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The association between physical activity levels and quality of life among patients with chronic kidney disease receiving hemodialysis treatment

La asociación entre los niveles de actividad física y la calidad de vida en pacientes con enfermedad renal crónica que reciben tratamiento de hemodiálisis

Ristanti Puji Astuti, Novita Intan Arovah, Yustinus Sukarmin
Universitas Negeri Yogyakarta (Indonesia)

Abstract. Patients with chronic kidney disease (CKD) undergoing hemodialysis face significant challenges in engaging in physical activity. Yet, the ability to perform daily activities is essential for improving quality of life. This study aimed to assess the relationship between quality of life and physical activity levels among CKD patients on hemodialysis. This cross-sectional study was conducted on 85 CKD patients receiving hemodialysis treatment. Quality of life was assessed using the Kidney Disease Quality of Life (KD-QoL), while physical activity was assessed using the International Physical Activity Questionnaire (IPAQ). The statistical descriptive, followed by the assessment of association using the Spearman Correlation, was then conducted. The study found that a higher proportion of CKD patients were men, married, unemployed and with comorbidities. The physical activity was mostly conducted in 'home-based/domestic' domains. Low KDQoL scores were observed in areas involving 'work', 'emotional', and 'physical health'. Occupational activity correlated with symptoms, social interaction, support, and staff encouragement (r=0.414-0.871). Domestic activity strongly correlated with 'kidney disease effects', 'work status', sleep, 'physical functioning', pain, 'general health', emotional well-being, and SF-12 scores (r=0.674-0.917). Leisure activity correlated with 'cognitive and sexual function', 'general health', and 'emotional well-being' (r=0.669-0.930). Transport activity correlated with symptoms, 'kidney disease effects', 'cognitive and sexual function', sleep, pain, and 'social function; (r=0.302-0.999). Total physical activity was also associated with various quality-of-life components (r=0.611-0.985). These findings suggest the importance of supportive environments to improve physical activity and the quality of life of CKD patients on hemodialysis.
Keywords: chronic kidney disease, hemodialysis, physical activity, sports medicine, quality of life

Resumen. Los pacientes con enfermedad renal crónica (ERC) sometidos a hemodiálisis enfrentan desafíos importantes a la hora de realizar actividad física. Sin embargo, la capacidad de realizar actividades diarias es esencial para mejorar la calidad de vida. Este estudio tuvo como objetivo evaluar la relación entre la calidad de vida y los niveles de actividad física entre pacientes con ERC en hemodiálisis. Este estudio transversal se realizó en 85 pacientes con ERC en tratamiento de hemodiálisis. La calidad de vida se evaluó mediante el Kidney Disease Quality of Life (KD-QoL), mientras que la actividad física se evaluó mediante el Cuestionario Internacional de Actividad Física (IPAQ). Luego se realizó la estadística descriptiva, seguida de la evaluación de asociación mediante la Correlación de Spearman. El estudio encontró que una mayor proporción de pacientes con ERC eran hombres, casados, desempleados y con comorbilidades. La actividad física se realizó principalmente en los dominios "trabajo/ocupacional" y "doméstico/doméstico", y solo se realizó poca actividad física en los dominios de "ocio". Se observaron puntuaciones bajas en KDQoL en áreas relacionadas con "trabajo", "emocional" y "salud física". La actividad ocupacional se correlaciona con los síntomas, la interacción social, el apoyo y el estímulo del personal (r=0.414-0.871). La actividad doméstica muestra las correlaciones más fuertes, afectando los efectos de la enfermedad renal, el estado laboral, el sueño, el funcionamiento físico, el dolor, la salud general, el bienestar emocional y las puntuaciones del SF-12 (r=0.674-0.917). La actividad de ocio se correlaciona con la función cognitiva y sexual, la salud general y el bienestar emocional (r=0.669-0.930). La actividad de transporte afecta los síntomas, los efectos de la enfermedad renal, la función cognitiva y sexual, el sueño, el dolor y la función social (r=0.302-0.999). La actividad física total impacta varios componentes de la calidad de vida (r=0.611-0.985). Estos hallazgos subrayan la importancia de entornos de apoyo para mejorar la actividad física y la calidad de vida de los pacientes con ERC en hemodiálisis. Estos hallazgos subrayan la importancia de entornos de apoyo para mejorar la actividad física y la calidad de vida de los pacientes con ERC en hemodiálisis.
Palabras clave: actividad física, calidad de vida, enfermedad renal crónica, hemodiálisis, medicina deportiva

