Physical activity and quality of life in chronic kidney individuals

Atividade física e qualidade de vida em indivíduos renais crônicos

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ABSTRACT | INTRODUCTION: The changes imposed by kidney disease and its treatment negatively affect the quality of life of individuals with kidney disease. Physical activity is reported as a therapeutic alternative in this population; however, most patients undergoing hemodialysis have low levels of physical activity. **OBJECTIVE:** To verify the correlation between physical activity and quality of life in individuals with chronic kidney disease undergoing hemodialysis. **METHODS:** This study is observational, analytical, descriptive, and quantitative developed in one of the Hemodialysis Units in the Northwest region of Rio Grande do Sul, Brazil, in tertiary clinical care, during the period from November 2018 to February 2019. Individuals over 18 years old and undergoing hemodialysis for chronic kidney disease for more than three months; belonging to the hemodialysis service. Data collection was performed by analyzing clinical and electronic medical records and semi-structured interviews. Evaluation using pedometers and the Kidney Disease and Quality of Life Short-Form-KDQOL-SFTM questionnaire was used. Regression modeling analyzes were performed to test the association between the number of steps/day and the evaluated outcomes. RESULTS: 40 (Forty) patients were included in the sample, of which 70% are men, with a mean age of 59.9 ± 13.0 years. In the correlation between physical activity and quality of life, the number of steps / day had a significant correlation with the dimensions symptoms and problems (r=0,523;p=0,003), effects of the disease (r=0,458; p=0,010), sexual function (r=0,361;p=0,050), sleep (r=0,357;p=0,049), physical function (r=0,617;p=<0,001), physical role (r=0,504;p=0,004), pain (r=0,496; p=0,005), emotional well-being (r=0,407; p=0,023), emotional role (r=0,435;p=0,014), social function (r=0,522;p=0,003), energy / fatigue (r=0,436;p=0,014) and physical composition (r=0,598;p=<0,001). The sample profile variables did not correlate with the number of steps/day. **CONCLUSION:** There was a positive correlation between physical activity and quality of life; that is, the higher the average number of steps/day, the better the quality of life of individuals undergoing hemodialysis.

KEYWORDS: Chronic Kidney Failure. Hemodialysis. Physical activity. Health level. Disease Impact Profile.

RESUMO | INTRODUÇÃO: As alterações impostas pela doença renal e por seu tratamento interferem negativamente na qualidade de vida dos indivíduos com doença renal crônica. A atividade física é relatada como uma alternativa terapêutica nesta população, porém a maioria dos pacientes submetidos à hemodiálise apresentam baixos níveis de atividade física. **OBJETIVO:** verificar a correlação entre a atividade física e qualidade de vida em indivíduos com doença renal crônica em hemodiálise. **MÉTODOS:** Este estudo é observacional, analítico, descritivo e quantitativo, desenvolvido em uma das Unidades de Hemodiálise da região Noroeste do Rio Grande do Sul, Brasil, na atenção clínica terciária, durante o período de novembro de 2018 a fevereiro de 2019. Foram incluídos indivíduos maiores de 18 anos e em tratamento hemodialítico por doença renal crônica há mais de três meses, pertencentes ao serviço de hemodiálise. Os critérios de exclusão foram os indivíduos com diagnóstico de doença renal aguda; aqueles que apresentaram aparentemente dificuldades em compreender, responder ou que não realizaram completamente os instrumentos de avaliação propostos (qualidade de vida e pedômetros), indivíduos que no momento da avaliação não apresentaram condições clínicas estáveis. A coleta de dados foi realizada pela análise dos prontuários clínicos e eletrônicos e entrevista semiestruturada. Utilizou-se avaliação pelos pedômetros e pelo questionário *Kidney Disease and Quality of Life Short-Form-KDQOL-SF*™. Análises de modelagem por regressão foram realizadas para testar a associação entre o número de passos/dia e os desfechos avaliados **RESULTADOS:** Foram incluídos na amostra 40 pacientes, destes, 70% são homens, com média de idade de 59,9 ± 13,0 anos. Na correlação entre atividade física e qualidade de vida, o número de passos/dia teve correlação significativa com as dimensões sintomas e problemas (r=0,523;p=0,003), efeitos da doença (r=0,458; p=0,010), função sexual (r=0,361;p=0,050), sono (r=0,357;p=0,049), função física (r=0,617;p=<0,001), papel físico (r=0,504;p=0,004), dor (r=0,496; p=0,005), bem estar emocional (r=0,407; p=0,023), papel emocional (r=0,435;p=0,014), função social (r=0,522;p=0,003), energia/fadiga (r=0,436;p=0,014) e composição física (r=0,598;p=<0,001). As variáveis idade, índice de massa corporal, tempo de hemodiálise e sexo não apresentaram correlação com o número de passos/dia. **CONCLUSÃO:** Houve correlação positiva entre atividade física e qualidade de vida, ou seja, quanto maior a média de número de passos/dia melhor a qualidade de vida de indivíduos em hemodiálise.

