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The Relationship between Physical Activity Levels and Functional Capacity in Patients with Advanced Chronic Kidney Disease

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Abstract

The purpose of this study is to assess whether the functional capacity of patients with chronic kidney disease stage V (CKD-5D) is different depending on their physical activity levels. We also compared functional capacity, quality of life, and symptoms of depression depending on treatment modalities (HD vs. PD). A Cross-sectional study included 52 patients (35HD and 17PD; males 61.5%, mean age 71 years). The main measurements were physical activity level using the Human Activity Profile questionnaire (HAP), muscle strength, functional capacity, health-related quality of life (HRQoL), and depressive symptomatology. The functional tests and physical activity levels correlated significantly. Participants on HD with low physical activity levels were older ($*p \leq .039$) and had worst physical function ($*p \leq .01$). The HAP is a useful tool to detect subjects with low functional capacity; there were no differences between the therapy modalities in terms of functional capacity, HRQoL, or depressive symptomatology.

Keywords

hemodialysis, peritoneal dialysis, physical activity, health-related quality of life

Introduction

The generalized increase in population-level life expectancy, together with improvements in the treatment of patients with chronic kidney disease stage V on dialysis (CKD-5D), are both factors that have contributed to the increased prevalence of patients undergoing renal replacement therapy (RRT) (Otero, de Francisco et al., 2010; Salvador González et al., 2015). Hemodialysis (HD) is the most common renal replacement, but other possibilities include peritoneal dialysis (PD). Thus, it is increasingly common to find elderly patients with a high level of comorbidity characterized by fragility and a high risk of functional impairment (Portilla Franco et al., 2016). Age, malnutrition, anemia, chronic inflammation, alterations in bone mineral metabolism, as well as high levels of associated comorbidity and alterations in urea metabolism can all contribute to progressive general worsening of health among patients with CKD-5D. In the shorter-term, this can lead to muscular weakness, and over the longer-term, to individuals becoming dependent upon others to complete their daily life activities (Portilla Franco et al., 2016).

Despite advances in the treatment of chronic kidney disease (CKD), an optimal level of health-related quality of life (HRQoL) still cannot be ensured for these individuals. Therefore, patients with CKD-5D have a significantly decreased HRQoL compared to healthy individuals or patients who undergo renal transplantation (RT). Hence, this impaired functional capacity and deterioration in HRQoL related to renal replacement treatment (RRT) over time is of great importance in patients with CKD-5D (Barbero Narbona et al., 2016; Hernández et al., 2018; Hernández Sánchez et al., 2015; Ortega Pérez de Villar et al., 2015). Moreover, these patients tend to engage in lower levels of physical activity than their healthy counterparts (Segura-Ortí et al., 2018).

The Human Activity Profile (HAP) questionnaire has been validated for patients with CKD, can easily be applied

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by all types of healthcare professional, and provides information which is useful in primary care or nephrology consultations for detecting patients who could benefit from interventions to help them improve their functional capacity (Johansen et al., 2001). So far, no published studies have analyzed whether the HAP can discriminate the levels of functional capacity from among patient cohorts. However, a wide range of recent work has provided extensive evidence for the strong benefits of physical exercise programs in the alleviation of the adverse effects of CKD both in terms of patient functional capacity and HRQoL (Esteve Simó et al., 2014; Heiwe & Jacobson, 2014). Therefore, the availability of a tool that can detect patients with a low functional capacity which can also be used during dialysis treatments would be of great clinical utility.

Recently published studies have shown that these patients tend to have very sedentary lifestyles and their functional capacity usually differs very little according to the type of RRT they use. A study from the UK (Iyasere et al., 2016) correlated HRQoL and physical condition among patients on hemodialysis (HD) or peritoneal dialysis (PD). However, based on the 12-Item Short Form Health Survey (SF-12) questionnaire, Barthel Index, and Timed Up-And-Go Test, they found no differences in the HRQoL of these patients. In addition, a Canadian study showed that there was no relationship between physical activity levels (measured using pedometers) and renal function (assessed by glomerular filtration rates), although the authors did note that patients with CKD-5D had a sedentary lifestyle (West et al., 2017). A similar study in Spain concluded that there were no differences in physical activity levels or HRQoL in patients with CKD-5D, although this cohort excluded patients aged over 70 years and only included six patients on HD and eight patients on PD (Hernández Sánchez et al., 2015). Although Spanish patients with CKD-5D tended to be older, there was only limited evidence for differences in their functional capacity based on their use of the HD or PD treatment modalities (Otero et al., 2010).

