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Physical Inactivity and Quality of Life in Frail Dialysis Patients

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Physical Inactivity and Quality of Life in Frail Dialysis Patients

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Abstract

Background Chronic kidney disease (CKD) leads to progressive kidney function decline, predisposing patients to frailty and reduced quality of life. Regular physical activity can benefit those undergoing renal replacement therapy.

Objectives To evaluate the impact of physical activity on frailty and quality of life in CKD patients undergoing hemodialysis.

Methods A cross-sectional, descriptive study with 64 CKD patients undergoing hemodialysis. Frailty was assessed using handgrip dynamometry, the 10-meter walk test, self-reported weight loss, and the International Physical Activity Questionnaire. Quality of life was measured using the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36).

Results The study identified 41 patients as pre-frail, 20 as frail, and 1 as non-frail. In comparing the frail and pre-frail groups, both exhibited a decline in quality of life. Significant differences were found between the groups in the physical, mental health, and overall domains, with the frail group showing worse outcomes. Additionally, both groups exhibited reduced levels of physical activity.

Conclusions CKD patients undergoing hemodialysis demonstrate low levels of physical activity, frailty, and impaired quality of life.

Keywords: Chronic Kidney Disease, Renal Dialysis, Exercise, Health Research Policy

1. Introduction

Chronic Kidney Disease (CKD) has an estimated global prevalence of 11% to 13%.[1] In Brazil, there were approximately 144,779 patients undergoing dialysis across 235 hemodialysis centers.[2] Consequently, there is an increase in healthcare system costs and a need for interventions to reduce complications from cardiovascular diseases such as CKD.[1]

CKD is defined as kidney damage lasting three months or more, with or without a reduction in Glomerular Filtration Rate (GFR), along with anatomical or structural abnormalities.[3] It is classified into five stages based on GFR. Risk management is conducted in stages 1 to 3 to prevent disease progression. In stages 4 and 5, patients are prepared for the initiation of Renal Replacement Therapy (RRT), and in stage 5, RRT is initiated, which can be performed via peritoneal dialysis or hemodialysis.[4]

Risk groups for developing CKD are classified as moderate and high. The moderate-risk group includes individuals with systemic diseases, recurrent urinary infections, repeated urinary stones, uropathies, children under 5 years old, adults over 60 years old, and pregnant women. The high-risk group consists of patients with hypertension, diabetes mellitus, and a family history of CKD.[5]

Patients undergoing RRT experience systemic inflammation and may progress to negative outcomes such as frailty syndrome, a multifactorial clinical condition widely discussed in literature through Fried frailty phenotype, which assesses five domains: low physical activity, unintentional weight loss, exhaustion, muscle weakness, and reduced gait speed.[6] Frailty increases with the progression of CKD stages and is associated with depression and worsening quality of life.[7] Moreover, physical inactivity heightens mortality risk due to elevated cardiovascular risk.[8]

Physical activity can mitigate systemic inflammation, metabolic disturbances, and alter body composition in these patients at any stage of the disease.[9] For stable CKD patients, regular exercise is safely recommended as it enhances functional and aerobic capacity, controls blood pressure levels, and has a positive impact on quality of life.[10] Additionally, regular physical activity is recommended and beneficial for individuals on RRT, offering improvements in mental health, sleep quality, and physical functioning.[11]

In recent years, numerous studies have assessed the presence of frailty phenotype in CKD patients due to the significant decline in physical health. However, few studies have investigated whether the duration of physical activity is a common factor in comorbidities associated with CKD. This study aims to explore the duration of physical activity and its relationship with the domains of frailty syndrome and quality of life.

2. Methods

2.1. Study Design and Population

This cross-sectional descriptive study was conducted from June to September 2019 at the Nephrology Center, a private facility in Itabaiana, Sergipe. The study included adults of both sexes, aged 18 years or older, with a medical diagnosis of CKD who were undergoing RRT through HD. Participants were required to have the cognitive ability to independently answer questions and be capable of walking, with or without the use of an assistive device. Informed consent was obtained from all patients.