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Novita Intan Arovah
novita@uny.ac.id

Introduction

Chronic Kidney Disease (CKD) is a progressive and debilitating kidney condition that affects millions of people globally, thus presenting a significant challenge to public health systems (Kovesdy, 2022). The CKD is characterized by a gradual loss of kidney function over time, leading to the accumulation of waste products in the body, which can have detrimental effects on overall health and well-being (Lim et al., 2021). Hemodialysis is one of the treatment options for CKD . While vital for maintaining life in those with advanced CKD, hemodialysis may negatively affect patients' daily lives and well-being (Cupisti et al., 2018). These challenges range from the physical constraints of the treatment itself to the psychological and emotional toll of managing a chronic condition (DePasquale et al. 2022). One of the most significant issues faced by individuals undergoing hemodialysis is a marked reduction in their ability to engage in physical activities due to moderate to severe clinical symptoms (Davoud & Abazari, 2020).

Physical activity is fundamental to maintaining and enhancing an individual's health status (DePasquale et al., 2022). Physical activity plays a crucial role in improving mental health and and enhancing the quality of life and enhancing the quality of life (Kalantar-Zadeh et al., 2021) and alleviating psychological distress in chronic patients. (Da Silva et al., 2024). For patients with CKD, particularly

those on hemodialysis, physical activity engaging in physical activity could be challenging due to the reduction of physical strength and endurance (Arazi et al., 2022). Therefore, CKD patients with hemodialysis often find themselves leading a sedentary lifestyle, which further exacerbates their health issues and reduces their quality of life (Concha & Mendoza, 2022).

The quality of life in CKD patients can be assessed using the Kidney Disease Quality of Life (KDQOL) (Hays et al., 1997), while physical activity can be assessed using the International Physical Activity Questionnaire (IPAQ) (Sember et al., 2020). The assessments of the quality of life among CKD patients receiving hemodialysis provide insights into how patients perceive their position within their environments' cultural and value systems, particularly in relation to their goals, expectations, standards, and concerns (Dalrymple et al., 2022) . Quality of life assessment stands as a pivotal health outcome, embodying the ultimate objective of healthcare interventions (Rokhman et al., 2023). Concurrently, physical activity is a significant modifiable factor that can substantially influence quality of life (Wilkinson et al., 2021). The hypothesized mechanism suggests that physical activity can ameliorate adverse effects associated with hemodialysis treatment, such as muscle wasting, fatigue, and depression, by improving physical functions, boosting mood, fostering a sense of well-being and improving quality of life (Mahindru et al., 2023).

Despite the hypothetical connection between physical activity and quality of life, the extent and nature of this relationship remain under-explored within the CKD population undergoing hemodialysis. This research study aimed to assess the levels of physical activity and quality of life outcomes and the association between physical activity levels and quality of life. The findings are expected to help develop targeted interventions that integrate physical activity into hemodialysis care, for improving patient quality of life and reducing healthcare costs

Method

Study design, participants, and ethical consideration

This study employed a cross-sectional research design, focusing on CKD patients undergoing regular hemodialysis treatment for at least three months. Participants were provided with informed consent and the research protocol was approved by the Research Ethics Committee of Universitas Negeri Yogyakarta, number 000521340422115202208 2.

Outcome measures and instruments

Quality of life

The Quality of life was measured using the Kidney Disease Quality of Life (KDQoL) (Hays et al., 1997). The instrument integrates the generic core metrics of the SF-36 survey with a bespoke component specifically designed to assess the nuances of quality of life among individuals with kidney disease (Burholt & Nash, 2011). The SF-36 portion comprises 36 items, systematically categorized across eight domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. This generic core is designed to capture a broad spectrum of health concepts that are universally applicable across various age groups, diseases, and treatment modalities. In addition to the generic core, the KDQoL encompasses a kidney disease-specific module, which includes 43 items which evaluate aspects uniquely pertinent to kidney disease patients, covering symptoms and problems directly associated with kidney disease, its impact on daily life activities, the perceived burden of the disease, employment status, cognitive functioning, quality of social interactions, sexual health, sleep quality, the level of encouragement provided by dialysis staff, and patient satisfaction with care received. The KDQoL instrument totals 79 items, evaluating general and disease-specific quality of life aspects. Based on the KDQoL scoring guideline, the KDQoL scores consist of 22 subscales, which include symptom/problem list, effects of kidney disease, burden of kidney disease, work status, cognitive function, quality of social interaction, sexual function, sleep, social support, dialysis staff encouragement, overall health, patient satisfaction, physical functioning, role limitations-physical, pain, general health, emotional well-being, role limitations-emotional, social function, energy/fatigue, SF-12 physical health composite and SF-12 mental health composite. Each subscale score ranges from 0 to 100, in which a higher score represents a higher quality of life.

