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Original Research Article

ASSOCIATION OF POLYPHARMACY WITH PHYSICAL FITNESS AND QUALITY OF LIFE IN ELDERLY HEMODIALYSIS PATIENTS WITH CHRONIC KIDNEY DISEASE – AN OBSERVATIONAL STUDY

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Abstract:
Introduction: Chronic Kidney Disease (CKD) affects 13–15% of adults in India, largely due to rising hypertension, diabetes, and obesity. As CKD progresses, patients often require multiple medications, leading to polypharmacy, which is linked to increased mortality, hospitalizations, and fall risk. Elderly patients on hemodialysis also face reduced physical activity, fitness, and quality of life (QOL). This study aimed to assess the association between polypharmacy, physical fitness, and QOL in elderly CKD patients on hemodialysis. **Material and Methods:** Of the 250 individuals screened, 100 participants aged ≥65 years were enrolled. Demographic data were collected. Physical fitness was assessed using the Five-Times Sit-to-Stand Test (FTSST), Six-Minute Walk Test (6MWT), Chair Sit-and-Reach Test, and Lower Extremity Functional Scale (LEFS). QOL was measured using the KDQOL-36 questionnaire. **Results:** Males had significantly higher height and weight ($p < 0.05$). Chair sit-and-reach scores differed across age groups but not genders. KDQOL-36 scores were higher in males ($p < 0.05$). FTSST and 6MWT scores differed significantly between the 65–74 and >74 age groups ($p < 0.05$). FTSST negatively correlated with 6MWT, LEFS, and KDQOL-36; KDQOL-36 positively correlated with 6MWT and LEFS (all $p < 0.05$). No significant associations were found between polypharmacy and age, gender, or functional measures. **Conclusion:** Polypharmacy did not significantly impact physical fitness or QOL. Age and gender, however, influenced outcomes.

Keywords: Drug therapy,Renal Insufficiency,flexibility,Life Quality,Geriatrics

INTRODUCTION

Chronic Kidney Disease (CKD) is a growing global health concern, defined as an impairment in kidney function or structure that persists for more than three months.[1] The increasing prevalence of predisposing factors such as hypertension, diabetes, and obesity has led to a sharp rise in CKD cases, posing significant challenges to healthcare systems worldwide. In India, studies have shown that approximately 13–15% of the adult population has CKD, highlighting the magnitude of the problem.[2]

As CKD progresses, patients often face complex health management needs, with polypharmacy becoming a significant concern. Polypharmacy, defined by the World Health Organization (WHO) as the concurrent use of five or more medications,[3] has been shown to be associated with various adverse outcomes, including increased mortality, higher rates of falls, adverse drug reactions, prolonged hospitalizations, and frequent readmissions following discharge.[4]

In addition to polypharmacy, patients with CKD, particularly those undergoing dialysis, often experience reduced physical activity, which is strongly linked to poorer quality of life (QOL). Lack of exercise can lead to decreased physical functioning, increased bodily pain, more frequent hospitalizations, and reduced survival rates.[5–7] physical fitness, characterized by the ability to perform daily tasks with adequate strength and stamina and to cope with the challenges of fatigue and stress, is a cornerstone of quality of life for patients with chronic kidney disease, as it helps reduce inactivity and supports overall health.[8] The WHO defines QOL as an individual's perception of their position in life within the context of their culture and value system, influenced by personal goals, expectations, and concerns.[9]

In CKD, maintaining physical fitness is vital for reducing the burden of disease and improving overall health outcomes. Given these challenges, a comprehensive approach to managing CKD must address not only the medical and pharmacological needs of patients but also their physical and psychological well-being. This involves minimizing the risks associated with polypharmacy, promoting physical activity, and enhancing overall QOL.[10-13] Such interventions are essential for improving the prognosis of CKD patients and supporting them in leading healthier, more fulfilling lives. By integrating strategies to optimize medication use and physical fitness, healthcare providers can significantly improve the outcomes for individuals living with CKD.

MATERIALS AND METHODS

The study group consisted of 100 older adults (men and women) aged 65 years or older, who were enrolled after screening a total of 250 individuals. Of those screened, 100 participants did not meet the inclusion criteria, 30 declined to provide informed consent, and 20 were lost to follow-up. Participants were recruited from a tertiary care hospital in Belagavi between December 2024 and April 2025 using a convenience (non-probability) sampling method. The sample size was determined based on correlation coefficient testing, aligned with the primary objectives of the study. All participants had a diagnosis of CKD requiring dialysis for at least three months (with a minimum of 25 dialysis sessions), were able to walk 100 meters with or without walking aids, were on five or more prescribed medications, had a Mini-Mental State Examination (MMSE) score of 24 or higher, and were able to complete outcome assessments 30 minutes post-dialysis.