PALAVRAS-CHAVE: Insuficiência Renal Crônica. Hemodiálise. Atividade física. Nível de Saúde. Perfil de Impacto da Doença.

Introduction

Chronic kidney disease (CKD) is progressive and irreversible and has a considerable impact on public health[1]. The data from the most recent Brazilian censuses are worrisome, demonstrating that this disease's incidence continues to grow[2]. CKD is complex and requires multiple, comprehensive interventions. The changes to the organism imposed by both the disease and its treatment exert a negative impact on the quality of life (QoL), affecting both biopsychosocial and contextual aspects[3]. Patients undergoing dialysis may have physical, psychological, and social limitations that affect their lifestyle beyond the clinical changes imposed by kidney disease and these limitations exert a considerable impact on the multidimensional concept of health-related QoL[4].

Physical activity is reported to be a low-cost, non-pharmacological therapeutic modality[5] that benefits cardiorespiratory function, improves QoL[6], and is a predictor of adverse clinical outcomes in patients with kidney disease[7]. Although most patients undergoing hemodialysis have low levels of physical activity[8], behavioral changes have a positive impact on the condition. If interactions among the individual, health team, and context promote healthy habits, behaviors, and actions, patients with kidney disease can have a longer life and are less vulnerable to the harmful effects of the complications the disease imposes and its treatment.

The present study hypothesized that a more active lifestyle is related to a better quality of life among individuals with CKD undergoing hemodialysis. Therefore, this study aimed to determine the correlation between physical activity and QoL as well as correlations between the number of steps per day and characteristics of the sample (age, body mass index, time on hemodialysis, and sex) in patients with kidney disease undergoing hemodialysis.

Methods

The present observational, descriptive, analytical, quantitative study received approval from the institutional review board of Universidade Regional do Noroeste do Estado do Rio Grande do Sul (UNIJUÍ) (certificate numbers: 3.012.096 and 90954218.6.0000.5350) following with the guidelines governing research involving human subjects stipulated in Resolution 466/2012 of the Brazilian National Board of Health.

The study was developed between November 2018 and February 2019 at a hemodialysis unit in the northwestern portion of the state of Rio Grande do Sul, Brazil, that offers care to approximately 160 individuals with acute and chronic kidney disease. The inclusion criteria were age 18 years or older and undergoing hemodialysis for CKD at the service for more than three months. The exclusion criteria were a diagnosis of acute kidney disease, difficulty understanding, answering, or completely performing the proposed evaluations (QoL questionnaire and pedometer), and unstable clinical condition at the time of evaluation.

After applying the eligibility criteria to all patients at a single hemodialysis unit, 40 individuals were selected to compose the sample (Figure 1). The data collection was performed by two physiotherapists who had undergone previous training to ensure standardization in the data collection process. Based on an analysis of the electronic and clinical charts, a semi-structured interview was designed to determine the characteristics of the sample, including the level of physical activity and quality of life.