The main objective of this study was to understand if the functional capacity of patients with CKD-5D differed between those who engaged in higher or lower levels of physical activity. Our secondary objective was to compare the functional capacity, quality of life and depressive symptomatology in patients with CKD-5D who received RRT either via HD or PD.

Material and Methods

We carried out a cross-sectional descriptive study from May 2018 to September 2018 in patients with CKD-5D who were receiving outpatient HD or PD at our Hospital. The study was approved by the Hospital Ethics Committee (CI: 02-17-108-038) and was carried out in accordance with the standards set out in the Declaration of Helsinki. Patients aged at least 18 years, receiving RRT for more than 3 months, who were cognitively aware and able to read and write Spanish and who had signed their informed consent to participation were included in this study. Individuals who were physically unable to perform the functional tests, suffering from a potentially communicable infectious disease, or who were actively participating in another study that could have influenced their physical condition or physical activity levels were excluded (Figure 1). The following functional tests and variables were performed and analyzed quarterly when patients came for their normal clinical follow-up outpatient visits. Functional tests were recorded by one renal nurse, who had more than 10 years' experience in the evaluation these tests in renal patients.

Demographic Variables, Biochemical Data, and Anthropometric Measurements

Demographic variables (age and sex) as well as renal etiology and the length of time the patient had required RRT were studied. In turn, the main biochemical data (glucose, creatinine, potassium, calcium, phosphorus, parathyroid hormone, and vitamin D), hemogram (hemoglobin and ferritin), nutritional parameters (albumin, total cholesterol, HDL, LDL, and triglycerides), and dialysis adequacy (Kt/v) data were collected. In terms of anthropometric calculations, the muscular tone of the humeral biceps and quadriceps of both extremities were measured in centimeters using a flexible tape (without compressing the surrounding soft tissues) and with the patient placed in the appropriate reference anatomical position (Watson et al., 1980). To maximize precision and avoid possible measurement errors, the results were calculated as the average of three consecutive measurements recorded at 15-s intervals.

Physical Activity Level Assessment

The general level of physical activity of each patient was evaluated using the HAP questionnaire. The HAP scale is self-administered and comprises a list of 94 daily activities; the maximal activity score (MAS) and adjusted activity score (AAS) were calculated in this evaluation. Depending on the outcome of the HAP, patients were classified as having physical activity levels that were "impaired" (<53 points), "moderately active" (53–74 points), or "active" (>74 points) according to previously published literature (Johansen et al., 2001; Ortega Pérez de Villar et al., 2016). Because the population with CKD-5D is usually sedentary, we split the sample into patient groups who were moderately active and active versus those who engaged in a low level of physical activity.

Objective Nutritional Assessment

Malnutrition is common among patients with CKD-5D and this causes increased morbidity and mortality in these individuals. Objective nutritional assessment allowed patients to

