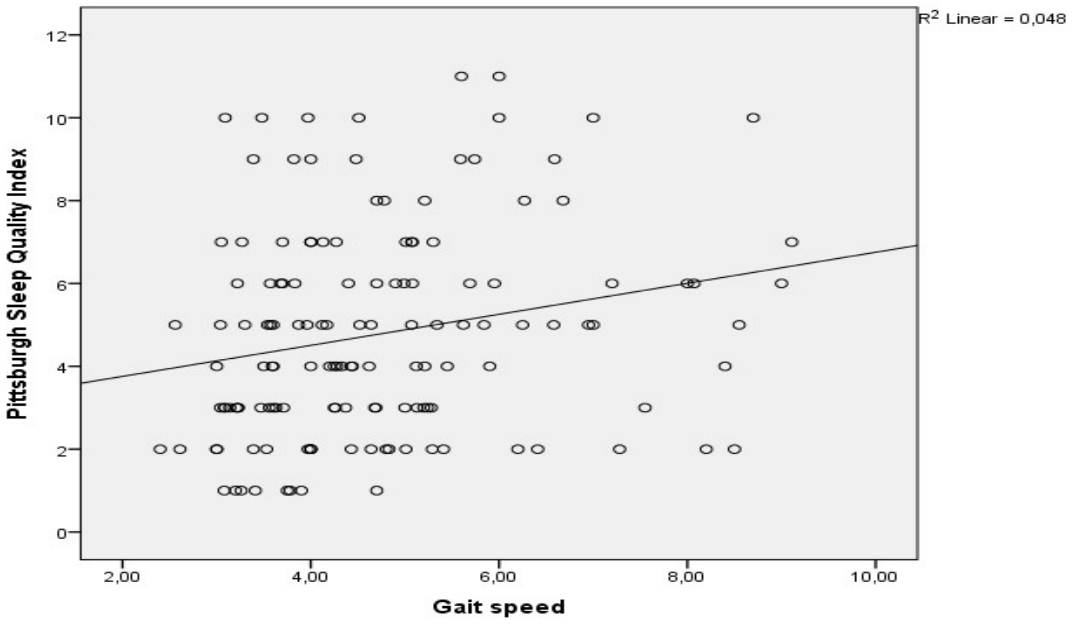
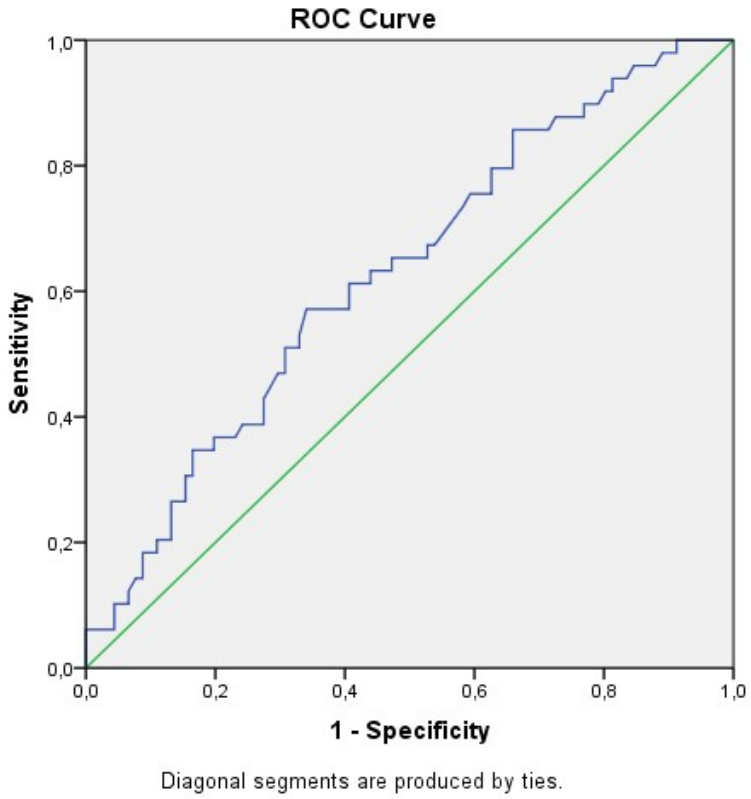


