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Evaluate of the Physical Performance of Patients Undergoing Hemodialysis

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Abstract
Background: Chronic kidney disease (CKD) is a worldwide health burden with high costs to the health system. It is associated with increased morbidity and mortality as well as a reduced quality of life. With the increase in the number of maintenance hemodialysis patients, debilitating conditions of muscle wasting and atrophy have become one of the biggest concerns for patients with CKD.
Objectives: The present study aimed to measure the physical performance level of patients with end-stage kidney disease and undergoing regular hemodialysis through using a short physical performance battery (SPPB) scale.
Methods: A descriptive design study (cross-sectional) was conducted on participants selected from the Dialysis Kidney Unit at Al-Sadder Medical Hospital in Al-Najaf City in order to achieve the study aim. The period of study is from 20th December 2020 to 28th February 2021. A non-probability (purposive sample) technique was used consisted of (62) patients who are medically diagnosed with CKD and undergoing hemodialysis included in the present study. The data were collected using a questionnaire consisting of three parts, including socio-demographic, clinical data form, and short physical performance battery (SPPB) scale.
Results: Show that there is a significant difference between means throughout three periods of test-1 (6.10), test-2 (6.16), and test-3 (5.40) at P=0.024, that the levels of all of the physical performance are below the predicted levels at the baseline assessment and they still deteriorate even at the third assessment The results indicated that the poor physical performance of patients suffer from chronic kidney disease and undergoing hemodialysis treatment.
Conclusion: Patients with end-stage kidney disease and undergoing hemodialysis have a low level of physical performance. This result is related to the physical activity regarding the population on hemodialysis, not being related to the demographic and clinical data evaluated.
Keywords: Assessment, Physical activity, ESKD and Hemodialysis, Physical performance

Introduction

Patients with chronic kidney disease (CKD) present with multiple and stressful symptoms, and the number and severity of these symptoms have been described as being comparable to those of hospitalized cancer patients in palliative care settings (Davison et al. 2021). CKD is one of the chronic conditions and major public health problems; it's referred to as an umbrella term describing kidney damage or a decrease in the glomerular filtration rate (GFR) that lasts for three months or more (Himmelfarb et al. 2020). The challenges behind chronic diseases; the patient still suffers from them for a long time. Furthermore, it requires ongoing long-term management (WHO 2015).

The global burden of chronic renal failure is increasing, and it is projected to become the 5th most common cause of years of globally life by 2040 (Reese et al., 2020) , accounted for by 77.5% of patients with CKD in the end-stage on renal replacement therapy (RRT), with 43.1% alone provided by hemodialysis (Khor et al. 2020). Hemodialysis and transplantation cost about 2–3% budget of the annual health care in high-income countries; spending on less than 0.03% of the total population of these countries in low-and middle-income countries, most people with renal failure don't get enough access to life-saving dialysis and kidney transplantation (Hostetter et al. 2020; Stanifer et al. 2016). Hemodialysis forms 89% of the global treatment for patients with end-stage kidney disease (ESKD).

The most common end-stage kidney disease complications include: anemia, bone disease, cardiovascular disease, and fluid buildup (Kielstein and Marcus 2014). In addition, sleep disturbances, fatigue, and sexual dysfunction are also CKD (Urquhart-Secord *et al.*, 2016). These problems may impair the patient's ability to carry out activities of daily living.

The burden of physical inactivity and poor physical performance among patients with CKD and hemodialysis, in particular, is a known global and multifactorial problem (Manfredini and Lamberti 2014). The World Health Organization, reported that "physical inactivity is already a major global health risk and prevalent in both industrialized and developing countries, causing approximately 5.2 million deaths. Physical inactivity is the primary cause of most chronic diseases, and it is one of the fourth main risk factors of CKD" and resulting in 6% of all-cause death globally (CDC, 2019).

