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Association of Gait Speed with Quality of Life in End-stage Renal Disease Patients with Uremic Pruritus

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ABSTRACT

OBJECTIVE: To find the association of gait speed with SF-36 scores in ESRD patients and the association of gait speed in MHD in the presence of uremic pruritus.

METHODOLOGY: We conducted a cross-sectional study in the Department of Nephrology, DHQTH, Dera Ismail Khan, from April-July 2025. Inclusion criteria were the presence of end-stage renal disease and a minimal duration of hemodialysis of six months. Patients under 18 years of age and those with pruritus due to non-uremic causes were excluded. The study sample comprised 86 patients receiving MHD, with (n=44) or without (n=42) uremic pruritus, meeting study criteria through a convenience sampling technique. We collected information about demography, ESRD phenotype, and gait speed. The QOL was evaluated using the SF-36 questionnaire, which investigates various physical and mental health aspects. All data were analyzed using GraphPad Prism version 8.4.

RESULTS: Patients with uremic pruritus exhibited lower SF-36 scores for physical functioning, role physical, bodily pain, general health, social functioning, and role emotional than non-pruritic patients (all $p<0.05$). These patients also had lower gait speed than their non-pruritic counterparts ($p<0.05$). Correlation analysis revealed modest to robust associations of gait speed with physical functioning, general health, role emotional, and mental health (all $p<0.05$), which were stronger in pruritic than in non-pruritic patients.

CONCLUSION: Collectively, uremic pruritus was associated with lower gait speed, QOL, and a robust interface between the gait speed and QOL. Future studies should formulate interventions to improve the gait speed and QOL in ESRD patients with uremic pruritus.

KEYWORDS: Gait speed, quality of life, SF-36, end-stage renal disease, uremic pruritus

INTRODUCTION

End-stage renal disease (ESRD) is an advanced and irreversible stage of renal failure, where the kidneys cannot meet bodily requirements. Patients with ESRD exhibit functional disability, reduced ambulance use, and a dependent lifestyle[1] ESRD patients on maintenance hemodialysis (MHD) experience a high burden of both physical and emotional symptoms that are underdiagnosed and have an adverse effect on their quality of life (QOL) [2]. Most ESRD patients with MHD experience chronic uremic pruritus, which can further compromise the QOL and functional mobility. A large proportion of ESRD patients on MHD experience moderate to severe uremic pruritus[3]. The occurrence of uremic pruritus usually starts 3-6 months after the start of MHD. However, in some ESRD patients, uremic pruritus develops even before the MHD[4]. It is generally well-recognized that uremic pruritus increases the disease severity and the risk of mortality in ESRD patients. For example, uremic pruritus, along with sleep disorders, was found to be an independent predictor of mortality[5]. Various tools are applied to measure the QOL of ESRD patients. Among them, the short-form health survey consisting of 36 items (SF-36) may be of primary relevance[6]. SF-36 evaluates various aspects of the physical and mental health of respondents. Previous studies have reported poor QOL in ESRD patients[7]. However, the relevant data on patients with uremic pruritus receiving MHD remain partly elusive. Gait speed is a reliable measure of physical capacity and has predictive value for mortality from various diseases[8]. Several studies suggest of association between gait speed and QOL. Patients with ESRD exhibit reduced gait speed compared with the age-matched controls. However, relevant data on ESRD patients are unavailable. In addition, the potential association of gait speed with SF-36 in ESRD patients with uremic pruritus remains unknown[9,10].

We aimed to bridge this gap in the literature by investigating the associations of gait speed with SF-36 scores in ESRD patients. We selected a cohort of patients on MHD with or without uremic pruritus. We hypothesized a coupling between gait speed and SF-36 that would be strengthened by the presence of uremic pruritus in these patients.

METHODOLOGY

A cross-sectional study was conducted at the Department of Nephrology, DHQ Teaching Hospital, Dera Ismail Khan, from April to July, 2025. The inclusion criteria were the presence of end-stage renal disease, as confirmed by clinical and laboratory testing. Only the male and female patients with a minimal duration of haemodialysis of six months were included. Conversely, patients less than 18 years, non-ambulant, and/or comatose patients were excluded. In addition, patients having pruritus due to non-uremic causes, such as chronic skin disease, cholestasis, and malignancies, were excluded from this study. The study was conducted after obtaining ethical approval. The study sample comprised 86 patients receiving MHD, with (n=44) or without (n=42) uremic pruritus, meeting study criteria through a convenience sampling technique. Written informed consent was obtained from all study participants. This study was conducted in accordance with the Declaration of Helsinki.