FIGURE II: RECEIVER OPERATING CHARACTERISTIC CURVE OF GAIT SPEED FOR PREDICTING POOR SLEEP QUALITY IN GERIATRIC STUDY POPULATION (AUC=0.629, P=0.012, 95% CONFIDENCE INTERVAL 0.533-0.724)



DISCUSSION

This study revealed that 35% of the geriatric patient cohort admitted to the internal medicine outpatient clinic has poor sleep quality. Gait speed was significantly slower in geriatric patients with poor sleep quality. Moreover, the sleep quality of slow walkers was considerably worse than normal walkers. There was a significant correlation between PSQI, indicating poor sleep quality with higher scores and 4-m walking time. ROC analysis revealed that a 4-m gait speed time significantly predicted poor sleep quality in geriatric patients.

In some previous studies, Sleep quality and functional capacity parameters were evaluated more specifically in different disease populations, age ranges, or cohorts of a single gender[4,15–20]. To the best of our knowledge, there is no cross-sectional research in the literature on geriatric internal medicine patients similar to the present study.

In a previous study covering the population aged 25–83 years (mean age 52.5 years), Teas et al. evaluated Sleep with PSQI and actigraphy and functional capacity with gait speed, handgrip strength, and chair stands[4]. According to the results, sleep parameters were independently associated with functional capacity[4]. The present study results conducted on the geriatric patient population are consistent with the data of Teas et al. Kirshner et al. evaluated a total of 73 community-dwelling older adults and revealed that those with insomnia had slower gait speed[16]. In another study, sleep disturbances in older women were demonstrated as an increased risk factor for hospitalization[17]. Goldman et al., in their research involving women alone, found that physical capacities, such as grip strength, chair stands, and gait speed, were worse in those with poorer sleep quality[17]. The results of the current research are also consistent with these findings. Another strength of the present study is that it includes comorbidities and laboratory results of participants, which are usually lacking in similar previous studies.

Gait speed is one of the most frequently used parameters for evaluating functional capacity in individuals. Evaluation of gait speed is an easy, non-invasive, safe, and inexpensive method that can provide quick results. Many studies have found that gait speed is an essential parameter of health or diseases in elderly individuals[10–12,21]. For example, a recently published study reported that slow gait speed was significantly associated with negative implications for patients undergoing cardiac surgery[21]. Ostir et al. showed that impaired gait performance was related to deterioration in the quality of life and the need for hospitalization[22]. In another study, gait speed in elderly male patients diagnosed with cancer was reported to be a significant predictor of mortality over a two-year follow-up period[23]. One of the adverse outcomes of impaired gait function in older individuals is falls and fall-related complications. The relationship between slow gait speed and poor sleep quality in geriatric patients is unclear. This may be due to the complex relationships and mechanisms of anatomy, psychology, physiology, and comorbidities that change with increasing age[15,24].

There are some limitations of our research. The current population consisted of a relatively small number of participants. Secondly, we used PSQI, a valid and reliable tool to assess sleep quality; however, objective methods, such as polysomnography or actigraphy, could also be used. Finally, the participants were from a single centre; a multicenter population could produce more decisive results. In addition, a prospective design with long-term follow-up can produce better results than a cross-sectional study.

CONCLUSION

The current study revealed that gait speed was slower in patients with poor sleep quality in the geriatric population. Sleep quality and gait speed are significantly correlated. Furthermore, gait speed significantly predicts poor sleep quality in geriatric patients. Gait speed measurement, an inexpensive, time-efficient, and easy method may help evaluate the sleep quality of geriatric patients.

Ethical Permission: Sakarya University, Sakariya, Turkey (ERC approval No. E-16214662-050.01.04-6781) dated: 05-02-2021.
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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publically.

AUTHOR CONTRIBUTIONS

Kaya T: Conception, data analysis, compilation, literature review, manuscript writing and final approval
Nalbant A: Conception, data analysis, and final approval
Yıldırım I: Data collection, data analysis
İşsever K: Data collection, data analysis
Karacaer C: Data collection, manuscript writing
Bilgin C: Data collection, manuscript writing
Vatan MB: Study design, drafting & revision
Acar T: Study design, drafting & revision

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