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ORIGINAL RESEARCH

Level of Physical Activity and functional capacity of patients with pre-dialytic chronic kidney disease and in hemodialysis

Nível de atividade física e capacidade funcional de pacientes com doença renal crônica pré-dialítica e em hemodiálise

Nivel de actividad física y capacidad funcional de pacientes con enfermedad renal crónica pre-dialítica y en hemodiálisis

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ABSTRACT | The aim of this study was to compare the functional capacity (FC) and level of physical activity (LPA) of individuals with chronic kidney disease (CKD) in long-term hemodialysis (HD) treatment (G1); in short-term HD treatment (G2); in conservative treatment (G3), and individuals without CKD (G4). This was a descriptive cross-sectional study with a convenience sample. A total of 44 individuals were evaluated, 13 of G1 (50.6 ± 11.5 years), 9 of G2 (50.8 ± 19.01), 9 of G3 (42.8 ± 15.6), and 13 of G4 (49 , 2 ± 11.2). FC was assessed by the six-minute walking test (6MW) and the L PA by the IPAQ questionnaire. For statistical analysis in the comparison between groups, we used ANOVA One-way with Bonferroni post hoc. For categorical variables, the Chi-square test was used. A significant difference was found in the comparison of the 6MW walking distance between G1 and G4 (409.4 ± 108.1 x 571, 9 ± 31.5m; p = 0.001) and between G2 and G4 (422.6 ± 133.2 x 571.9 ± 31.5 m, p = 0.006). Similar results were observed for 6MW distance in prediction percentage. Regarding LPA, no significant differences were found between the groups and most individuals presented low levels. Therefore, it was concluded that individuals with CKD in HD treatment present reduction of CF when compared to people without CKD.

Keywords | Renal Insufficiency, Chronic; Renal Dialysis; Exercise; Walk Test.

RESUMO | O objetivo deste estudo foi comparar a capacidade funcional (CF) e o nível de atividade física (NAF) de indivíduos com doença renal crônica (DRC) em tratamento hemodialítico (HD) em longo prazo (G1); em curto prazo (G2); em tratamento conservador (G3) e indivíduos sem DRC (G4). Trata-se de um estudo transversal, descritivo, composto por uma amostra de conveniência. Foram avaliados 44 indivíduos, sendo 13 do G1 (50,6±11,5 anos), 9 do G2 (50,8±19,01), 9 do G3 (42,8±15,6) e 13 do G4 (49,2±11,2). A CF foi avaliada pelo teste de caminhada de seis minutos (TC6´), e o nível de atividade física pelo questionário IPAQ. Para a análise estatística na comparação entre grupos utilizou-se o *Anova One-way* com *post hoc* de Bonferroni. Para variáveis categóricas foi utilizado o teste de qui-quadrado. Foi encontrada diferença significativa na comparação da distância percorrida no TC6' entre G1 e G4 (409,4±108,1 x 571,9±31,5m; p=0,001) e entre G2 e G4 (422,6±133,2 x 571,9±31,5m; p=0,006). O mesmo ocorreu para valores da distância percorrida no TC6' em percentual do previsto. Quanto ao NAF, não foram encontradas diferenças significativas entre os grupos, e a maioria dos indivíduos apresentou baixo NAF. Dessa forma, conclui-se que indivíduos com DRC que realizam HD apresentam redução da CF quando comparados a pessoas sem DRC.

Descritores | Insuficiência Renal Crônica; Diálise Renal; Exercício; Teste de Caminhada.