The inclusion criteria were: (a) age 65 years or older; (b) MMSE score ≥24; (c) diagnosis of CKD requiring dialysis for at least three months (minimum 25 sessions); (d) ability to walk 100 meters with or without walking aids; (e) concurrent use of five or more prescribed medications; and (f) ability to complete outcome assessments 30 minutes post-dialysis. The exclusion criteria were: (a) recent surgery or hospitalization within the past three months; (b) lower limb amputation; (c) severe visual or hearing impairment; (d) neurological conditions such as stroke, amyotrophic lateral sclerosis (ALS), or multiple sclerosis (MS); (e) orthopedic conditions such as severe osteoarthritis or recent fractures; and (f) diagnosed unstable angina, post-coronary artery bypass grafting (CABG), pulmonary embolism, or myocardial infarction.

All experiments reported in this manuscript were performed in accordance with the ethical standards of the institutional research committee and the 1975 Helsinki Declaration, as revised in 1983. Written informed consent was obtained from all participants prior to their inclusion in the study. The study was approved by the Institutional Research and Ethics Committee (approval number: KIPT/874), and the study was registered with the Clinical Trials Registry of India (CTRI/2025/03/082711). The study followed the STROBE guidelines of observational design.

Assessment

During the initial assessment, demographic and clinical information was collected, including age, height, weight, body mass index (BMI), Aadhar identification number, contact details, dialysis frequency, and the number of prescribed medications. Medication count was used to define the presence of polypharmacy.

Strength- Assessed using the Five-Time Sit-to-Stand Test (FTSST) [14]

Lower limb strength was measured using the Five-Time Sit-to-Stand Test (FTSST). The participants sat comfortably on a regular chair, with their arms crossed over their chest and both feet resting flat on the ground. They were instructed to rise to a full standing position and return to sitting five times as quickly as they could, without using their hands for support. Timing commenced at the verbal command 'Go' and concluded upon completion of the fifth stand. The total duration was documented. The assessment was halted if the participant was unable to finish all repetitions or required physical assistance.

Balance- Six-Minute Walk Test (6MWT)[15]

Balance was assessed using the Six-Minute Walk Test (6MWT), conducted on a flat, straight 30-meter walkway. Participants were instructed to walk as far as possible in six minutes at a comfortable yet brisk pace. Standardized verbal encouragement was provided at regular intervals to sustain motivation. The main measurement was the total distance walked, noted in meters.

Lower Limb Function – Assessed using the Lower Extremity Functional Scale (LEFS)[16,17]

Functional assessment of the lower extremities was conducted using the Lower Extremity Functional Scale (LEFS). The researcher administered the questionnaire, which consists of 20 items evaluating common activities such as walking, stair climbing, squatting, and running. Participants were asked to rate the level of difficulty they experienced in performing each activity on a scale from 0 to 4, where 0 indicates extreme difficulty or inability to perform the task and 4 indicates no difficulty. Higher total scores reflect better lower limb function.

Flexibility – Assessed using the Chair Sit-and-Reach Test[18]

Flexibility was assessed using the Chair Sit-and-Reach Test. Participants sat upright on a stable chair with one leg extended forward, heel flat on the floor, and ankle dorsiflexed. The other foot remained flat on the ground for support. With hands stacked, participants were instructed to reach forward toward the toes of the extended leg, keeping the knee straight. The maximum reach was recorded in centimeters using a ruler placed along the extended leg. Each participant performed two trials, and the better of the two scores was used for analysis.

Quality of life – Assessed using the Kidney Disease and Quality of Life (KDQOL™-36) Questionnaire [19]

Assessed using the Kidney Disease and Quality of Life (KDQOL™-36) Questionnaire. Participants responded to items across these domains, and cumulative scores were used to evaluate the overall impact of CKD and dialysis on daily functioning and well-being.

Procedure:

Participants were recruited in accordance with predefined inclusion and exclusion criteria. All participants were aged 65 years or older and undergoing maintenance dialysis.
Following enrollment, participants completed standardized assessments evaluating balance, aerobic capacity, lower limb function, flexibility, and QOL. The Five-Time Sit-to-Stand Test (FTSST) and Six-Minute Walk Test (6MWT) were performed sequentially, with a one-minute rest interval between them. In the FTSST, participants were instructed to stand up and sit down five times as quickly as possible without using their hands. The time required to complete all repetitions was recorded. In the 6MWT, participants were asked to walk as far as possible within six minutes, and the total distance covered was measured.
The Lower Extremity Functional Scale (LEFS) and the Kidney Disease QOL questionnaire (KDQOL™-36) were administered by the researcher through direct interaction. To ensure data reliability, three readings were taken for each physical performance test, and the mean value of these readings was used in subsequent analyses.