The variables collected for the sample's characterization were age, sex, body mass index (BMI), time on hemodialysis, etiology of kidney disease, type of access, and absence/presence of pre-dialysis follow-up. Weight (kg) was determined using a portable scale and height (cm) was determined

using a portable stadiometer for the calculation of the (kg/m2). The quality of life was evaluated using the Kidney Disease and Quality of Life Short-Form (KDQOL-SFTM), which is a specific questionnaire that has been validated for use in Brazil and addresses important dimensions of the QoL of individuals with CKD. The questionnaire was administered during the hemodialysis session and is composed of the 36 items (eight domains) from the 36-Item Short-Form Health Survey (SF-36) plus 43 items (11 domains) specifically related to CKD and dialysis. The KDQOL-SFTM is self-administered and the final score ranges from 0 to 100, with higher scores denoting a better health-related QoL[9].

Physical activity level was measured by the number of steps taken per day using a pedometer, which is a device sensitive to body movements. The classification of physical activity level was suggested by Tudor-Locke[10,11]. The individuals received a pedometer (Omron Healthcare, model HJA-310, Kyoto, Japan) to continuously wear attached to the waist, except during bathing or activities that could wet or damage the device and while sleeping. The pedometer was given to the participant on a day of hemodialysis and collected at the following session. The average number of steps per day was determined, as the device records and reinitiates the count every 24 hours. No cutoff point was used for this variable.

Categorical variables were expressed as frequency and percentage. Numeric variables were expressed as mean and standard deviation (SD) or median and interquartile range (IQR), depending on the Shapiro-Wilk test results. Median and IQR were used for the time on hemodialysis and the number of steps/day. All other variables were expressed as mean ± SD. Regression models were created to test associations between the number of steps/day and the variables of interest. Spearman's correlation coefficients were calculated to determine the strength of correlations between the level of physical activity and the QoL dimensions. The level of significance was set at 5% (p < 0.05). The data were grouped, tabulated, and analyzed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 23.0.

Results

At the time of data collection, the service treated 60 individuals, 42 of whom were excluded: 10 died, six transferred to a different service, two received a discharge, six underwent intensive treatment, and 18 declined to participate in the study. Among the remaining 118 individuals, 78 answered the questionnaires and 53 agreed to use the pedometers. To meet the study objectives, a total of 40 patients with CKD undergoing hemodialysis who participated in the evaluation methods were included in the sample (Figure 1).

Table 1 displays the demographic and clinical characteristics of the sample. The mean age was 59.9 ± 13.0 years. Men accounted for 70% of the sample. The median time on hemodialysis was 34.5 months. The predominant etiology of CKD was hypertension plus diabetes mellitus (32.5%), followed by hypertension alone (30%). The median number of steps/day was 2690 (918 to 5009) (Figure 2).

The results of the linear regression analysis revealed that the number of steps/day was significantly correlated with the following KDQOL-SFTM dimensions: symptoms and problems (r = 0.523; p = 0.003), effects of the disease (r = 0.458; p = 0.010), sexual function (r = 0.361; p = 0.050), sleep (r = 0.357; p = 0.049), physical function (r = 0.617 ; p < 0.001), physical role (r = 0.504; p = 0.004), pain (r = 0.496; p = 0.005), emotional well-being (r = 0.407; p = 0.023), emotional role (r = 0.435; p = 0.014), social function (r = 0.522; p = 0.003), energy/fatigue (r = 0.436; p = 0.014) and physical composition (r = 0.598; p < 0.001). These data and data on the other dimensions are displayed in Table 2. No significant correlations were found between the number of steps/day and the characteristics of the sample (age, BMI, time on hemodialysis, female sex, or general health score on the KDQOL-SFTM) (Table 3).

The scores of each dimension of the QoL questionnaire are displayed in Table 4. The lowest QoL were found for work status, sexual function, and physical functioning dimensions, whereas the highest scores were found for cognitive function, social support, and encouragement from the dialysis staff.