To assess quality of life, the SF-36 questionnaire was used. The SF-36 evaluates the physical, social, and mental health of the respondents. The questionnaire consists of 36 items associated with eight domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. The scores for each domain ranged from 0 to 100, with lower scores indicating poor functioning.

For the assessment of gait speed, a standardized protocol was used as previously described. Briefly, the participants were instructed to walk in a straight line for eight meters at their normal pace. The data from the first and the last two meters were excluded due to the acceleration and deceleration phases. The time to complete the central four meters was used to estimate gait speed.

For Statistical analysis, unpaired t-tests were used to compare the SF-36 scores between the two groups of patients. A linear regression analysis was used to measure the correlations of gait speed with various SF-36 domains. Data are presented as frequencies and percentages, and a p-value of less than 0.05 was considered statistically significant. All data were analyzed using GraphPad Prism version 8.4.

RESULTS

Basic characteristics of the participants: The study includes 86 participants with (n = 44) or without (n = 42) uremic pruritus (**Table I**).

Table I: Demographic characteristics of the participants, *p<0.05

		With pruritus (n = 44)	Without pruritus (n=42)
Gender (n, %)	Men	27 (61.3)	31 (73.8)
	Women	17 (38.7)	11 (26.2)
Age groups (participants; n, %)	18 to 29	11 (25)	8 (19)
	30 to 45	6 (13.6)	13 (31) *
	46 to 60	19 (43.2)	16 (38.1)
	More than 60	8 (18.2)	5 (11.9)
Gait speed (m/s) (mean ± SD)		0.72 ± 0.9	0.77 ± 0.8*
Duration on hemodialysis (participants; n, %)	6-12 months	4 (9.1)	2 (4.8)
	1-3 years	11 (25)	12 (28.6)
	> 3 years	29 (65.9)	28 (66.7)
Prevalence of comorbidities (n, %)	Diabetes mellitus	19 (43.1)	11 (26.2) *
	Hypertension	18 (40.9)	15 (35.5)
	Smoker	4 (9)	3 (7.1)
	Obesity	12 (27.2)	8 (19)

There was no difference in the proportions of the two genders across the study groups. Among the age groups, the relative proportion of patients aged 30-45 was higher in non-pruritic than in pruritic patients ($p < 0.05$). Similarly, the non-pruritic patients also exhibited higher gait speed than pruritic patients ($p < 0.05$). The duration of hemodialysis was similar between the two groups. However, the proportion of patients with diabetes mellitus was higher in pruritic than in non-pruritic patients ($p < 0.05$) (**Table I**).

SF-36 scores of the study participants: We next investigated the SF-36 scores between the two groups of study participants (**Figure 2**). The non-pruritic patients exhibited higher scores for physical functioning and role physical than the pruritic patients (both $p < 0.05$) (**Figure 1A**). Similarly, the non-pruritic patients had higher scores for bodily pain and general health than the pruritic patients (**Figure 1B**). Next, the non-pruritic patients exhibited higher scores for social functioning and similar scores for vitality when compared to the pruritic patients (**Figure 1C**). Lastly, the non-pruritic patients also showed higher scores for role emotional than the pruritic patients ($p < 0.05$) **(Figure 1D**).