RESUMEN | El objetivo de este estudio fue comparar la capacidad funcional (CF) y el nivel de actividad física (NAF) de los individuos con enfermedad renal crónica

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(ERC) en tratamiento de hemodiálisis (HD) a largo plazo (G1); a corto plazo (G2); en tratamiento conservador (G3) e individuos sin ERC (G4). Se trata de un estudio transversal, descriptivo, compuesto por una muestra de conveniencia. Se evaluaron 44 individuos, siendo 13 del G1 (50,6 ± 11,5 años), 9 del G2 (50,8 ± 19,01), 9 del G3 (42,8 ± 15,6), y 13 del G4 (49,2 ± 11,2). La CF fue evaluada por la prueba de caminata de seis minutos (PC6'), y el nivel de actividad física por el cuestionario IPAQ. Para el análisis estadístico en la comparación entre grupos, se utilizó el *Anova One-way* con prueba *post-hoc* de Bonferroni. Para las variables categóricas se utilizó la prueba de chi-cuadrado. Se encontró una diferencia significativa en la comparación de la distancia recorrida en el TC6' entre G1 y G4 (409,4 ± 108,1 × 571,9 ± 31,5m; p = 0,001), y entre G2 y G4 (422,6 ± 133,2 × 571,9 ± 31,5m; p = 0,006). Lo mismo ocurrió para valores de la distancia recorrida en el TC6' en porcentaje de lo previsto. En cuanto al NAF, no se encontraron diferencias significativas entre los grupos, y la mayoría de los individuos presentó bajo NAF. Por lo tanto, se concluye que individuos con ERC que realizan HD presentan reducción de la CF en comparación con personas sin ERC.

Palabras clave | Insuficiencia Renal Crónica; Diálisis Renal; Ejercicio; Prueba de Caminata.

INTRODUCTION

Chronic Kidney Disease (CKD) consists of changes in the renal systems, leading to the progressive, slow and irreversible loss of kidney function, which are essential organs for metabolic the metabolic and water-electrolyte balance of the organism[1,2]. The *Clinical guidelines for the care of the patient with chronic kidney disease – CKD* in the *Unified Health System*[3] recommend the classification into stages according to the glomerular filtration rate (GFR), which range from 1 to 5. In this last stage, patients with GFR<10ml/min/1.73m^2 shall initiate the renal replacement therapy (RRT).

According to the Brazilian Society of Nephrology, in 2014[4] about 91.4% of the people who needed RRT were submitted to hemodialysis (HD). The HD is usually performed three times a week, with duration of three to four hors per session, which leads to a routine with many restrictions and limits the activities of daily living from the moment the treatment starts[5]. This favors the reduction of functional capacity (FC)[6,7] and levels of physical activity (LPA), which in turn is related to a increased mortality in patients in HD[8].

In the literature, there is still no consensus whether is the CKD itself or the HD that contributes to the reduction of FC and LPA in these individuals and what are the long- and short-term effects of HD on these variables.

According to Aucella et al.[9], the reduction of LPA is present in any of the stages of CKD. Fassbinder et al.[10] reported that physical and functional changes occur in patients with CKD regardless of the treatment performed. The authors[10] compared the FC, evaluated through the six-minute walk test (6MW), of individuals with CKD in a conservative treatment with that of a group in HD, and observed that the CKD is the primary cause of FC reduction, regardless of the treatment performed.

On the other hand, according to Zhang et al.[11], patients with CKD presented changes in physical function arising from the disease; however, after initiation of HD, the patients also presented sarcopenia, intensifying the decline of physical function. In addition, other changes arising from the hemodialysis treatment are highlighted, such as fatigue, cramping, prostration, anemia, and depression[6,12]. In this context, Gomes et al.[7] demonstrated that patients in HD are 24% less active when compared to a healthy group, thus showing that HD is one of the main causes of LPA reduction. Furthermore, Cunha et al.[13] investigated the influence of HD time on the FC, evaluated through the 6MW, and observed that patients in HD for more than 48 months had a lower FC than those in HD for a smaller period, thus demonstrating the negative impact of the HD time on this outcome.

Therefore, there is still no clarity on the information from the literature about the moment when these individuals have a higher loss of the physical and functional condition. Given this context, this study aimed to verify the influence of CKD n the FC and relate it to the LPA and the time under hemodialysis treatment, as well as to compare these variables with those of patients in conservative treatment and healthy individuals.