Figure 1. Selection of patients at hemodialysis unit in northeastern portion of state of Rio Grande do Sul, Brazil, 2018-2019
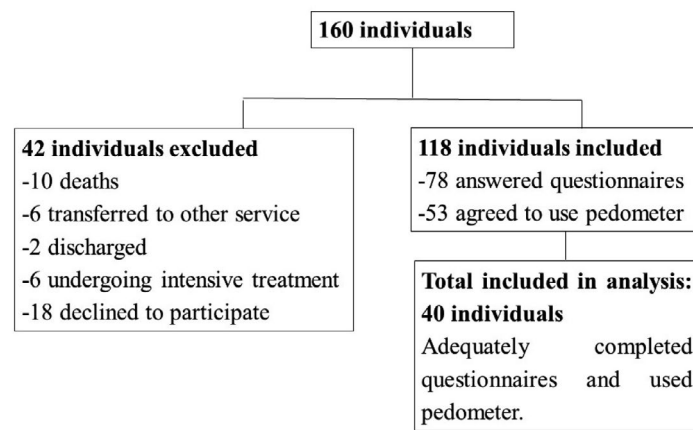
Figure 2. Number of steps per day among patients with chronic kidney disease undergoing hemodialysis

[**Steps/Day**]
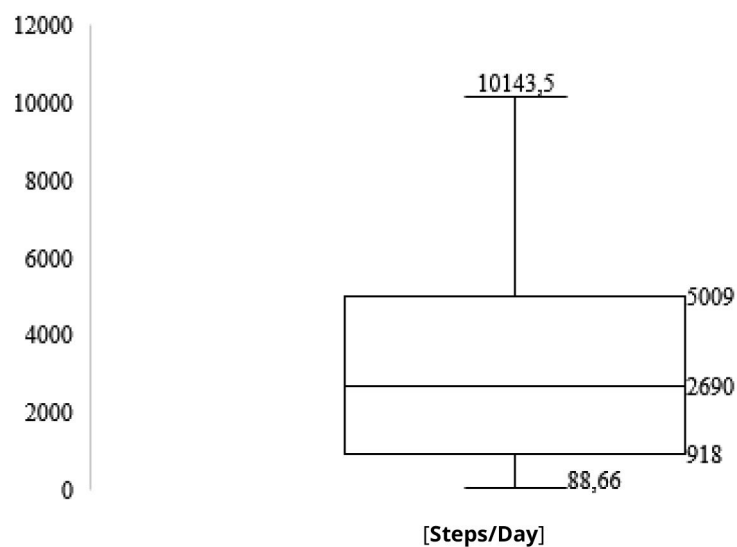
Table 1. Demographic and clinical characteristics of patients with chronic kidney disease undergoing hemodialysis (n = 40). Santo Ângelo, RS, Brazil (2018/2019)

Characteristics	Total (n = 40)
Age (years) (mean ± SD)	59.9 ± 13.0
BMI (kg/m^2) (mean ± SD)	26.7 ± 4.9
Time on hemodialysis (months) median (IQR)	34.5 (14.2 – 54.7)
Male sex, n (%)	28 (70.0)
Etiology of CKD, n (%)	
HAS	12 (30.0)
DM	6 (15.0)
HAS + DM	13 (32.5)
Polycystic kidneys	1 (2.5)
Not specified	3 (7.5)
Other	5 (12.5)
Type of access, n (%)	
AV fistula	28 (70.0)
Long-term catheter	12 (30.0)
Pre-dialysis follow-up, n (%)	24 (60.0)
N° steps/day	2690 (918 – 5009)

BMI: body mass index; CKD: chronic kidney disease; AV: arteriovenous; data expressed as mean ± standard deviation or median (interquartile range), as appropriate; IQR: interquartile range

Table 2. Correlation between number of steps/day and quality of life based on KDQOL-SF questionnaire among patients with chronic kidney disease undergoing hemodialysis. Santo Ângelo, Brazil (2018/2019)

Quality of life	Number of steps/day	
	r	p
Symptoms and problems	0.523	0.003*
Effects of disease	0.458	0.010*
Disease burden	0.332	0.068
Work status	0.287	0.117
Cognitive function	0.323	0.077
Social interaction	0.227	0.219
Sexual function	0.361	0.050*
Sleep	0.357	0.049*
Social support	0.037	0.843
Dialysis staff encouragement	0.138	0.458
General health	0.170	0.362
Patient satisfaction	-0.321	0.079
Physical functioning	0.617	<0.001*
Physical role	0.504	0.004*
Pain	0.496	0.005*
General health state	0.297	0.105
Emotional well-being	0.407	0.023*
Emotional role	0.435	0.014*
Social functioning	0.522	0.003*
Energy/fatigue	0.436	0.014*
Physical component	0.598	<0.001*
Mental component	0.346	0.057

* significant correlation: $p < 0.05$.