Physical Activity

The physical activity level was measured using the long version of the International Physical Activity Questionnaire (IPAQ) (Lee et al., 2011; Forde., 2018). The long version of IPAQ provides detailed information across a broad range of physical activity domains: (a) leisure or recreational, (b) domestic or home-based, (c) occupational/work-related, and (d) transport-related activities. The long version of the IPAQ asks respondents to recall their physical activity over the last seven days, covering various intensities such as walking, moderate-intensity activities, and vigorous-intensity activities, along with time spent sitting.

The scoring system of the IPAQ long version categorizes physical activity into MET (Metabolic Equivalent Task) minutes per week, a common unit for estimating the energy expenditure of physical activities (Fan et al., 2014). To calculate MET minutes, each type of activity (walking, moderate, and vigorous) is assigned a MET value (3.3 for walking, 4.0 for moderate, and 8.0 for vigorous activities, as per the IPAQ scoring protocol) (Ashok et al., 2017). The MET minutes/week calculation formula is: MET value of activity performed days per week. This formula is applied separately for each activity type, and the results are summed to provide the total physical activity in MET minutes per week.

Statistical Analysis

Descriptive statistics were employed to summarise social demographic factors, with categorical variables presented as frequency and percentage and continuous variables such as age were summarised by their mean, median, and standard deviation (SD). Physical activity levels across various domains were descriptively assessed, and each domain's mean, median, and SD were calculated. Similarly, quality of life was described using the mean, median, and SD for overall and component scores. Spearman's rank correlation coefficient was used to explore the relationships between physical activity and quality of life. All analyses were conducted using SPSS 25, with a p-value of <0.05 considered indicative of statistical significance.

Result

Table 1 presents the characteristics of the 85 participants in this study who were predominantly men, with a notable presence of comorbidity. Most have attained a high level of education, were married and unemployed.

Table 1.
Sociodemographic characteristics, according to chronic kidney disease (CKD).

Characteristics	N	%	Mean	Modus	Median	SD	Minimum	Maximum
Age (years)								
20-39	41	48	30	37	30	5	21	39
40-82	44	52	55	43	54	11	40	83
Gender								
Man	58	68	-	-	-	-	-	-
Woman	27	32	-	-	-	-	-	-
Comorbidities								
Hypertension	41	48	-	-	-	-	-	-
Diabetes	16	19	-	-	-	-	-	-
Other	28	33	-	-	-	-	-	-
Education								
Primary	8	9	-	-	-	-	-	-
Junior high	9	11	-	-	-	-	-	-
school,	31	86	-	-	-	-	-	-
High school,	37	44	-	-	-	-	-	-
Marital status								
Not married	17	20	-	-	-	-	-	-
Married	68	80	-	-	-	-	-	-
Employement Status								
Employed	37	44	-	-	-	-	-	-
Unemployed	38	45	-	-	-	-	-	-
Retired	9	11	-	-	-	-	-	-

Note: N = Sum of Sample, % = Percentage, SD = Standard Deviation

Physical activity and quality of live descriptive statistics

Table 2 summarizes the mean, median and standard deviation of physical activity and quality of life of the participants.

Table 2.
Physical activity level and Quality of Life

Scale	Mean	Median	SD
Physical Activity Levels (Mets)			
Occupational/Work -related	2383	0	8387
Domestic /home-based	6818	2820	9536
Leisure /recreational	2152	0	6742
Transport	2744	495	7745
Total	7798	3.381	20811
Quality of Life			
Symptom/problem list	54.46	52.08	23.20
Effects of kidney disease	56.69	59.38	23.01
Burden of kidney disease	46.80	43.75	25.34
Work status	40.12	50.00	38.21
Cognitive function	68.14	73.33	20.77
Quality of social interaction	76.05	80.00	16.53
Sexual function	77.36	75.00	22.98
Sleep	53.78	55.00	17.59
Social support	80.04	83.33	18.04
Dialysis staff encouragement	79.94	87.50	26.59
Overall health	59.30	60.00	25.38
Patient satisfaction	86.82	100.00	24.00
Physical functioning	47.44	50.00	26.69
Role limitations--physical	35.17	25.00	36.46
Pain	61.72	55.00	25.83
General health	60.17	60.00	22.04
Emotional well-being	68.88	68.00	18.24
Role limitations--emotional	34.88	33.33	36.48
Social function	60.47	56.25	23.24
Energy/fatigue	59.07	60.00	14.46
SF-12 Physical Health Composite	38.32	35.45	8.66
SF-12 Mental Health Composite	46.74	47.35	8.50