Physical activity is very important in today's world. Exercise keeps the body strong and healthy (National Kidney Foundation 2020). Thus, increasing physical activity is an essential aspect of disease prevention and management in patients with CKD (Kirkman et al., 2014). The "National Institute for Health and Care Excellence" "NICE" recommends in guidelines for CKD in adults the following: Encourage people with CKD to take exercise, stop smoking and achieve a healthy weight (Robinson-Cohen et al. 2010). Physical activity enhances

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various metabolic benefits that may moderate and reduce the long-term risk of kidney dysfunction progression (Heiwe and Jacobson 2019).

Considering that patients with chronic renal disease who are undergoing hemodialysis therapy deal with many comorbidities associated with a sedentary lifestyle, it is important to assess their level of physical activity to develop strategies to encourage and monitor it, especially during the hemodialysis period.

Study objective: The current study aimed to an assessment of the patient's physical performance level who have chronic kidney disease and undergoing hemodialysis through using a short physical performance battery (SPPB) scale.

Methodology

Design of study: A descriptive design (cross-sectional) study was used through the present study to an assessment of the physical performance of patients with chronic kidney disease among patients treated in Al-Sadder Medical Hospital in Al-Najaf City during a period of the study is from 20th December 2020 to 28th February 2021.

Selection of Participants: According to the American Society of Nephrology and "National Kidney Foundation" (NKF), chronic kidney disease diagnosis clinical practice guideline (Andrew et al. 2015), patients eligible were recruited to participate in the current study (62 participants were selected randomly from each center, "Al-Sadder Medical City"/ Hemodialysis Center) who admitted there during the time of the study period. Those patients were diagnosed with end-stage renal disease undergoing hemodialysis, meeting the inclusion criteria for participation.

Study setting: The study was conducted in Al-Najaf City / Al-Najaf Health Directorate /Al-Sadder Medical City (specialized center for kidney transplantation and nephrology disease).

Sample and Sampling Technique: utilized a non-probability (purposive sample) technique, selected of (62 patients) are included in the current study. All patients are medically diagnosed with end-stage kidney disease and receiving hemodialysis. Those were subjected to the following: taking a medical history and complete a clinical examination.

Criteria for Sample Inclusion: The researcher used the following criteria for specifying the study subjects who are included in the study, patients out of these criteria are basically excluded:

1. All patients are diagnosed with chronic kidney disease and undergoing hemodialysis.
2. The age of all patients is 20 years and older.
3. Alert patients and free from any change in the level of consciousness because the study requires subjective measurements.
4. All patients are from the Iraqi Nationality because of the Iraqi society nature that differs from other cultures.
5. Medically stable patients as reported verbally by the physician; to avoid complications.

These specifications were determined with the help of subspecialty nephrologists.

Criteria for Sample Exclusion: Patients with end-stage renal disease who had absolute or relative contraindications to the physical performance test.

Sample Size: based on statistical power, in randomized controlled trials, statistical power is usually set to a number equal to or greater than 0.80, with many experts in clinical trials now advocating a power set of 0.90 (Sullivan 2015). But the researcher set the statistical power at 0.95 to reduce to 0.05 the possibility of a "false negative" result, and to increase the power of the study; the researcher increases the sample size to (58) participants, become the actual power 95%, to recruit this number of patients. The researcher depended on the confidence interval (0.95) to determine whether there was a considered statistically significant difference (p-value $\leq$0.05) for assessment of the physical performance.

Study Instrument: An assessment tool is adopted by the researchers based on the previous literature to measure physical performance for patients with CKD. The final instrument of study consists of three parts: Part I: patients' socio-demographic data, Part II: patients' clinical data, Part III: short physical performance battery (SPPB) measurement.

"This questionnaire information was gathered from multiple recent resources, including comprehensive clinical nephrology, Harrison nephrology, and recent studies about CKD".

Data Collection: Utilization of the interviews face-to-face for the socio-demographic. Regarding physical performance assessment, the researcher uses the guided observation technique to assess the patients' physical performance. The data collection method started from 21st December 2020 to 18th February 2021. The physical performance is assessed through the ask patient collected using the SPPB tool while the patients were closely monitored.