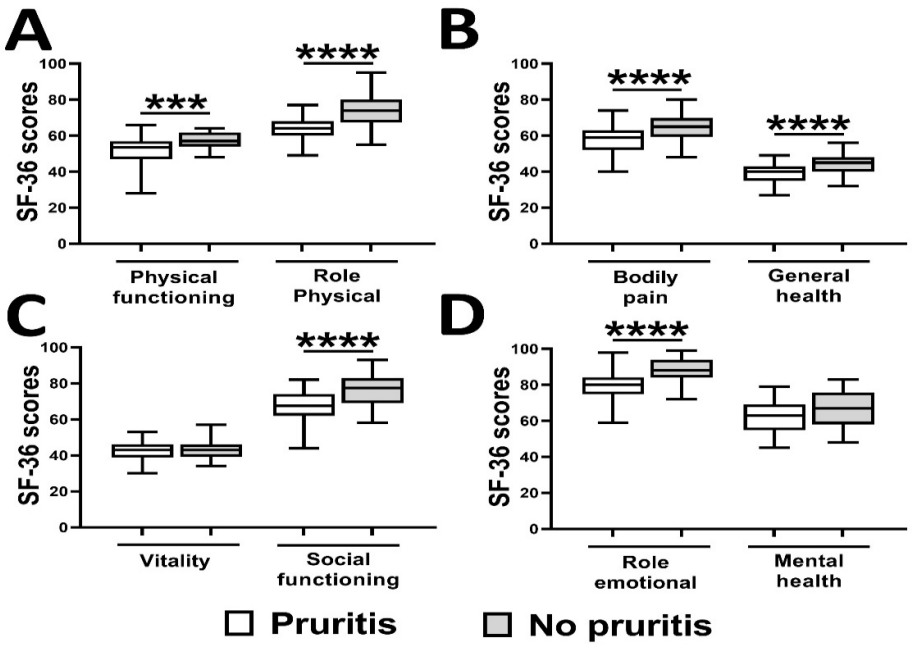

Figure 1: SF-36 scores for physical functioning and role physical (A), bodily pain and general health (B), vitality and social functioning (C), and role emotional and mental health (D) in patients of end-stage renal disease with (n=44) or without (n=42) pruritus, unpaired t-test, ***p<0.001, ****p<0.0001.

Correlations of gait speed with SF-36 scores: We next investigated the correlation of gait speed with SF-36 scores in the study participants (**Figures 2 and 3**). Gait speed showed significant correlations with physical functioning in pruritic ($r2 = 0.219$, $p < 0.05$) and non-pruritic ($r2 = 0.107$, $p < 0.05$) patients (**Figure 2A**). However, similar correlations of gait speed were not found with role physical (**Figure 2B**) and bodily pain (**Figure 2C**) in the study participants. Conversely, gait speed exhibited significant correlations with general health in the pruritic ($r2 = 0.178$, $p < 0.05$) and non-pruritic ($r2 = 0.165$, $p < 0.05$) patients.

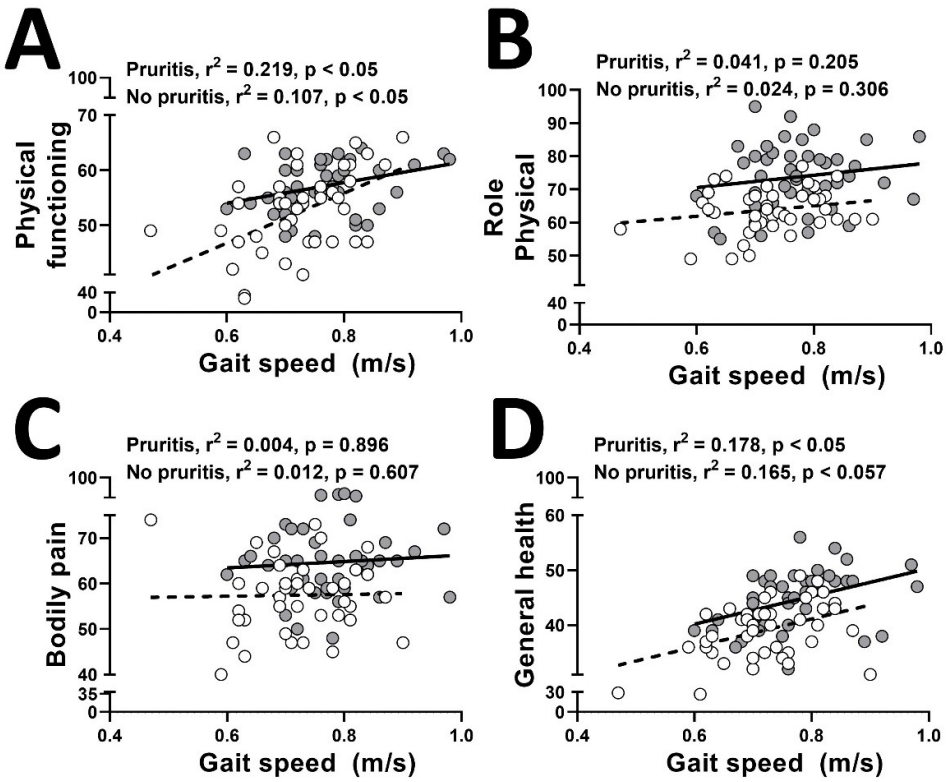

Figure 2: Correlation analysis of gait speed with SF-36 scores for physical functioning (A), role physical (B), bodily pain (C) and general health (D) in patients of end-stage renal disease with (n=44) or without (n=42) pruritus.