METHODOLOGY

This research was a cross-sectional observational study, consisting of a convenience sample. The study was conducted in accordance with the Resolution No. 466/12

of the National Health Council[14] and was approved by the Ethics Committee in Research with Human Beings. All participants signed the informed consent form (ICF) prior to participation in the study.

Were selected individuals with more than 18 years of age, of both genders, who were divided into the following groups: G1 (patients with CKD who were in HD for more than six months); G2 (patients with CKD who were in HD for less than six months); G3 (patients with CKD who were under a conservative treatment, with disease staging between two and four); and G4 (individuals without CKD and non-practitioner of regular physical activity). Were excluded those who presented unstable angina, decompensated heart failure, uncontrolled systemic arterial hypertension, decompensated diabetes mellitus, chronic pneumopathy, disabling osteomyoarticular diseases, and difficulty in understanding.

Patients undergoing treatment in the nephrology clinic located in the Regional Hospital of Araranguá made up the G1 and G2; subjects within the G3 were recruited in the primary health units of the municipality of Araranguá; and the individuals in G4 were selected in the community, matching the patients from G1 in gender and age.

The anthropometric evaluation was performed through the measurement of body mass in kilograms (kg) and height in meters (m) for subsequent calculation of the Body Mass Index (BMI), in kg/m^2. Before the first weekly session of HD, there is a interdialytic period of three days, whereas in the other two sessions the interdialytic period is two days[15]. Accordingly, all measures of HD patients were collected before the second weekly session, due to the hypervolemia the patients present at the first session of each week[15].

The FC was evaluated through the distance walked in the 6MW, according to the American Thoracic Society[16]. In this study, a corridor of 25m was used. The values of distance walked were compared with the prediction equations of Britto et al.[17].

The LPA was evaluated through the questionnaire International Physical Activity Questionnaire (Ipaq), short version, created by the World Health Organization (WHO)[18].

For G1 and G2, two meetings were held. In the first, the study was presented, the ICF was signed and the clinical data was completed, with the application of the Ipaq questionnaire during the HD session. After seven days, the anthropometric evaluation and the 6MW were carried out. For G3 and G4, only one meeting was held, in which all evaluations occurred.

SAMPLING CALCULATION

The sampling calculation was performed considering the 6MW as the primary outcome. Data of mean and standard deviation of the study of Britto et al.[17] were used for healthy individuals, and those of Fassbinder et al.[10] for the group in HD, to calculate the effect size[19]. Considering the significance level of 5% and a power of 80%, it has been estimated that nine individuals per groups were required.

STATISTICAL ANALYSIS

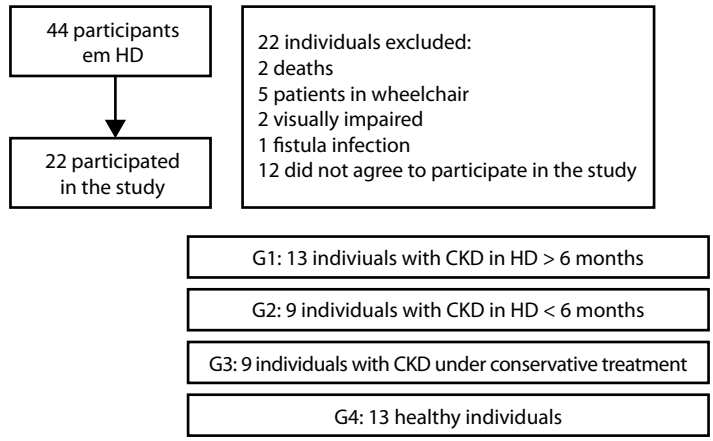
Data were analyzed through the Statistical Ultimate Academic for Windows and were expressed in descriptive statistics for the numeric variables and in relative and absolute frequencies for the categorical variables. For quantitative variables, the Shapiro-Wilk normality tests was performed. For the comparison between groups, we used ANOVA One-way with Bonferroni post hoc. For categorical variables, the Chi-square test was used. A value of $p<0.05$ was considered significant.