Each patient required a time between (5-10) minutes to answer the questions and checklist; the researcher has chosen the "short physical performance battery" (SPPB) tool as a performance-based measure of physical function. Because it uses simple equipment, requires little training to administer, and only takes a few minutes to complete.

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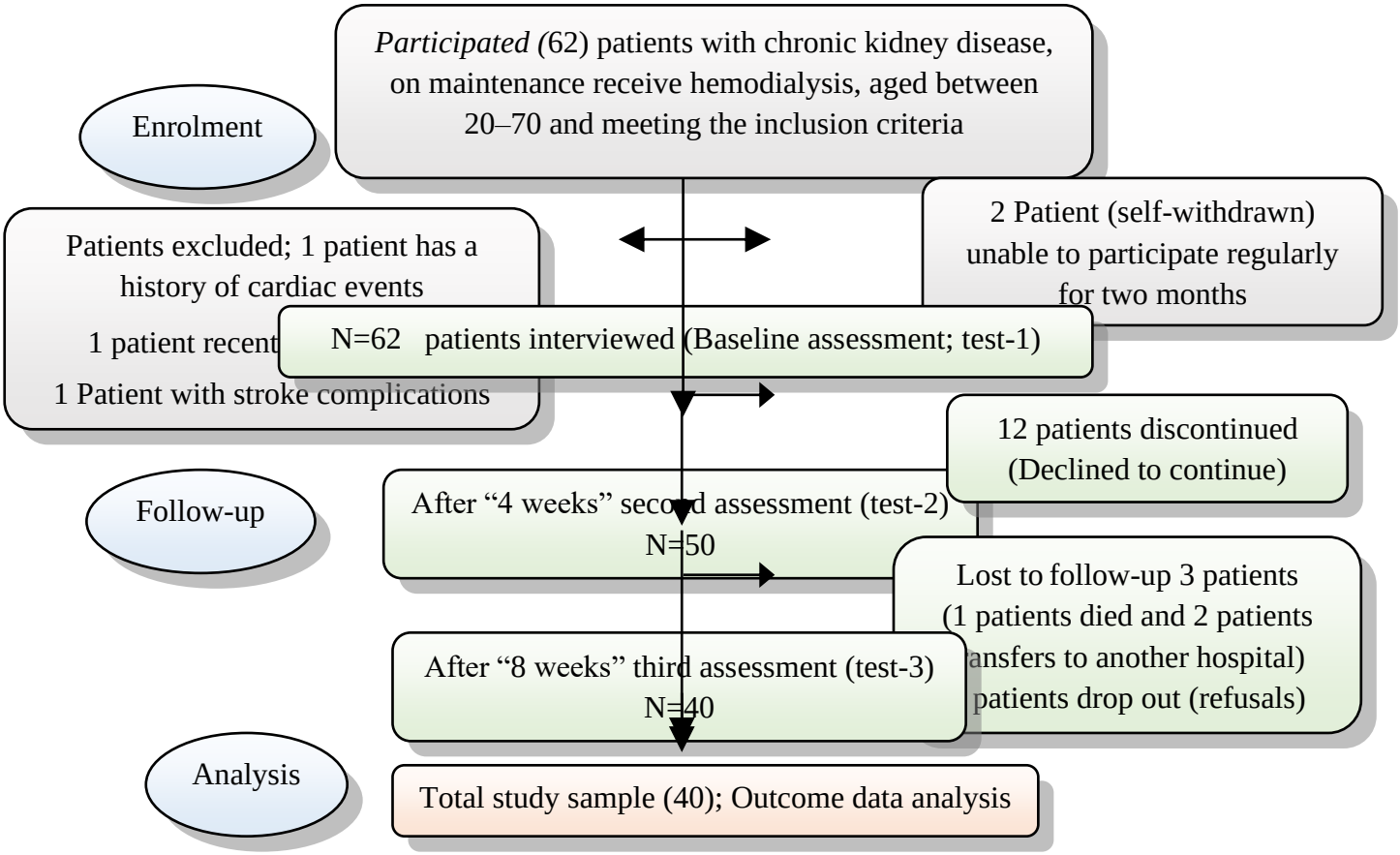