Note: SD = Standard Deviation, Mets: Metabolic Equivalent of Task, SF = Short Form

Table 2 reveals that physical activity levels varied widely with the highest mean levels in the domestic domain and the lowest in occupational and leisure activities. Quality of life metrics indicated moderate levels of symptom burden, effects of kidney disease, and overall health. Patients reported higher levels of social support, patient satisfaction, and quality of social interaction, while physical and emotional role limitations were lower. These findings suggest that while kidney disease patients experience a range of physical activity levels, their quality of life were moderate challenged.

The association between physical activity levels and quality of life

Table 3 summarizes the association between activity levels and quality of life.

Table 3.
Correlation between Physical Activity Level and Quality of Life Related to Kidney Disease Components

Subscales/Domain	Occupational	Domestic	Leisure	Transport	Total
Symptom/problem list	.414*	.102	.102	.758*	.100
Effects of kidney disease	.017	.825*	.825*	.302*	.611*
Burden of kidney disease	.045	.199	.199	.348*	.196
Work status	.029	.880*	.851*	.042	.898*
Cognitive function	.097	.131	.669*	.627*	.909*
Quality of social interaction	.871*	.438*	.103	.171	.779*
Sexual function	.721*	.423*	.905*	.430*	.475*
Sleep	.502*	.833*	.294	.999*	.960*
Social support	.824*	.219	.972*	.427*	.929*
Dialysis staff encouragement	.441*	.709*	.044	.382*	.824*
Overall health	.071	.413*	.426*	.051	.874*
Patient satisfaction	.909*	.680*	.090	.246	.466*
Physical functioning	.545*	.888*	.264	.044	.947*
Role limitations--physical	.048	.107	.251	.620*	.094
Pain	.303	.917*	.222	.532*	.732*
General health	.053	.674*	.877*	.187	.775*
Emotional well-being	.018	.831*	.930*	.187	.797*
Role limitations--emotional	.347*	.442*	.250	.303*	.326*
Social function	.011	.453*	.104	.412*	.861*
Energy/fatigue	.058	.616*	.325*	.393*	.694*
SF-12 Physical Health Composite	.292	.778*	.677*	.901*	.985*
SF-12 Mental Health Composite	.078	.804*	.375*	.981	.892*

Note: SF-12 = Short From, *=significant

Table 3 presents correlations between physical activity levels (occupational, domestic, leisure, transport, total) and quality of life subscales related to kidney disease. Significant positive correlations (indicated with asterisks) were found across various domains. In the domestic domain, significant correlations ranged from moderate to high (.674 to .917) for subscales such as effects of kidney disease, work status, sleep, patient satisfaction, physical functioning, general health, emotional well-being, pain, role limitations-emotional, and both SF-12 physical and mental health composites. The leisure domain showed significant correlations with cognitive function, sexual function, general health, emotional well-being, and both SF-12 composites, with coefficients ranging from .375 to .930. In the transport domain, significant correlations were observed with the symptom/problem list, effects of kidney disease, burden of kidney disease, sleep, social support, dialysis staff encouragement, role limitations--physical, pain, social function, energy/fatigue, and the SF-12 physical health composite, with coefficients ranging from .302 to .999. The occupational domain had fewer significant correlations, primarily with quality of social interaction and social support, with coefficients of .824 and .871, respectively. The total physical activity domain displayed significant correlations with effects of kidney disease, physical functioning, general health, emotional well-being, and both SF-12 composites, ranging from .611 to .985. These findings suggest that physical activity positively impacts various aspects of quality of life for kidney disease patients.

Discussion

This study advances the existing literature by investigating the relationship between physical activity levels and quality of life in patients with CKD undergoing hemodialysis, focusing on different physical activity domains. The findings of this study suggest varied physical activity patterns, with highest in domestic and lowest in occupational and leisure activities. These findings provide a basis for developing targeted interventions to enhance physical activity across these domains, thereby potentially improving the quality of life for this patient group.