Statistical Analysis:

The collected data were summarized by using the Descriptive Statistics: frequency, percentage; mean and S.D. The Independent sample "t" test was used to compare age, height, weight, BMI, FTSST, 6 MWT, lower limb function, and KDQOL – 36; between males and females. Also, to compare FTSST, 6 MWT, lower limb function, and KDQOL – 36; according to the age groups: 65-74, and > 74; the Independent sample "t" test was used. The Chi square / Likelihood ratio test was used to compare differences in proportions. To find the relation between FTSST, 6 MWT, lower limb function, KDQOL – 36, age, height, weight, and BMI; the Pearson correlation coefficient: ("r") was used. The Spearman's ratio was used to find the relation of FTSST, 6 MWT, lower limb function, and KDQOL – 36 with polypharmacy. The p value < 0.05 was considered as significant. Data were analyzed by using the SPSS software (SPSS Inc.; Chicago, IL) version 29.0.10

RESULTS

Table 1: Descriptive Statistics for age, height,

weight, and BMI

(n = 100)	Range	Mean ± SD
Age (Years)	65 to 84	69.76±4.59
Height (Cm)	150 to 172	158.30±4.73
Weight (Kg)	40 to 85	61.53±7.32
BMI (Kg/M^2)	18.4 to 33.2	24.56±2.59

Statistical analysis was performed using SPSS v29.0.10. Descriptive statistics (frequency, percentage, mean, SD) summarized the data. Independent t-tests compared age, height, weight, BMI, FTSST, 6 MWT, lower limb function, and KDQOL-36 between gender and age groups (65-74 and >74). The Chi-square/Likelihood ratio test assessed differences in proportions. Pearson correlation coefficients evaluated relationships among continuous variables, while Spearman's ratio assessed associations with polypharmacy. A p-value < 0.05 was considered statistically significant.
Age of the participants ranged from 65 to 84 years with mean: 69.76 ± 4.59 years; height ranged from 150 to 172 Cm with mean: 158.30 ± 4.73 Cm; weight ranged from 40 to 85 Kg with mean: 61.53 ± 7.32 Kg; and the BMI ranged from 18.4 to 33.2 Kg/M^2 with mean: 24.56 ± 2.59 Kg/M^2.

Table 2: Distribution of age groups, gender, and chair sit and reach test: Left right

		Frequency	%
Age groups	65-74	85	85
	> 74	15	15
Gender	Male	64	64
	Female	36	36
Chair sit and reach test: Left right	(-1 -1)	7	7
	(-2 -2)	30	30
	(-2 -3)	2	2
	(-3 -2)	3	3
	(-3 -3)	32	32
	(-3 -4)	3	3
	(-4 -3)	3	3
	(-4 -4)	19	19
	(-5 -3)	1	1

The polypharmacy of the participants reveals: "Five" (38%), "Six" (31%), "Seven" (26%), "Eight" (5%).
Among the 100 participants; the 85% were in the age group: 65 to 74 years; and the 15% were in the age group: > 74 years. The majority were males (64%); and the 36% were females. The chair sits and reach test - left right were found to be 7% in (-1 -1), 30% in (-2 -2), 2% in (-2 -3), 3% in (-3 -2), 32% in (-3 -3), 3% in (-3 -4), 3% in (-4 -3), 19% in (-4 -4), and 1% in (-5 -3).

Table 3: Comparison of FTSST, 6 MWT, lower limb function, and KDQOL – 36 according to gender("t" = Independent sample "t" test; * Significant)

		Mean± SD	"t"	p value
FTSST (Seconds)	**Male**	15.60±1.99	-0.65	0.517
	Female	15.89±2.33		
6 MWT (Meters)	**Male**	435.55±81.24	-0.10	0.922
	Female	437.14±72.09		
Lower limb function (LEFS)	**Male**	42.39±7.04	1.33	0.185
	Female	40.36±7.75		
KDQOL - 36	**Male**	72.33±5.49	2.23	0.028*
	Female	69.44±7.34		

The Chi square / Likelihood ratio test was used to compare gender, chair sit and reach test: Left right; according to age groups. There was a difference (p < 0.05) in chair sit and reach test: Left right; according to age groups.
The Likelihood ratio test was used to compare chair sit and reach test: Left right; according to gender. There was no difference (p > 0.05) in chair sit and reach test: Left right; between males and females.
The Independent sample "t" test was used to compare FTSST, 6 MWT, lower limb function, and KDQOL – 36; according to gender. There was a difference (p < 0.05) in the KDQOL – 36; between males and females.