Figure (1): Participant's Flow Diagram

Physical Performance Measures: measured physical performance at baseline and two additional measurements four weeks "two months". It selected a two-month interval because the measurement tool was used in previous studies to identify physical functional changes among nursing home residents receiving hemodialysis. These studies recommended that there be an interval of at least one month between measurements. Two measures of physical performance were used with high test-retest reliability of the SPPB scale in the dialysis population to assess physical performance among older adults (Guralnik et al. 2000). The SPPB consisting three assessments (balance, 4-m gait speed, and chair stand tests); each test was scored on a scale of (0 to 4) points, based on ability to attempt the task or/and time to completion, for a total score ranging from 0 (worst) to 12 (best), using cutpoint criteria established by Guralnik et al., (1994) as follows: (0-6 points) low performance, (7-9 points) intermediate performance, and (10-12 points) high performance. No aspect of the test should be attempted unless both the examiner and the participant feel it is safe to do so (Stookey et al. 2014). The SPPB is a widely used test of physical performance among older populations, and it's widely used in both clinical and research settings also, it's a validated measure of lower extremity function in CKD and is predictive of disability, hospitalization, and mortality (Hargrove et al. 2019).

Statistical Analyses: In order to achieve the study objective, all continuous variables were tested for statistical normal distribution using the Shapiro–Wilk test and showed it distributed normally. The following approaches to statistical data analysis are used the Statistical Package for the Social Sciences (SPSS) version 23 and Microsoft Excel (2019). The analysis included two types of statistics: Descriptive data analysis; the sociodemographic variables were conducted through frequency distribution presented as tables, percentages, graphic presentation by using bar charts, and the participants' statistical mean and standard deviation were calculated. Inferential data analysis; according to the distribution and type of variables, statistical tests were applied, followed by the analysis of the association between the level of physical performance categorization and sociodemographic and clinical variables, using chi-square.

"This study was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies".

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Study results

Table (1) Summary Statistics of The Study Sample Socio-Demographic Data

Variables	Intervals and Rating	Frequency	Percentage
Age (year)	20 - 29	4	6.5
	30 - 39	10	16.1
	40 - 49	18	29.0
	50 - 59	18	29.0
	60+ and more	12	19.4
	$\bar{x}$ ± S.D.	48.83 ± 11.31	
Gender	Male	42	67.7
	Female	20	32.3
Education Level	Doesn't read and write	10	16.1
	Read and write	22	35.5
	Primary school graduated	16	25.8
	Intermediate school graduated	2	3.2
	Secondary school graduated	6	9.7
	Institutes, college, or postgraduate	6	9.7
Occupation Status	Governmental employed	10	16.1
	Own worker or self-employed	6	9.7
	Retired	2	3.2
	Housewife	18	29.0
	Jobless	18	29.0
	Disable	8	12.9
Monthly Income	Insufficient (Low)	34	54.8
	Sufficient to some extent (Moderate)	26	41.9
	Sufficient (High)	2	3.2
Total		62	100.0

$\bar{x}$: Mean; S.D: Standard deviation;

Socio-demographic characteristics of the participants:

Table (1) indicates the statistical distribution of the participants according to their socio-demographic data. Regarding the study sample, the study result indicates that most of the participants are 40-59 years old, mean age was 48.83 (SD, 11.31) years; male (67.7%), does read and write (35.5%), occupation status between a housewife (29.0%) and jobless (29.0%) and their income is insufficient (54.8%).