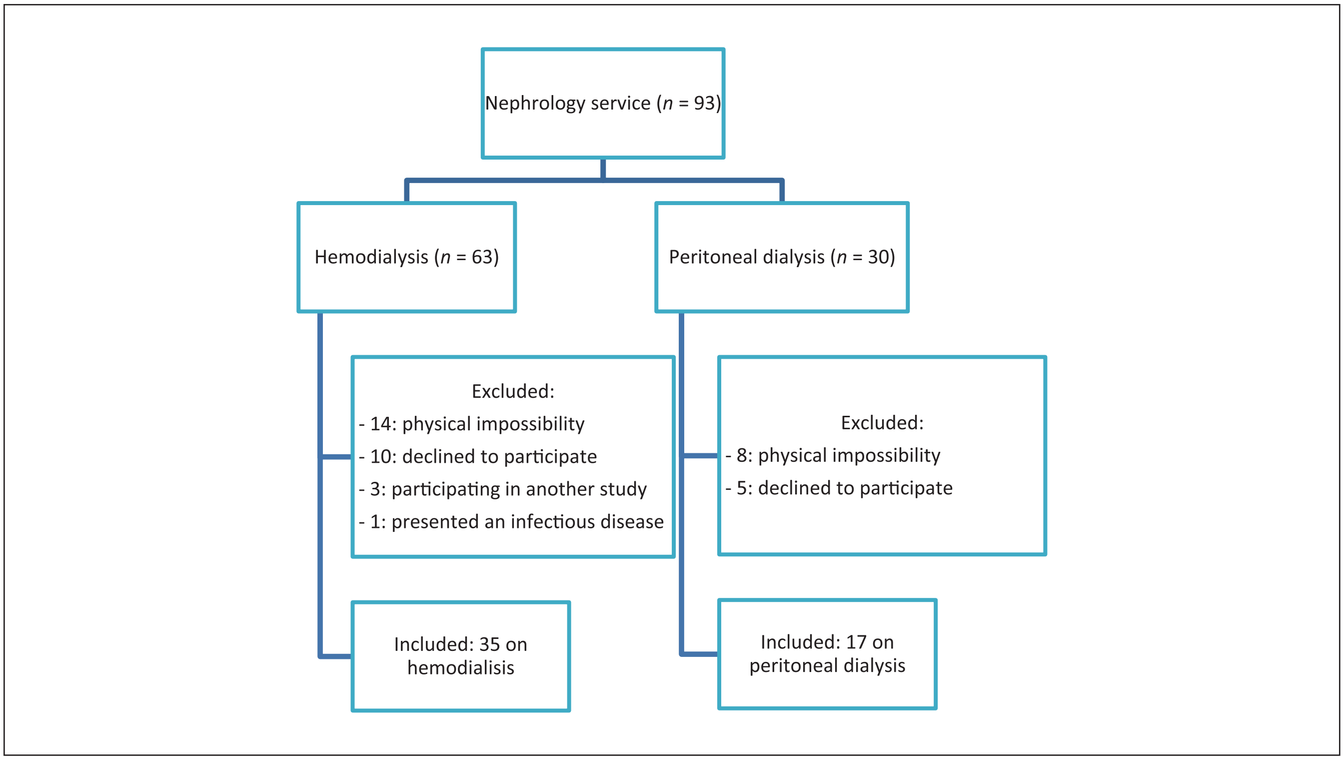

Figure 1. Flow diagram of the study selection process.

be classified so that any who were at risk of malnutrition could be more easily detected (Sagrario Jiménez Jiménez et al., 2012). To obtain this data, we analyzed the patients' weight, body mass index (BMI), brachial circumference, and tricipital fold, as well as analytical data for albumin (g/L), cholesterol (mmol/L), and transferrin (g/L). Each variable was assigned a score and these were summed; the nutritional assessment was deemed "normal" for scores of 28–32 points, "moderate" for 23–27 points, and "low" for less than 22 points (Sagrario Jiménez Jiménez et al., 2012; São Romão Preto et al., 2017).

Muscle Strength and Functional Capacity Variables

Muscle strength was assessed by manual dynamometry using a Jamar dynamometer with the patient in a sitting position and with their wrist and forearm semi-pronated; the patients performed three consecutive 3-s repetitions using their dominant arm, with a 15-s rest between each repetition; the highest score from the three repetitions was recorded (Leal et al., 2011; Segura-Ortí & Martínez-Olmos, 2011; Vogt et al., 2016). The functional capacity of the patients was assessed using the Short Physical Performance Battery (SPPB), Sit-to-stand-to-sit 10 (STS-10), and 6-min walking test (6MWT).