Table 4: Relation between FTSST, 6 MWT, lower limb function, and KDQOL – 36("r" = Pearson correlation coefficient; * Significant)

		FTSST (Seconds)	6 MWT (Meters)	Lower limb function (LEFS)	KDQOL - 36
FTSST (Seconds)	"r"	1	-0.555	-0.338	-0.270
	p value	--	< 0.001*	0.001*	0.007*
6 MWT (Meters)	"r"		1	0.076	0.242
	p value		--	0.455	0.015*
Lower limb function (LEFS)	"r"			1	0.368
	p value			--	< 0.001*
KDQOL - 36	"r"				1
	p value				--

The Pearson correlation coefficient: ("r") was used to find the relation between FTSST, 6 MWT, lower limb function, and KDQOL – 36. The FTSST was negatively correlated ($p < 0.05$) with 6 MWT, lower limb function, and KDQOL – 36. Also, the KDQOL – 36 was positively correlated ($p < 0.05$) with 6 MWT, as well as lower limb function.

Table 5: Relation of FTSST, 6 MWT, lower limb function, and KDQOL – 36 with age, height, weight, and BMI("r" = Pearson correlation coefficient; * Significant)

		Age (Years)	BMI (Kg/M^2)
FTSST (Seconds)	"r"	0.414	-0.06
	p value	< 0.001*	0.554
6 MWT (Meters)	"r"	-0.572	0.189
	p value	< 0.001*	0.059
Lower limb function (LEFS)	"r"	-0.037	0.149
	p value	0.717	0.139
KDQOL - 36	"r"	-0.127	-0.055
	p value	0.209	0.589

The Pearson correlation coefficient: ("r") was used to find the relation of FTSST, 6 MWT, lower limb function, and KDQOL – 36 with age and BMI. The age (Years) was positively correlated ($p < 0.05$) with FTSST; and it was negatively correlated ($p < 0.05$) with 6 MWT. Also, there was a positive correlation ($p < 0.05$) between KDQOL – 36 and height (Cm).

Table 6: Correlation Of Etiologic Profile With Grade of Ev On Ugie

		Gender				Likelihood ratio	Age groups				Likelihood ratio	p value
		Male		Female			65-74		> 74			
		n	%	n	%		n	%	n	%		
Polypharmacy	Five	23	35.9	15	41.7	1.22	33	38.8	5	33.3	5.3	0.151
	Six	19	29.7	12	33.3		29	34.1	2	13.3		
	Seven	18	28.1	8	22.2		20	23.5	6	40		
	Eight	4	6.3	1	2.8		3	3.5	2	13.3		

The Likelihood ratio test was used to find the association between polypharmacy and gender. There was no association ($p > 0.05$) between polypharmacy and gender.

DISCUSSION

This study aimed to investigate the association between polypharmacy and its impact on physical fitness and QOL in elderly patients with CKD undergoing hemodialysis. The results offer valuable insights into how physical fitness parameters, specifically lower limb strength, balance, flexibility, and functional ability, interrelate with patient-reported QoL, while also evaluating whether polypharmacy contributes significantly to these outcomes.

Consistent with the study objective, our findings indicate that polypharmacy was highly prevalent in this population, with participants prescribed an average of six medications three months after initiating dialysis. However, there were no statistically significant associations between polypharmacy and functional or QoL outcomes. This aligns with A Descriptive Meta-Analysis of Data by *Adjeroh et al., 2023* shows that, minimal differences in Mental Component Summary (MCS) scores, symptom burden, and health utility values across varying medication regimens in dialysis patients. These results support the interpretation that the influence of pharmacotherapy on health-related QOL (HRQoL) is modulated by a balance between its therapeutic benefits and the burden of complex treatment routines.[1]

In terms of physical function, mobility impairment emerged as a critical issue among older adults on dialysis. This finding is supported by qualitative study, by *Liu, Christine K. et al.* , emphasises the importance of psychological resilience and patient motivation in maintaining functional independence.[20] In our study, performance on the Chair Sit and Reach Test, a proxy for lower body flexibility, varied significantly across age groups ($p < 0.05$), but not by gender ($p > 0.05$). A descriptive meta-analysis by *Bohannon, R. W. (2006),* highlights the effect of aging on flexibility and supports the broader observation that mobility declines with increasing age in this population.[21]