Exclusion criteria included patients with significant visual or auditory impairments; acute infections at the time of assessment; cardiovascular conditions with hemodynamic instability; malignant neoplasms; recent surgeries within the last three months, except for vascular adjustments; acute fractures; a history of bariatric surgery; and cognitive impairment indicated by the Mini-Mental State Examination (MMSE), with scores below 13 for illiterates, below 18 for those with low to medium education, and below 26 for those with higher education.[12]

The study was approved by the Ethics and Research Committee, and all participants signed the Informed Consent Form before the study began. The data collection instruments used are publicly available and validated for use in Brazil.

Additionally, the study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[13]

2.2. Measures

At the beginning of the study, an evaluation form was employed to collect sociodemographic data, health history, and information related to CKD and its treatment. The frailty components were assessed according to Fried et al. (2001)[14] and included weight loss (unintentional), weakness, poor endurance and energy, slowness, and low physical activity level. Individuals were classified as frail if they exhibited three or more of these components, pre-frail if they exhibited one or two, and non-frail if none were present.

The 10-meter walk test (10MWT) was used to assess the maximum walking speed of the participant. Individuals who had a walking speed of 0.8 m/s or less were considered to have poor performance and scored in this domain of frailty.[15]

Exhaustion was assessed using the vitality domain of the SF-36 questionnaire. Individuals scoring below 55 points were classified as experiencing exhaustion.[16]

Weight loss was evaluated based on self-reported data from the patients. Unintentional weight loss of 4.5 kg or more, or a loss exceeding 5% of body weight over the past year compared to the previous year, was considered a frailty risk factor.[14]

Physical activity levels were measured using the short form of the International Physical Activity Questionnaire (IPAQ).[17] Individuals who engaged in less than 150 minutes per week of moderate and/or vigorous physical activity were classified as inactive and scored on this criterion of frailty.[18]

Muscle strength was assessed using handgrip strength measured with a Jamar hydraulic hand dynamometer (Saehan Corporation, Changwon, Korea), following the American Society of Hand Therapists' guidelines, which recommend three recorded measurements.[19] The patient was seated with the shoulder adducted and in a neutral position, the elbow flexed at 90°, and the forearm and wrist in a neutral position.[18] Reference values were based on BMI and sex.[14]

Quality of life was evaluated using the SF-36 (Medical Outcomes Short Form Health Survey 36), which assesses eight domains with scores ranging from 0 (worst) to 100 (best).[16]

2.3. Statistical Analysis

Descriptive statistics were used to characterize the sample. Data were presented as mean ± standard deviation (SD) or mean ± standard error (SE) for normally distributed variables, and as median for non-normally distributed variables, assessed using the Kolmogorov-Smirnov test. Independent t-tests were employed for comparisons between groups, while chi-square tests were used for

comparing categorical variables between groups. A significance level of 5% ($p<0.05$) was adopted for all tests.

3. Results

After applying the inclusion and exclusion criteria, 62 participants were included in the analysis. Two participants were subsequently discontinued: one ceased hemodialysis following a kidney transplant, which prevented the scheduled data collection, and the other passed away between acceptance into the study and the administration of the assessment tools, as shown in Figure 1.