Next, we did not observe significant correlations of gait speed with SF-36 scores for vitality (**Figure 3A**) and social functioning (**Figure 3B**) in the study participants. However, gait speed exhibited significant correlations with role emotional in the pruritic patients (r^2 = 0.105, $p < 0.05$) (**Figure 3C**). Lastly, we found significant correlations of gait speed with mental health in pruritic (r^2 = 0.301, $p < 0.05$) and non-pruritic (r^2 = 0.185, $p < 0.05$) patients (**Figure 3D**).

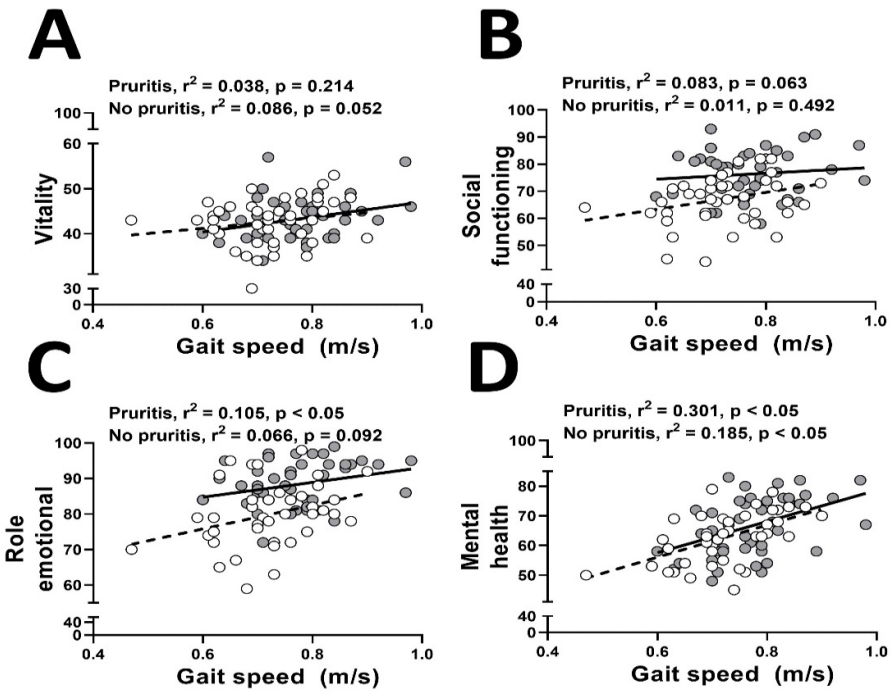

Figure 3: Correlation analysis of gait speed with SF-36 scores for vitality (A), social functioning (B), role emotional (C), and mental health (D) in patients of end-stage renal disease with (n=44) or without (n=42) pruritus.

DISCUSSION

Renal medical researchers frequently underreport the prevalence of pruritus in patients with end-stage renal disease. Different countries report different prevalences; England has the highest (50%) and France has the lowest (36%), while other small-scale studies worldwide show a range of 5-75%. In our study, we found the association of gait speed with SF-36 scores in ESRD patients and the association of gait speed in MHD in the presence of uremic pruritus. In our study, we found lower SF-36 scores in pruritic vs non-pruritic ESRD patients across various domains associated with physical and mental health[11,12]. As expected, uremic pruritus was associated with a lower gait speed in ESRD patients taking MHD. Which was the primary goal of our study to find correlation between uremic pruritus lower gait speed and affects QOL making it few recent studies that are conducted as in a low resource place like Dera Ismail khan marks significant impact on literature and will help in understanding the association in critically ill patients[13] correlation analysis revealed that gait speed was associated with physical functioning, general health, role emotional, and mental health of ESRD patients. Lastly, the presence of pruritus strengthened the correlations of gait speed with these SF-36 domains[14,15].