RESULTS

Of a total of 44 patients with CKD in hemodialysis treatment, 22 participated in the study, being 13 individuals in HD>6 months in the G1 and 9 individuals in HD<6 months in the G2 The G3 had 9 individuals with CKD under conservative treatment, and the G4 consisted of 13 healthy individuals. These and other information of the groups can be observed in Figure 1.

The anthropometric features of the four groups are presented in Table 1. No significant differences were observed between the groups regarding age, gender, and anthropometric variables. As predicted, the G1 and G2 showed a significant difference regarding HD time.

Results concerning the distance walked in the 6MW are presented in Figure 2. One can observe that there was a significant difference ($F=7.20$; $p=0.00056$) when comparing G1 and G4 ($p=0.001$) and G2 and G4 ($p=0.006$).



Source: Prepared by the authors (2018).

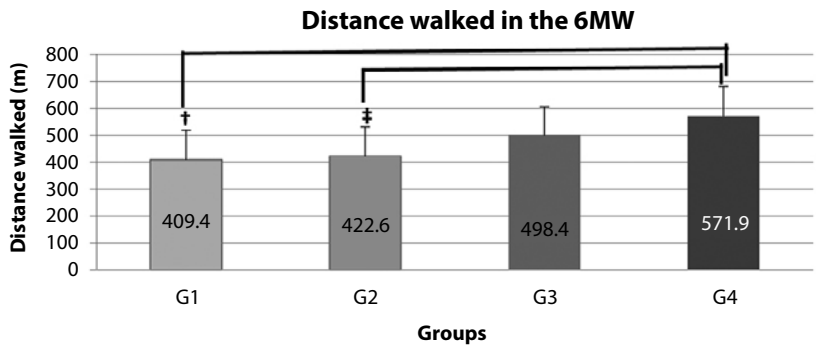
Figure 1. Flowchart of the selection process of the study participants

Table 1. Subjects characterization

Variable	G1 (n=13)	G2 (n=09)	G3 (n=09)	G4 (n=13)	P value
Age (years)	50.6±11.5	50.8±19.1	42.8±15.6	49.2±11.2	0.572
Gender (M/F)	5/8	4/5	4/5	5/8	0.984
Body mass (kg)	62.8±24.5	66.5±11.5	71.4±12.7	80.0±16.4	0.102
Height (m)	1.62±0.1	1.63±0.1	1.56±0.1	1.66±0.1	0.188
BMI (kg/m2)	24.0±2.8	24.8±2.9	29.3±5.4	28.5±3.5	0.073
HD time (months)	52.9±41.9	3.5±1.9	-	-	<0.001

Source: Prepared by the authors (2018).

HD: hemodialysis; M: male; F: Female; m: meter; kg/m2: kilograms per square meter; kg: kilogram. G1: CKD in HD>6 months; G2: CKD in HD<6 months; G3: CKD in conservative treatment; G4: healthy individuals.



Source: Prepared by the authors (2018).

G1: CKD in HD>6 months; G2: CKD in HD<6 months; G3: CKD in conservative treatment; G4: healthy individuals. m: meters. † p=0.001 G1 x G4. ‡ p=0.006 G2 x G4.

Figure 2. Distance walked in the 6MW in the four groups studied

In addition, the mean percentage values achieved in comparison with the expected in each groups were G1: 71.3±18.2%; G2: 73.2±24.3%; G3: 85.8±11.8%; and G4: 103.0±7.7%; also showing a significant difference when comparing G1 and G4 (p<0.0001) and G2 and G4 (p=0.001).

According to the LPA evaluation, as the Ipaq questionnaire, there was no significant difference between the groups through comparison of proportions (p>0.05) (Table 2). Whereas the LPA classification according to the WHO, most individuals presented a low LPA and there was no significant difference among the groups.

Table 2. Level of physical activity in the second Ipaq in the four groups

LPA	G1 (n=13)	G2 (n=9)	G3 (n=9)	G4 (n=13)
Low	9 (69%)	7 (78%)	7 (78%)	10 (77%)
Moderate	4 (31%)	2 (22%)	1 (11%)	2 (15%)
Intense	0 (0%)	0 (0%)	1 (11%)	1 (8%)

Source: Prepared by the authors (2018).