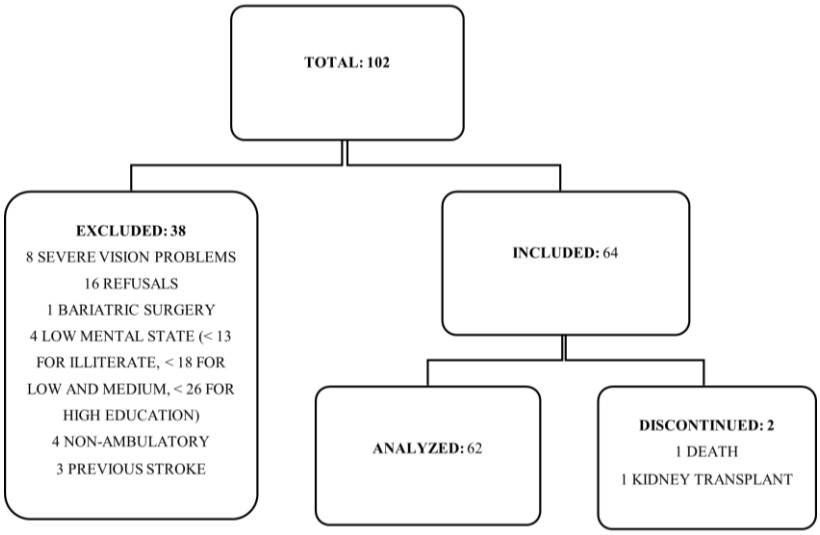


Figure 1: Flowchart of Study Participants

The sample characteristics are detailed in Table 1. Of the 62 patients included in the study, 61 (98%) were categorized as having some level of frailty, while only 1 patient (2%) was classified as non-frail. Among the 61 frail patients, 41 (67%)

were classified as pre-frail and 20 (33%) as frail. Due to the impracticality of comparing data from a single non-frail participant with the other groups, the non-frail individual was excluded from the analysis.

Table 1: Sample Characterization

	Pre-frail n= 41	Frail n= 20	p-value
Age	46,39±13,87	50,2±14,17	0,321
Male	25 (60, 97%)	13 (65%)	0,761
Dialysis Duration (months)	42,48±5,79	47,3±9,26	0,683
Vascular Access Type			
CVC	10 (24,39 %)	6 (30%)	0,64
AVF	31 (75,6 %)	14 (70%)	0,64
Duration of Pre-Dialysis Nephrological Follow-up (months)	405.9±194,09	203.25±111,38	0,487
Etiology			
HTN	29 (70,73%)	11 (55%)	0,225
DM	3 (7,31%)	5 (25%)	0,055
LH	8 (19,51 %)	4 (20%)	0,964
Others	7 (17,07%)	3 (15%)	0,837
Comorbidities			
HTN	24 (58,53%)	10 (50%)	0,537
DC	4 (9,75%)	1 (5%)	0,533
MI	5 (12,19%)	3 (15%)	0,793
CHF	3 (7,31%)	1 (5%)	0,737
Obesity	2 (4,87%)	1 (5%)	0,984

Values are expressed as mean ± SD (Standard Deviation) or mean ± SE (Standard Error). HD: Hemodialysis; CVC: Central Venous Catheter; AVF: Arteriovenous Fistula; HTN: Systemic Arterial Hypertension; DM: Diabetes Mellitus; LH: Hereditary Lesion; DC: Heart Disease; MI: Acute Myocardial Infarction; CHF: Chronic Heart Failure. Intergroup p-value, independent samples t-test, *p <0,05.

Table 2 displays the frequency distribution of frailty phenotype components across the groups, according to the cutoff points. All participants completed the tests and assessments through the questionnaires. It is noted that exhaustion and

low physical activity were the most frequently observed components in both groups.

Table 3 presents the mean scores for each domain of the SF-36 questionnaire. The total score and the physical functioning and mental health domains indicated that pre-frail individuals reported statistically better quality of life.

In both the pre-frail and frail groups, pain and physical functioning were the domains with the lowest scores, while social functioning was the highest scoring domain in both groups. However, the frail group exhibited better scores in these domains compared to the pre-frail group.

Table 2: Frequency Distribution of Frailty Phenotype Items Among Groups

	Pre-frail (n%)	Frail (n%)
Grip strenght	2 (4,87%)	15 (75%)
Weight loss	8 (19,51%)	13 (65%)
Exhaustion	21 (51,21%)	16 (80%)
Low physical activity	32 (78,04%)	19 (90%)
Gait speed	1 (2,43%)	6 (30%)

Table 3: Assessment of Quality of Life Using the Short Form Health Survey 36 (SF-36) Questionnaire

SF-36 Domains	Pre-frail	Frail	p-value
Physical functioning	69,39±24,14	57,5±24,94	0,079
Role physical	57,92±38,09	33,75±38,28	0,024*
Bodily pain	31,78±30,82	38,55±34,8	0,443
General health	44,98±17,95	45,8±15,79	0,864
Vitality	49,75±12,24	44,5±18,05	0,185
Social functioning	81,70±26,82	81,25±27,35	0,951