Table 3. Linear regression analysis for number of steps/day and characteristics of sample. Santo Ângelo, Brazil (2018/2019)

Variables	Univariate		
	B	P	95% CI
Age	- 14.1	0.788	-120.9 – 92.6
BMI	-156.6	0.262	-437.7 – 124.4
Time on hemodialysis	-43.6	0.089	-94.3 – 7.1
Female sex	-1513.5	0.305	-4476.6 – 1449.5
General health score - KDQOL-SF™	32.7	0.245	-23.7 – 89.2

BMI: body mass index; KDQOL-SF™: Kidney Disease and Quality of Life-Short Form; β: coefficient of model; CI: confidence interval.

Table 4. Quality of life using KDQOL-SFTM questionnaire of patients with chronic kidney disease undergoing hemodialysis. Santo Ângelo, Brazil (2018/2019)

KDQOL-SF™	Total (n = 40)
Dimensions specific to CKD	-----
1. Symptoms and problems	79.4 ± 15.2
2. Effects of disease	81.4 ± 16.8
3. Burden of disease	53.1 (25.0 – 67.2)
4. Work status	0.0 (0.0 – 50.0)
5. Cognitive function	93.3 ± 9.8
6. Social interaction	86.5 ± 15.1
7. Sexual function	25.0 (0.0 – 75.0)
8. Sleep	74.4 ± 17.6
9. Social support	93.7 ± 14.9
10. Dialysis staff encouragement	95.6 ± 10.8
11. Patient satisfaction	72.9 ± 18.4
Broad dimensions	----
1. Physical functioning	55.0 (26.2 – 75.0)
2. Physical role functioning	0.0 (25.0 – 75.0)
3. Pain	74.0 ± 23.4
4. General health state	37.7 ± 19.6
5. Emotional well-being	72.6 ± 23.0
6. Emotional role functioning	85.8 ± 31.9
7. Social role functioning	70.3 ± 26.8
8. Vitality	61.4 ± 22.6
Overall health	64.5 ± 21.1

KDQOL-SF™: Kidney Disease and Quality of Life-Short Form; data expressed as mean ± standard deviation or median (interquartile range), as appropriate.

Discussion

This study analyzed the correlation between physical activity and quality of life and correlated the number of steps/day with characteristics of the sample (age, body mass index, time on hemodialysis, and sex) in patients with chronic kidney disease undergoing hemodialysis. The patients were found to be insufficiently active and a positive correlation was found between the level of physical activity and the majority of QoL dimensions assessed using the KDQOL-SFTM. An insufficient number of steps per day was found for a physically active life[11]. The lowest QoL scores were found for work status, sexual function, and physical limitations, whereas the highest scores were found for cognitive function, social support, and encouragement from the dialysis staff.

The median number of steps was 2690. Older people and individuals with disabilities or chronic diseases are limited with regard to activities of daily living. Tudor-Locke[11] established approximately 5500 steps per day or 4600 steps/day in an average week for the classification of a non-sedentary lifestyle in this population. Therefore, the vast majority of the present sample had an insufficient number of steps for a physically active life.

The low level of physical activity has been described in previous studies, which report that the majority of patients with CKD are classified as sedentary and have a low functional capacity[12,13]. Kidney disease and dialysis favor a sedentary lifestyle and a reduction in physical fitness, which affect QoL[13] and lead to functional dependence[14], causing what is known as a "cascade effect". The regular practice of physical activity can contribute to a better perception of health-related QoL in patients undergoing hemodialysis, with benefits in all dimensions[15].