Polypharmacy showed no statistically significant differences based on gender or age group, which is consistent with previous a nationwide cohort study by *Chang, T.I., Park, H., Kim, D.W. et al.* suggesting that the phenomenon is widespread among older adults with chronic illness. This likely reflects the high burden of comorbidities that require complex medication regimens. These observations reinforce the need for regular and individualized medication reviews for all dialysis patients, rather than selectively based on demographic profiles.[2]

Our data demonstrate significant interrelations between lower limb strength, mobility, and QoL. The Five Times Sit to Stand Test (FTSST) was negatively correlated with the Six Minute Walk Test (6MWT), Lower Extremity Functional Scale (LEFS), and KDQOL-36 scores. This suggests that poor lower limb strength is associated with reduced dynamic balance, diminished functional ability, and lower self-reported QOL reported by *Tiwari et al.*Conversely, 6MWT performance was positively correlated with LEFS and KDQOL-36 scores, underscoring its utility as a composite indicator of both physical and psychosocial well-being.[22]

Importantly, LEFS scores were strongly and positively associated with KDQOL-36, indicating that perceived lower limb function is a key determinant of QOL. Furthermore, a study conducted by Abo EI-Saoud, A.M., Shehata, O.Z., Emerah, A.A. *et al.* suggests, integration of patient-reported outcome measures into the routine assessment of dialysis patients, given their capacity to reflect the broader consequences of physical impairments on daily living and emotional health.[24]

Flexibility, as measured by the Chair Sit and Reach Test, showed positive correlations with 6MWT, LEFS, and KDQOL-36 scores, and a negative correlation with FTSST time. This highlights the supportive role of flexibility in enhancing lower limb strength, dynamic balance, and overall functional performance. Given the high prevalence of joint stiffness and muscle wasting in dialysis patients, flexibility training should be considered a core component of rehabilitation programs. This is further supported by findings from Izquierdo et al., who emphasize that flexibility exercises are vital components of comprehensive physical activity guidelines for older adults, especially those with chronic health conditions such as dialysis-dependent CKD.[25]

Taken together, these findings highlight the multidimensional nature of physical fitness and its direct influence on both objective function and subjective well-being. Interventions that target strength, balance, and flexibility in a comprehensive manner may offer synergistic benefits in improving mobility, functional independence, and QOL in older adults undergoing dialysis.

STRENGTHS AND LIMITATIONS

A key strength of this study is the comprehensive assessment of multiple components of physical fitness, including strength, balance, flexibility, and mobility, along with QOL in a well-defined population of elderly patients receiving hemodialysis. Standardized and validated tools were used for all outcome measures, and assessments were conducted by a trained assessor, which helped reduce variability and improve data reliability.

However, the study has several limitations. Its observational design limits the ability to draw causal conclusions, and the use of convenience sampling may reduce the generalizability of the findings. Flexibility data from the Chair Sit and Reach Test could not be analyzed in relation to polypharmacy due to low frequency counts and the risk of zero-cell values in statistical testing. The classification of polypharmacy was not based on drug type or therapeutic category, which may have limited the identification of more specific medication-related effects. Additionally, reliance on self-reported questionnaires, such as the Kidney Disease QOL instrument, may have introduced subjective bias.

CONCLUSION

In conclusion, this observational study found significant differences in physical and QOL outcomes among older adults on dialysis, with males having higher height, weight, and KDQOL-36 scores, and significant age-related declines observed in chair sit-and-reach, FTSST, and 6MWT performance. Correlation analysis revealed that poorer lower limb strength was associated with reduced mobility and QOL, while better mobility and lower limb function were linked to higher QOL. Age was associated with declining strength and mobility, and taller individuals reported better QOL. Importantly, polypharmacy was highly prevalent but showed no significant association with gender, age group, or any functional or QOL measure, and no significant correlations among main outcomes were observed in participants older than 74 years. These findings highlight the impact of age and gender on functional outcomes and QOL in this population, while suggesting that, although polypharmacy is common and may contribute to medication burden, its direct association with functional status and QOL is less pronounced than the overall effects of aging and dialysis itself. This underscores the need for ongoing individualized assessment and medication review, but also suggests that interventions targeting physical function and QOL should address broader factors beyond polypharmacy alone.

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Conflicts Of Interest:
The authors declare no conflict of interest.

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