The SPPB is a battery of three functional tests. The first was a balance test in which the patient was asked to assume three different positions (feet together, semi-tandem, or tandem) for 10 s in each time and scores were assigned according to the results. The second assessment was the gait speed test in which the patient was asked to walk 4 m at a normal pace; this test was performed twice, and the fastest time was used to assign the appropriate score. Finally, in the Sit-to-stand-to-sit 5 (STS-5) test the patient was required to get up and sit down from a chair five times consecutively; the time taken (in seconds) to perform the test up to the point of the fifth standing repeat was used to assign the appropriate score (Reese et al., 2013; Ortega-Pérez de Villar et al., 2018). The final SPPB score ranged from 1 to 12 points, with a patient limitation being considered "severe" for scores of 0–3 points, "moderate" for 4–6 points, "minor" for 7–9 points, and "absent" for 9–12 points.

The STS-10 test assessed the time it took for the patient to get up and sit down consecutively from a chair 10 times, but in this test the stopwatch was stopped when the patient was sitting in the position at the end of the 10th repetition (Segura-Ortí & Martínez-Olmos, 2011). Finally, the last test used in the functional capacity assessment was the 6MWT in which the maximum distance traveled during a period of 6 min at a lively pace was recorded in meters using an approved odometer (Acquistapace & Piepoli, 2009). The variables were collected following detailed instructions for each of the tests in order to standardize the procedures (Ortega-Pérez de Villar et al., 2018; Segura-Ortí & Martínez-Olmos, 2011)

Health-Related Quality of Life and Symptomatology of Depression

The health-related quality of life was assessed using the validated Euroqol 5D questionnaire (EQ-5D). The first part of the questionnaire is descriptive and contains five health dimensions grouped into three severity levels, with 1 representing the absence of problems; 2 indicating the presence of moderate problems; and 3 reflecting the presence of many problems. The patient was asked to mark the severity level corresponding to their state of health on the day they completed the questionnaire. The following dimensions were measured: mobility, self-care, daily activities, pain or discomfort, and anxiety or depression. The second part of the EQ-5D was a vertical analog millimeter scale which ranged from 0 (the poorest state of health) to 100 (representing the best imaginable health status). The individual marked the point that best reflected their overall health status at the time they completed the survey (Herdman et al., 2001).

Depressive symptomatology was assessed using Beck's depression inventory. This is a validated, self-administered questionnaire with 21 multiple-answer questions designed to detect the presence of depression and estimate its severity by evaluating a broad spectrum of psychological, cognitive, and somatic depressive symptoms. The possible score range was 0–63 points, with values up to 10 points being considered "normal," 11–16 "mild," 17–29 "moderate," and 30–63 as "serious." In general, the higher the score, the more severe the intensity of the depression (Abdel-Rahman et al., 2011).

Statistical Analysis

The distribution of the variables was not normal. Thus, we described the continuous variables as the median and 25th and 75th percentiles and the qualitative variables were expressed as percentages. We used Mann–Whitney U tests to compare patients with an impaired level of physical activity (AAS < 53) to moderately active and active patients (AAS ≥ 53) for each RRT type, according to the HAP questionnaire assessments. The intensity of association between the HAP questionnaire and RRT type was examined using Spearman correlation analyses. Mann–Whitney U tests were used for quantitative variables and Chi squared tests were employed for categorical variables when comparing the characteristics of the HD versus the PD group. All the statistical analyses were carried out with SPSS software (version 24, SPSS Inc., Chicago, IL, USA) considering probability values of $p < .05$ as significant.

Results

Figure 1 shows the distribution of patients and the reasons for their inclusion or exclusion. A total of 52 patients (35 in the HD group and 17 in the PD group) were included in the study, of which, 61.5% were men. The mean patient age was 71 years (range = 59–81 years) and the patients had been receiving RRT for an average of 19 months (range = 10–44 months). The average Charlson index was 8.2 ± 2.6 and the most prevalent disease etiologies for chronic renal failure were diabetes mellitus (33.6%), glomerulonephritis (18.3%), and hypertension (13.5%). The data disaggregated by substitute treatment are described in Table 1 and show that there were no statistically significant differences between the two groups.