The research also identifies positive correlations between physical activity and various quality of life aspects in CKD patients undergoing hemodialysis. Notable correlations include effects of kidney disease, work status, sleep, patient satisfaction, physical functioning, general health, emotional well-being, pain, and SF-12 composites across various domains. Leisure and transport domains also showed significant correlations with cognitive function, sexual function, social support, and other subscales. These findings suggest the positive roles of physical activity in enhancing quality of life for kidney disease patients.

The findings of this study align with and extend upon previous research, emphasizing the intricate link between physical activity levels and quality of life among individuals with CKD (Gualdi-Russo & Zaccagni, 2021), particularly those undergoing hemodialysis. A decrease in physical activity can affect well-being and quality of life (Rivera et al., 2023). Similar studies have emphasized the importance of physical activity for this patient population (Restrepo et al., 2024). Activity is an important tool to improve quality of life (De Souza Martins et al., 2023), noting improvements in physical and mental health. Results as a result of increased activity levels. Increasing physical activity can improve quality of life (Romero-Martínez et al., 2024). For example, previous research consistently shows that engaging in regular physical activity can result in significant improvements in cardiovascular health, muscle strength, and fatigue levels in CKD patients, which is an important factor affecting overall quality of life. Physical

exercise increases the level of quality of life (Vázquez et al., 2023). Moreover, studies have highlighted the psychological benefits of physical activity (Bakker et al., 2021), including reductions in symptoms of depression and anxiety, which are prevalent in the CKD population (Dziubek et al., 2021;Mosleh et al., 2020). This body of evidence collectively supports the idea that physical activity serves as a pivotal element in managing CKD-related symptoms and enhancing life quality.

A notable observation from the study is the marked lack of leisure or recreational physical activity among CKD patients, pointing to significant barriers to participation in such activities. This gap highlights the need for interventions to address these barriers, which may include physical limitations, energy deficits, and psychological issues. This nuance adds an important dimension to our understanding of how these patients integrate physical activity into their daily lives, suggesting potential barriers to engaging in leisure-based physical activities (Bennett et al., 2022) Comparatively, previous studies have often focused on structured exercise interventions without fully considering the broader context of patients' everyday activity patterns and preferences (Bakker et al., 2021). The emphasis on work and domestic domains underscores the potential for tailored interventions that recognize and leverage these existing patterns of activity (Kim et al., 2022). These findings underscore the profound impact of kidney disease on patients' lives, not just in terms of physical health, but also affecting their emotional well-being and ability to engage in work and daily activities. The low engagement in leisure activities highlights a potential area for intervention, suggesting that enhancing opportunities for leisure may improve the overall quality of life for these individuals.

The study's implications are significant, indicating the necessity for healthcare providers and policymakers to consider supportive work and social environments that accommodate the needs of CKD patients undergoing hemodialysis. Moreover, there is a clear need for strategies aimed at managing both the emotional and physical aspects of kidney disease (Sein et al., 2020), therefore improving patients' independence and quality of life. A major strength of this study is its focused approach on a relatively underserved population within CKD research. The utilization of validated instruments like the KDQOL and IPAQ enhances the reliability of the findings. Additionally, the study's design allows for a nuanced understanding of how different domains of physical activity correlate with quality of life. However, the study is not without limitations. The sample size of 85 patients, while informative, restricts the generalizability of the findings to the broader CKD population. Additionally, the cross-sectional nature of the study limits the ability to infer causality between physical activity levels and quality of life. The use of subjective physical activity measures also limits the precision of the measures compare to the use of objective physical activity measures such as pedometer and accelerometer. Future research should, therefore, aim to address these limitations by employing longitudinal designs to explore causality and including larger, more diverse samples to enhance generalizability and incorporating objective physical activity measures. Further, investigating the specific types of physical activity that are most beneficial for improving quality of life in this population could provide targeted insights for intervention development.

Conclusion

The study reveals varied physical activity patterns among CKD patients on hemodialysis, with predominant engagement in domestic physical activity, and lower participation in occupational and leisure activities. The findings from this study also demonstrate significant associations between various domain of physical activity and most quality-of-life dimensions, advocating for an integrated patient care approach that includes supportive environments and holistic management strategies for improving physical activity. These findings are expected to inform the development of targeted physical activity interventions aligned with CKD patients' unique needs and capacities to improve their quality of life.

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Datos de los/as autores/as:

Ristanti Puji Astuti	ristantipuji.2021@student.uny.ac.id	Autor/a
Novita Intan Arovah	novita@uny.ac.id	Autor/a
Yustinus Sukarmin	yustinus_sukarmin@uny.ac.id	Autor/a