Role emotional	68,29±42,78	65±43,89	0,780
Mental health	46,24±13,11	36,2±11,27	0,005*
Total	450,08±77,8	402,55±74,65	0,027*

Values expressed as mean SD in groups p-value between groups, t-test for independent samples, *p <0.05

4. Discussion

Our results revealed a high prevalence of frailty among patients with CKD undergoing hemodialysis. Previous studies support this finding, indicating that frailty affects approximately one-third of individuals with CKD and is associated with an increased mortality risk.[20] These impairments are related to inflammatory and metabolic changes, elevated oxidative stress, deficits in growth hormone and testosterone, hypothyroidism, and high levels of pro-inflammatory cytokines such as interleukin-6 and tumor necrosis factor-alpha, which accelerate the aging process.[21.22]

In this study, participants showed reductions across all eight domains of the SF-36 quality of life questionnaire compared to normative values for the Brazilian population,[23] indicating a global decline in general health. Previous research has demonstrated that low to moderate acceptance of illness,[24] along with the psychoneuroimmunological mechanisms of frailty, such as increased production of pro-inflammatory cytokines, exacerbates depressive disorders and negatively impacts the quality of life.[25,26]

The analysis of physical activity levels revealed a significant reduction in activity, with average times of 27 minutes for walking, 20 minutes for moderate activity, and 4 minutes for vigorous activity across groups. This decline compromises the maintenance of functional capacity and increases the risk of developing sarcopenia. Physical activity is essential, as it reduces apoptosis, oxidative stress, and inflammation, as well as improves mitochondrial and neuromuscular function, as a protective factor against sarcopenia.[27]

The arteriovenous fistula (AVF) was the most common type of vascular access in both groups (pre-frail 75.6% and frail 70%). Studies show that AVF is the preferred access method for hemodialysis due to its durability and reduced infection rates in mature cases.[28,29] However, it poses challenges for maintaining an active lifestyle, as movement or limb overload must be restricted, limiting the potential for physical exercise.[30-32]

Another domain with negative changes was mental health, which may reflect the psychosocial burden of chronic illness and complications such as frailty, which complicates coping with disease-related changes and associated clinical issues.[25] Studies show that physical activity positively impacts health and quality of life in hemodialysis patients, with active individuals reporting better perceptions of all quality of life domains compared to insufficiently active individuals.[33]

In light of these findings, there is a need for health education initiatives for CKD patients undergoing hemodialysis. The Ministry of Health's Ordinance No. 1,168, dated June 15, 2004, emphasizes improving quality of life, education, health protection, recovery, and prevention with autonomy and equity at all levels of care, from primary to advanced. Specifically, concerning the type of vascular access, it is essential to raise awareness about possible active life strategies during the adaptive period and provide longterm guidance.[34] Promoting physical activity and reducing frailty-related complications is crucial.

This study is important for understanding the low-income population undergoing hemodialysis therapy in a center located in the interior of Sergipe serving surrounding towns. However, it has limitations, including being based on a single nephrology center with a small sample size and uneven representation among the frailty groups. Additionally, the inability to assess biochemical parameters during the evaluations limited the scope of the analysis.

5. Conclusion

Our results indicate that patients with CKD often experience frailty, leading to a significant impairment in quality of life, as evidenced by reductions across all evaluated domains. Notably, there was a substantial decrease in physical function and mental health among patients classified as frail compared to those classified

as pre-frail. These findings underscore the necessity for multidisciplinary care involving physiotherapists, physical educators, and psychologists at all levels of care.

In clinical practice, it is essential to address physical aspects and explore interventions to enhance outcomes for individuals undergoing hemodialysis. Public policies can play a crucial role by establishing accessible and practical environments, supporting the monitoring of physical activity, and incorporating it into the treatment plans for patients with Chronic Kidney Disease.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics and Research Committee (approval number 3.366.523), and all participants signed the Informed Consent Form before the study began.

Declaration of Competing Interest

The authors have no conflicts of interest.

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