In addition, Table 1 shows the main anthropometric, biochemical, nutritional assessment, and dialysis adequacy measurement results. No significant differences were found in relation to muscle tone variables and nutritional biochemical parameters. However, there were significant differences in the creatinine (HD = 7.5 mg/dL vs. PD = 5.4 mg/dL; $p = .008$), potassium (HD = 5.6 mEq/L vs. PD = 4.6 mEq/L; $p = .002$), parathyroid hormone (HD = 362 pg/mL vs. PD = 208.4 pg/mL; $p = .026$), vitamin D (HD = 25.9 ng/mL vs. PD = 14.6 ng/mL; $p = .004$), and hemoglobin (HD = 11.7 g/dL vs. PD = 12.5 g/dL; $p = .005$) biochemical data. Table 1 also shows the significant differences ($p \leq .01$) in the objective nutritional assessments; patients in the PD group had normal nutritional assessment results and those treated with HD had moderately lower results.

Table 2 shows data related to the patient physical activity levels and the HAP results; both the patients in the HD and PD groups with impaired physical activity levels were older and all their functional test results were poorer compared to more active patients with CKD5D. No significant differences were found between these groups in terms of HRQoL in relation to patient activity levels. Table 3 shows that the correlation coefficients for both the HD and PD groups were significant and were stronger in the HD group (these correlation coefficients all exceeded 0.8); the correlation coefficient for handgrip strength was 0.3. Table 4 shows that there were no significant differences between the HD and PD groups in terms of the functional capacity, physical activity, HRQoL, and depressive symptomatology results.

Discussion

This study shows, for the first time, that the physical activity level HAP questionnaire results can be used to discriminate both HD and PD patients with greater or lesser functional capacity. Given the difficulty of assessing CKD patients outside of their normal clinical routine, it is very useful to have a tool that can be easily administered while they are receiving HD or being attended in a primary care consultation to screen for those with a high risk of fragility (Johansen et al., 2013; Portilla Franco et al., 2016). Our results showed that patients on RRT engaged in low levels of physical activity.

We observed that, while the HD population patients with impaired activity levels had worse HRQoL scores, the opposite occurred in the PD population. This may be because PD patients were more autonomous and had the option of

Table 1. Clinical and Demographic Data.

	Total	Hemodialysis	Peritoneal dialysis	*p* value
Age (years)	71.0 (59.0–81.0)	70.0 (60.0–82.0)	71.0 (54.0–81.0)	.558
Time on substitutive treatment (months)	19.0 (10.0–44.0)	22.0 (11.0–48.0)	13.5 (6.7–19.7)	.231
Sex (% male)	61.5	61.8	61.1	.597
Weight (Kg)	68.4 (64.1–81.5)	68.0 (63.2–81.2)	71.7 (65.8–82.7)	.493
Body mass index	28.3 (24.9–32.0)	28.0 (23.6–30.4)	28.4 (25.0–32.7)	.643
Glomerulonephritis (%)	18.3	13.9	22.7	.428
Hypertension (%)	13.5	13.6	13.4	.964
Diabetes mellitus (%)	33.6	27.3	40	.562
Muscular tone				
Upper extremities				
Right biceps (cm)	29.7 (26.8–33.6)	29.7 (26.9–33.4)	30.7 (26.9–34.2)	.554
Left biceps (cm)	29.7 (26.7–33.4)	29.4 (26.7–32.8)	31.9 (26.7–33.9)	.398
Lower extremities				
Right quadriceps (cm)	51.0 (45.4–56.4)	51.1 (44.6–56.1)	51.6 (46.8–59.0)	.436
Left quadriceps (cm)	50.7 (44.9–55.8)	50.9 (43.4–55.3)	51.2 (46.9–58.3)	.481
Biochemistry				
Glucose (mg/dl)	122.5 (96.4–154.6)	126.1 (96.1–166.5)	120.7 (97.5–147.1)	.858
Creatinine (mg/dl)	6.9 (4.9–8.4)	7.5 (6.4–9.1)	5.4 (4.5–6.7)	.008*
k (mEq/l)	5.4 (4.6–5.7)	5.6 (4.9–5.9)	4.6 (4.2–5.4)	.002*
Ca (mg/dl)	9.1 (8.7–9.6)	9.1 (8.6–9.6)	9.2 (8.8–9.7)	.586
P (mg/dl)	4.5 (3.7–5.3)	4.6 (3.8–5.2)	4.3 (3.6–5.7)	.910
i-PTH (pg/ml)	317.9 (148.0–441.0)	362.0 (178.2–488.6)	208.4 (118.9–331.9)	.026*
25-OH Vit. D (ng/ml)	20.5 (13.2–30.5)	25.9 (15.5–33.1)	14.6 (9.3–21.0)	.004*
Hematological data				
Hemoglobin (g/dl)	11.9 (11.1–12.6)	11.7 (10.4–12.3)	12.5 (11.8–13.4)	.005*
Ferritin (ng/ml)	385.0 (254.0–597.0)	408.0 (249.1–636.0)	376.5 (261.0–440.5)	.535
Nutritional parameters				
Albumin (g/dl)	3.8 (3.4–4.1)	3.7 (3.4–4.1)	3.8 (3.4–3.9)	.970
Total cholesterol (mg/dl)	153.1 (131.8–172.0)	147.7 (126.8–159.3)	155.6 (139.9–189.1)	.148
HDL cholesterol (mg/dl)	45.6 (34.2–54.5)	42.9 (30.5–54.5)	49.3 (40.6–54.6)	.289
LDL cholesterol (mg/dl)	77.3 (61.9–88.9)	73.4 (57.9–85.1)	85.1 (70.5–108.2)	.108
Triglycerides (mg/dl)	115.5 (87.9–160.5)	117.2 (89.2–189.9)	110.3 (85.7–153.9)	.586
Objective nutritional assessment	28.0 (23.5–31.0)	26.0 (23.0–28.0)	31.0 (29.0–34.0)	≤.01*
Dialysis adequacy				
HD dose (Kt/v)		1.4 (1.8–1.6)		
PD dose			2.1 (1.9–2.9)	