Physical exercise is considered to be important and a fundamental adjuvant in the treatment of CKD that is associated with improvements in both physical and mental aspects[16]. Johansen et al.[16] cite variables associated with a low level of physical activity, such as advanced age, the female sex, diabetes mellitus, atherosclerosis, and a low level of schooling. However, no significant correlations were found between the number of steps per day and the characteristics of

the sample in the present study. The only variable to approach a significant correlation was time on hemodialysis (Table 3). Cunha et al.[17] concluded that individuals on hemodialysis for more than 48 months had lower functional capacity compared to those undergoing treatment for a shorter period of time, which, according to Gomes et al.[18], also culminates in a low level of physical activity.

In the assessment of QoL, the lowest scores were found for physical limitations, work status, and sexual function, which consequently led to lower scores in the assessment of the overall health of the individuals. The physical component is often reported to be an important dimension related to low QoL scores[19]. Regarding work status, the complexity of the disease, diminished functioning, the aging process itself, and the fact that dialysis requires time may be factors that hinder individuals (retired or not) from exercising work activities, which explains the low score in this QoL item.

However, most dimensions on the questionnaire had a mean score higher than 60 points, which denotes a good quality of life[20]. The highest scores were found for cognitive function, social support, and encouragement from the dialysis staff. Grasselli et al.[20] also found good scores on social and staff support items, demonstrating the influence of personal relations on health issues. However, previous studies have found that the severity of the disease is associated with greater cognitive decline[21]. Thus, educational actions targeting self-care and independence on activities of daily living are important.

Individuals with kidney disease commonly have lower QoL scores compared to the general population. Moreover, low scores on the physical dimension of health-related QoL are considered predictors of death[22]. It should be pointed out that somatic complaints related to CKD can mimic symptoms of other diseases that end up affecting all QoL domains, especially depression[23].

The predominant etiology of CKD was hypertension plus diabetes mellitus. This finding is compatible with data from the Brazilian Dialysis Census[2] involving 291 kidney services, which found that 58% of individuals on dialysis in Brazil are men and 65.1% are between

45 to 74 years of age. Like previous censuses, hypertension and diabetes were the most common etiologies of CKD. What differed in comparison to the Brazilian census was BMI. The population on dialysis in Brazil mainly falls within the ideal range (18.5 to 24.9 kg/m2), whereas the mean BMI in the present sample was higher (26.7 ± 4.9 kg/m2), which may be related to regional characteristics.

Although the association between a good physical activity level and quality of life has been described in previous studies involving patients on hemodialysis[5-7], this association was shown scientifically in the present investigation using a pedometer, which is an assistive device that can facilitate the evaluation and follow-up of patients at hemodialysis services. The major limitation of the present study was restricting the analysis to a single regional center, which diminishes the power of generalization of the results. However, the general characteristics of the sample were similar to those found in the majority of studies in the literature involving patients with CKD undergoing hemodialysis.

Conclusion

A positive correlation was found between physical activity and quality of life in individuals undergoing hemodialysis, as those with a higher average number of steps per day had a better quality of life.

Authors' contributions

Cecconello L participated in the conception, design, search, and statistical analysis of the data, interpretation of the results, writing and proofreading the manuscript, and approved the final version to be submitted for publication. Morais EM participated in the data collection and revision of the manuscript and approved the final version to be submitted for publication. Scopel KRO participated in the conception, design, and revision of the manuscript and approved the final version to be submitted for publication. Stumm EMF participated in the proofreading of the manuscript and approved the final version to be submitted for publication. Moreira PR participated in the conception, design, interpretation of the data, writing, and revision of the manuscript and approved the final version to be submitted for publication. Winkelmann ER participated in the conception, design, statistical analysis of the data, interpretation of the results, writing, and revision of the manuscript and approved the final version to be submitted for publication.

Conflicts of interest

The authors declare no financial, legal, or political conflicts involving outside parties (government, private businesses and foundations, etc.) regarding any aspect of the work submitted (including but not limited to subsidies and funding, participation on a consulting board, the study design, preparation of the manuscript, statistical analysis, etc.).

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