Our data indicate that the presence of uremic pruritus negatively affects the QOL of ESRD patients taking MHD. Specifically, the pruritic patients exhibited lower scores on several domains of SF-36 associated with physical and mental health. This finding is generally consistent with previous reports indicating the harmful effects of uremic pruritus on QOL[16]. It is possible that the presence of comorbidities partly affects these findings. Specifically, the occurrence of diabetes mellitus was higher in pruritic than in non-pruritic patients. We cannot dissect the potential contribution of diabetes mellitus to lower QOL in pruritic patients. Conversely, the prevalence of hypertension, smoking, and obesity was similar among the two groups of study participants[16,17].

Several studies indicate that patients with ESRD are frail and exhibit functional disability with lower gait speed. We found a further reduction of gait speed in the patients with uremic pruritus. This finding may be attributed to the myotoxic effects of uremic metabolites. Specifically, these metabolites blunt skeletal muscle aerobic capacity and regeneration, which together can reduce gait speed in these patients. In support of this, skeletal muscle atrophy and/or weakness are correlated with gait speed in multiple diseases and aging[18]. We found significant correlations of gait speed with SF-36 domains attributed to physical functioning. Gait speed is a prime determinant of physical capacity in clinical and community settings[19]. For example, patients with reduced gait speed are more likely to develop functional disability, mobility limitations, and reduced physical capacity. The significant correlations of gait speed with the physical functioning and role physical domains of SF-36 validate and extend these findings[11,14].

The neuropathic effects of uremia are extensively documented and characterized. For example, uremic metabolites cause neurotoxicity and death of the motor and sensory neurons. Uremic toxins can also disrupt the blood-brain barrier, which may further enhance the direct neurotoxic effects of these metabolites [4]. In addition, a coupling between neuronal health and physical capacity is recognized in several diseases. Consistent with these reports, we found robust correlations between gait speed and mental health in ESRD patients[7]. Interestingly, the correlation was stronger in pruritic than in non-pruritic patients, indicating the strengthening of coupling between mental and physical health with advancing disease severity[9]. Gait speed also exhibited a weaker, albeit statistically significant, correlation with the role emotional domain of SF-36 in pruritic patients, but not in non-pruritic patients. In addition to being associated with worse mental health outcomes, such as elevated anxiety and a worse quality of life overall, uremic pruritus is a major predictor of depressive symptoms[20]. Uremic

pruritus-related itching frequently gets worse at night, disrupting sleep and exacerbating mental health conditions. Together, these reports indicate the associations of mental and physical decline in ESRD patients with uremic pruritus[21].

This study has several strengths. The mono-centric study design ensures consistency in the assessment procedures described in this study. SF-36 is an internationally recognized, standardized tool for measuring QOL[8]. The inclusion of both genders eliminates the potential gender discrepancy in the harmful effects of uremic pruritus. However, this study has some limitations. We did not investigate the confounding effects of comorbidities on QOL and gait speed in the study population. The sample size is modest, and a larger sample size would have yielded the results of higher biological significance[5,6]. In this disability-burdened population, the interdisciplinary approach to assessing and treating mobility limitations and functional decline has the potential to significantly improve patient-centred outcomes. A patient's walk from the weight scale to the examination room or dialysis machine can provide valuable information for the nephrology community and patients with kidney disease[8].

CONCLUSION

Altogether, we report the negative consequences of uremic pruritus on mental and physical decline in ESRD patients on MHD. We also report a coupling between QOL and gait speed in these patients. Future studies should formulate strategies to mitigate the reduction in QOL and physical health of ESRD patients with uremic pruritus.

Ethical Permission: Gomal Medical College, MTI, D.I. Khan, Pakistan, ERC letter No. 245/GIMS/JC.
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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 publicly.

AUTHOR CONTRIBUTION

Burki A: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work, Drafting the work or revising it critically for important intellectual content.
Ali N: Drafting the work or revising it critically for important intellectual content, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
Kifayat S: Final approval of the version to be published, drafting the work or revising it critically for important intellectual content.
Azam A: Final approval of the version to be published, drafting the work or revising it critically for important intellectual content.
Burki S: Drafting the work or revising it critically for important intellectual content, final approval of the version to be published.

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