Note. Hemodialysis $n = 35$ and peritoneal dialysis $n = 17$; data are presented as the median (25th percentile–75th percentile). K = potassium; Ca = calcium; P = phosphorus; i-PTH = intact parathyroid hormone; Vit. D = vitamin D; kt/v = Daugirdas second generation single pool model. Statistical significance: $^*p \leq .05$.

engaging in some physical activity. The advantage of the EQ-5D questionnaire was its speed of completion; however, future studies should contrast the results obtained from this survey with those from the Short Form 36 Health Survey (SF36), a broader questionnaire also commonly used in this population (Segura-Ortí et al., 2018; Tang et al., 2017).

Handgrip strength, which is a predictor of survival (Vogt et al., 2016), was lower among patients with low activity levels, although this difference was not significant, perhaps because of the small sample size we analyzed here. Although the patients with impaired activity levels in our study were older, it appeared that their physical activity levels themselves rather than their age best explained their functionality (Segura-Ortí et al., 2018). All the functional capacity measurements were correlated with the HAP in both the HD and PD groups, and all the correlation levels exceeded 0.8 the HD population, except for the handgrip strength variable. This study shows that there were no differences in functional capacity, muscle strength, HRQoL, depressive symptomatology, or physical activity levels between HD and the PD groups.

We also found significant differences in some analytical parameters (including creatinine and potassium) between the two RRT modalities we studied (HD vs. PD), which can be explained by differences in these two dialytic techniques. Furthermore, we observed differences in the nutritional

Table 2. Physical Activity Level and Several Variables.