Table (2) Statistics Distribution of Participants According to Clinical Characteristic

Clinical Characteristic	Rating and interval	Frequency	Percentage
Period of Hemodialysis (Years)	less than or 1	8	12.9
	2 – 3	20	32.3
	4 - 5	26	41.9
	6 or more	8	12.9
Duration of hemodialysis session (Hours)	2.5	2	3.2
	3.0	30	48.4
	3.5	6	9.7
	4.0	24	38.7
Number of Hemodialysis Sessions (per week)	2	30	48.4
	3	26	41.9
	4	6	9.7
Duration of Diagnosis Renal Failure (years)	less than or 1	2	3.2
	2 - 4	28	45.2

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	5 or more	32	51.6
Smoking Habit	Smoker	12	19.4
	Ex-smoker	24	38.7
	Non-smoker	26	41.9
Total		62	100.0

Clinical characteristics of the participants:

Table (2) Shows the statistical distribution of the study sample according to their clinical characteristic; the study result indicates that the majority of the study subjects are; duration of hemodialysis between 4 - 5 years; three hours per session; two times hemodialysis session per week; duration of diagnosis renal failure 5 years and more; and non-smoker.

Table (3) Summary Statistics Overall Assessment of Physical Performance

Physical Performance Levels	Baseline assessment (test-1)		Second assessment (test-2)		Third assessment (test-3)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Low	40	64.5	28	56.0	30	75.0
Intermediate	20	32.3	20	40.0	8	20.0
High	2	3.2	2	4.0	2	5.0
Total	62	100.0	50	100.0	40	100.0

Low physical performance (0-6 points), Intermediate physical performance (7-9 points), and High physical performance (10-12 points).

Table (3) Shows the overall assessment of the physical performance among the study sample; the majority of them have a low physical performance at the baseline assessment (test-1), second assessment (test-2), and third assessment (test-3). That indicate that there is a non-improvement in the physical performance throughout three periods of measurements.

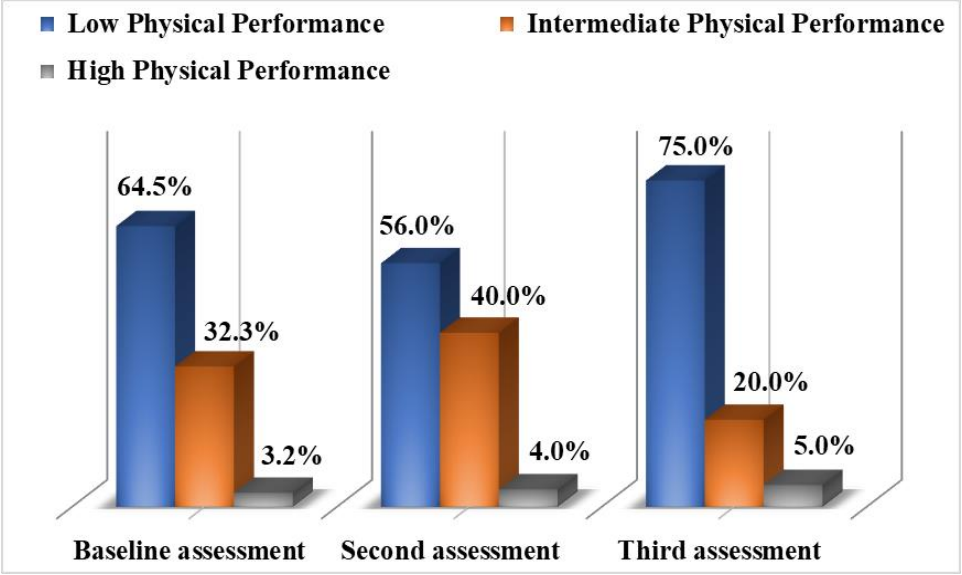

Figure (2) Overall Assessment physical performance throughout Three Periods of Measurements

Table (4) Applying One-Way Analysis of Variance Test (ANOVA) of Physical Performance throughout Three Periods of Measurements

Measurement interval	N	Mean	Std. Deviation	F-value	Sig.
Baseline assessment (test-1)	62	6.10	1.68	1.43	0.024 S
Second assessment (test-2)	50	6.16	1.65		
Third assessment (test-3)	40	5.40	1.60		

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N (number), F (ANOVA value); S: Significant

Table (4) Show that there is a significant difference between means throughout three periods of measurement baseline assessment (test-1), second assessment (test-2), and third assessment (test-3), that the levels of all of the physical performance are below the predicted levels at the baseline assessment and they still deteriorate even at the third assessment (i.e., there is deterioration in the physical performance of patients as long as they are undergoing hemodialysis).