Variables	Physical activity level (35 HD)			Physical activity level (17 PD)		
	Normal or moderately active (n = 15)	Impaired activity (n = 20)	p value	Active or moderately active (n = 9)	Impaired activity (n = 8)	p value
HAP AAS	66.0 (58.0–73.0)	38.0 (22.5–43.0)	≤.01*	60.0 (56.0–71.0)	38.0 (30–45.3)	≤.01*
Demographics						
Age (years)	67.0 (45.0–74.0)	77.0 (62.0–83.0)	.039*	55 (46–76)	78 (71–84.8)	.036*
Sex (% males)	6 (40%)	8 (40%)	.635	4 (44.4%)	3 (37.5%)	.581
Muscular strength						
HG (kg)	25.0 (19.7–35.3)	20.6 (18.0–24.9)	.139	27.0 (18.5–43.0)	21.5 (17.3–26.3)	.236
Functional capacity test						
6MWT (m)	471.0 (430.0–489.0)	289.5 (215.5–333.0)	≤.01*	434.0 (341.0–459.0)	287.5 (265.8–329.8)	.011*
SPPB (points)	11.0 (9.0–12.0)	7.0 (5.0–9.0)	≤.01*	11.0 (7.5–11.5)	6.5 (5.0–8.0)	.015*
STS-5 (s)	11.7 (9.4–14.0)	21.0 (15.2–23.0)	≤.01*	13.0 (11.5–17.3)	17.5 (15.1–26.0)	.021*
4 m Gait speed (m/s)	0.9 (0.9–1.0)	0.8 (0.6–0.9)	≤.01*	0.9 (8.3–0.9)	0.8 (0.7–0.9)	.021*
STS-10 (s)	24.2 (21.5–29.5)	44.1 (30.9–48.4)	≤.01*	27.2 (24.7–38.2)	37.9 (33.8–60.9)	.027*
HRQoL EuroQol	85.0 (55.0–88.0)	65.5 (40.7–86.5)	.330	66.0 (55.5–76.5)	77.5 (56.5–87.7)	.167

Note. HAP AAS = human activity profile test adjusted activity score; HG = dominant arm handgrip strength; 6MWT = 6-min walking test; SPPB = short physical performance battery; STS = sit-to-stand-to-sit test; m = meters; s = seconds.
HAP scores: "active" or "moderately active" physical activity level ≥53 and "impaired" physical activity levels being ≤53 points.
Statistical significance: $^*p \leq .05$.

Table 3. Spearman Correlation Coefficients for Physical Activity Levels and Physical Function Tests.

Variables	Physical activity level 35 HD		Physical activity level 17 PD	
	Correlation coefficient	p value	Correlation coefficient	p value
STS10	−0.832	.01*	−0.482	.005*
SPPB	0.875	.01*	0.507	.04*
6MWT	0.908	.01*	0.56	.02*
HG	0.380	.02*	0.480	.05*

Note. STS = sit-to-stand-to-sit test; SPPB = short physical performance battery; 6MWT = 6-min walking test; HG = dominant arm handgrip strength; HD = hemodialysis.
Statistical significance: $^*p \leq .05$.

assessment outcomes between these groups, which could be explained by the fact that patients treated with PD had fewer dietary restrictions.

Various studies have shown similar results. In Spain, in a small-scale study using the Yale Physical Activity Survey (YPAS) physical activity questionnaire, KDQoL questionnaire, and Senior Fitness Test (SFT) to assess six patients on HD, eight on PD, and 11 who received a RT, found no significant differences between these groups (Hernández Sánchez et al., 2015). Another study which included 21 patients on HD and 21 on PD also found no differences in their physical, mental, or HRQoL statuses based on the SF12, Barthel Scale, Lawton Brody Scale, and Yesavage Test; however, this study did conclude that there were differences in phosphorus and calcium between these groups that could perhaps be explained by the dietary restrictions of patients related to their specific RRT modalities (Barbero Narbona et al., 2016). Another study from the UK based on the SF12, Timed up-and-go test, and Barthel Scale, showed no significant differences in quality of life, fragility, anxiety and depression, physical ability, and satisfaction between a sample of patients aged over 60 years either receiving PD (229 individuals) or HD (122 patients; (Iyasere et al., 2016).

We also identified research related to HRQoL and the different RRT modalities (Barbero Narbona et al., 2016; Rebollo-Rubio et al., 2015; Stokes, 2012). A study published in 2009 compared patients receiving PD or HD in Iran and showed that those on PD had a higher HRQoL (Noshad et al., 2009). However, our results showed no differences in the HRQoL of patients and their RRT type, which was perhaps related to differing demographic characteristics such as age and sociocultural aspects, as well as the better autonomy of patients on PD in our study. Overall, our results were similar to those using similar functional tests and questionnaires published in the related literature. However, there were differences in the tests we used to assess functional capacity, the

Table 4. Functional Capacity, Strength, Health-Related Quality of Life, and Depressive Symptoms.

	Total	Hemodialysis	Peritoneal dialysis	*p* value
Physical function				
STS10 (s)	31.3 (24.9–44.0)	30.4 (24.2–44.7)	33.9 (27.1–42.8)	.431
6MWT (m)	352.5 (287.7–449.5)	361.5 (289.2–466.5)	328.5 (283.0–434.7)	.619
SPPB (points)	9.0 (6.0–12.0)	9.0 (7.0–11.0)	8.0 (6.0–11.0)	.902
Gait speed (s)	4.6 (4.3–5.0)	4.5 (4.2–5.1)	4.6 (4.3–5.0)	.940
STS5 (s)	15.0 (11.9–20.7)	14.7 (11.7–20.9)	15.0 (12.7–20.1)	.908
Strength				
HG (kg)	24.0 (18.0–33.2)	23.2 (18.2–33.7)	24.0 (18.0–30.7)	.592
Physical activity level				
HAP (points)	49.0 (38.0–64.75)	45.0 (37.0–66.0)	55.0 (38.0–62.0)	.513
Quality of life (EuroQol 5D)	66.0 (51.5–85)	66.0 (47.0–86.0)	67.0 (55.7–77.2)	.807
Mobility	2.0 (1.0–2.0)	1.0 (1.0–2.0)	2.0 (1.0–2.0)	.293
Personal care	1.0 (1.0–1.0)	1.0 (1.0–1.0)	1.0 (1.0–1.2)	.699
Daily activities	1.0 (1.0–2.0)	1.0 (1.0–2.0)	1.0 (1.0–2.0)	.466
Pain/discomfort	1.0 (1.0–2.0)	1.0 (1.0–2.0)	1.5 (1.0–2.0)	.843
Anxiety/depression	1.0 (1.0–2.0)	1.0 (1.0–2.0)	1.0 (1.0–2.0)	.945
Health visual scale	60.0 (48.0–80.0)	60.0 (40–80)	60.0 (50–70)	.783
Depressive symptoms				
Beck	9.5 (5.2–14.7)	9.0 (6.0–15.0)	11.0 (5.0–16.0)	.740

Note. Hemodialysis $n=35$ and peritoneal dialysis $n=17$. STS = sit-to-stand-to-sit test; 6MWT = 6-min walking test; SPPB = short physical performance battery; HG = dominant arm handgrip strength; HAP = human activity profile; s = seconds; m = meters.
Statistical significance: $^{*}p \leq .05$.

questionnaire used to assess HRQoL, and how we used the HAP to assess the physical activity levels of the two RRT modalities.

The novelty of our study is that we analyzed for the first time whether the functional capacity of patients with CKD-5D differed according to patient physical activity levels and their RRT modality.

The main limitations of our study were its small sample size and the non-homogeneous size of the HD versus the PD groups. Another limitation is that verbal report of physical activity is not always accurate. Use of an objective measure like accelerometers or pedometers may be more accurate. In contrast, its strengths were that we did not discriminate against participants based on their age and that we avoided bias as much as possible by having the same nurse (who had 10 years of experience in collecting functional variable data in renal patients) to record all the measurements.

Lastly, our work highlighted the need for comprehensive assessment of renal patients. Our data suggest that a questionnaire such as the HAP can discriminate against patients with better or worse functional capacities. This would allow clinicians to intervene to direct certain patients toward exercise programs that could help to maintain their independence. Because the results for patients on HD or PD were similar, identical outpatient programs could be implemented for both populations. In conclusion, the HAP is an easy-to-use questionnaire that could be a useful tool both for primary care and nephrological nursing staff. We were able to use the HAP to discriminate between patients with better or worse functional capacities (as confirmed by functional testing) independently of the patient RRT modality, making it a very helpful tool for the detection of patients at risk of fragility.

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