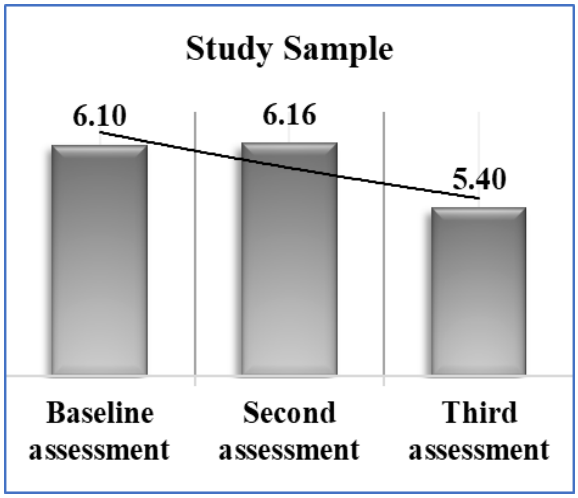

Figure (3) Overall Mean of Physical Performance Throughout Three Periods of Measurements

Table (5) Effect of Demographic Data on Patients' Physical Performance

Variable	Chi-Square Value	df	Sig. (P-Value)
Age (year)	10.37	8	0.24 NS
Gender	6.38	2	0.04 S
Level of Education	8.69	10	0.56 NS
Occupation status	13.35	10	0.20 NS
Socio-economic status	2.87	4	0.57 NS

***df: degree of freedom; S: Significant at P<0.05; NS: Non-significant**

The chi-square test is conducted to describe the association between the demographic data and patients' physical performance. The study findings presented in table (5) indicate that there is a significant association between the patient's gender. While there is a non-significant association with the other socio-demographic data.

Table (6) Effect of Clinical Characteristic on Patients' Physical Performance

Clinical Characteristic	Chi-Square Value	df	Sig. (P-Value)
Duration of Hemodialysis (years)	4.67	6	0.02 S
Hours of hemodialysis per session	2.14	6	0.90 NS
Number of hemodialysis session per week	1.78	6	0.93 NS
Duration of diagnosis renal failure	3.98	4	0.40 NS
Smoking habit	4.68	4	0.32 NS

***df: degree of freedom; S: Significant at P<0.05; NS: Non-significant**

The chi-square analysis is conducted to determine the association between the patients' physical performance and their clinical data. The study results presented in table (6) indicate that there is a significant

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association between the duration of hemodialysis (years) and patients' physical performance, while there is a non-significant association with the other clinical characteristic.

Discussion

Low physical performance is a common complication associated with CKD; low physical performance and impairment are associated with elevated risks of disability and death (Alkhaqani and Ali 2021). In addition, this concept has been expanded further to show that CKD is also associated with weak functional status (Shlipak *et al.*, 2004).

This descriptive study contributes to the overall objective of addressing gaps in present knowledge around the assessment levels of physical performance for patients with CKD. The outcome of the current study is to examine the physical performance level of patients with chronic kidney disease and receive hemodialysis. After implementation of the SPPB measurement through the present work, the study results indicated that a low level of physical performance is extremely common and often severe across diverse chronic kidney disease populations. Most patients who report physical performance level as either low (i.e., there is deterioration in the physical performance of patients diagnosed with chronic kidney disease and undergoing hemodialysis treatment).

The study results agree with several other studies. Araújo Filho et al. (2016), studied the "Physical activity level of patients on hemodialysis" they reported that individuals with chronic kidney disease undergoing hemodialysis therapy have a low level of physical performance. Most of the patients in this study were sedentary. Although the presence of fatigue and symptoms related to depression as likely potential causes for not performing physical activity due to changes in lifestyle, self-image, and chronic kidney disease, it is recognized that these factors may somehow contribute to a decrease in the level of physical performance among those on hemodialysis. A narrative review study have been conducted on the importance of physical performance in patients with chronic renal disease by Bakker et al. (2021), that entitled "assessing physical activity and function in patients with chronic kidney disease" they noted that the level of physical activity specifically, for those undergoing hemodialysis therapy, was lower than for healthy sedentary individuals. Patients who receive hemodialysis show markedly impaired physical performance, health, and functioning. In addition, Manfredini and Lamberti (2014), studied the "performance assessment of patient on dialysis" they stating regarding hemodialysis time and physical activity that there was no observed association between the number of years of the process of hemodialysis and physical functioning in patients with maintenance hemodialysis, most patients in this study were deterioration in the physical performance as long as continue undergoing hemodialysis.

The study results show there is a non-significant association between socioeconomic, demographic data, and other clinical characteristics. In contrast to the results seen in this study, França et al. (2009) found that persons with higher socioeconomic status were more inactive, and attributed this to the fact that persons from lower economic classes use active mobility more often, such as walking, which is a significant part of the overall physical activity for these people.

Low physical performance levels in patients undergoing hemodialysis may have a multifactorial cause, such as a state of chronic fatigue that occurs during hemodialysis, possibly because the metabolic clearance that can be provided through hemodialysis is greatly inadequate compared to normal renal function. In addition, patients often have multiple comorbidities, which lead to a lower general activity pattern, i.e., a more passive lifestyle. Additionally, protein-energy wasting often occurs in patients suffered from end-stage kidney disease, which is defined as an inflammatory condition that results to diminished muscle mass and strength, which can have a significant impact on physical capacity (Dam et al. 2019).

According to the study by Delgado and Johansen (2012), reported only a small proportion of nephrologists assessment of physical activity levels for their patients and provide them with guidance for the exercises. These authors noted that these professionals didn't direct their patients because they didn't feel confident in providing guidance on the subject, nor do they also didn't believe that patients undergoing hemodialysis would increase their physical activity level if they were asked to and did so. Consider exercise as important as other aspects related to chronic kidney disease.

Conclusions

The study has concluded that patients with end-stage kidney disease and undergoing hemodialysis have a low level of physical performance and deterioration as long as they are undergoing hemodialysis. This result is related to the physical activity regarding the population on hemodialysis, not being related to the demographic and clinical characteristics evaluated.

Recommends: The researchers recommend that comprehensive and longer follow-up population-based studies could be conducted to determine the physical performance of patients with chronic disease. Assessment of the physical capacity of patients with chronic disease or undergoing hemodialysis should be part of their routine management. This routine assessment of patients may allow stratifying risks of the patients (hospitalizations, complications of the peripheral disease, etc.) to identify patients' interest in receiving advice regarding the benefits of exercise into specific rehabilitation therapy programs. Incorporate routine assessment of physical activity and physical function into the clinical workflow, for example, by adding easy procedures of measures to the patient file.

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Limitation: The present study encounters some limitations, such as the dropout in the number of patients before they complete the study. A relatively short follow-up duration due to the limited study period is an additional limitation. One of the barriers to routine measurements is understanding which physical performance measures should be used in this population. Future studies should try to overcome these limitations.

Ethical Considerations: A legal, governmental agreement obtained the ethical study approval before conducting the study according to the standards for conducting research with human beings from the National Research Ethics Committee (NREC). The objectives of the study and participation right or withdrawal from the study were explained clearly to the study participants, and the participation was voluntary and signed an informed consent form.

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Conflicts of interest: Authors declare no conflict of interest.

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