LPA: Level of Physical Activity G1: CKD in HD>6 months; G2: CKD in HD<6 months; G3: CKD in conservative treatment; G4: healthy individuals. Chi-square: p>0.05

DISCUSSION

In this study, it was observed that the HD interferes with FC, which was shown by a difference in the distance walked by individuals in HD in the 6MW, regardless of the time of initiation of this treatment, when compared to healthy individuals. These findings were not observed in patients with CKD under conservative treatment.

The reduction of FC in patients under HD showed in this study (71.3% in G1 and 73.2% in G2) was also observed by other authors[13,20,21] who used the 6MW, even though they used different prediction equations. In the study of Cunha et al.[13], 16 patients in HD reached 70.3% of the expected distance. Jatobá et al.[22] showed that the 27 individuals in HD investigated in their study reached 76.9% of the expected distance. Similar values were observed in the study of Baumgartem et al.[23], with 72% of the expected. In the study of Teixeira et al.[20], the percentage reached by these patients was even lower (63.7%).

As regards the comparison of FC of individuals under HD (G1 and G2) with that of patients with CKD under conservative treatment (G3), there was no significant difference, although one can observe that there is a decline in the distance walked as the disease progresses (G3 vs. G2/G1) and the HD treatment times increases (G2 vs. G1). These data corroborate the study of Fassbinder et al.[10], which demonstrated a reduction of FC y the 6MW of individuals in HD and in conservative treatment. The reduced FC is more evident when the results of patients in HD are compared with those of healthy individuals (G1/G2 vs. G4), highlighting that, regardless the RRT time, there is a reduction on the ability to perform exercises when compared to healthy individuals.

In the study by Coelho et al.[21], a control group and patients with CKD under conservative treatment were compared. It was demonstrated that the mean distance walked in the 6MW by the control groups was 724 meters, whereas in the groups with CKD it was 560 meters, showing a significant reduction of FC in patients with CKD. However, in this study, no significant difference was observed in this variable; nonetheless, the distance walked by patients with CKD under conservative treatment was also smaller than that of healthy individuals.

The comparison of FC between groups in HD for more than six months (G1) and less than six months (G2) did not show a significant difference; however, the FC of G1 was inferior to that of G2. In contrast, Cunha et al.[13] observed that patients in HD for more than 48 months had a greater FC than those in HD for a smaller period, as demonstrated by a smaller distance walked in meters in the 6MW.

Regarding LPA, most individuals, in all groups, showed a prevalence of low LPA. Concerning patients in HD, this data is also evidenced in the literature. Cavalcanti et al.[1] showed that, of the 101 individuals in HD evaluated, 79.2% had a low level of physical activity. Stringuetta-Belik et al.[24] evaluated the level of physical activity through the Ipaq questionnaire and concluded that 75% of the patients with CKD also presented a reduced physical activity. Yet, according to Zamojska et al.[25], the reduction of physical activity is common in patients in HD because the comorbidities arising from the disease and treatments, such as diminished muscle strength, cramping and fatigue, are constraints for the practice of physical activity.

This study has not evaluated the activities carried out in daily life, but, knowing that HD is a procedure performed in 3- to 4-hour sessions and brings several weaknesses related to the procedure, there is a trend of lower realization of physical activity during the day of HD. This reduction in the realization of activities is presented in the study of Gomes et al.[7], who compared the LPA of healthy individuals with that of patients in HD, by an accelerometer, and concluded that only the time spent lying was significantly higher in the HD groups in the RRT days.

Despite the fact this study have only selected healthy individuals who were sedentary, the literature shows that in patients with CKD under conservative treatment the LPA is reduced to approximately 75% in comparison with healthy individuals[26,27], something not observed in this study.

To our knowledge, this is the first study to compare patients in HD, patients with CKD under conservative treatment, and healthy individuals. Because of this, the data in the literature are scarce for a broader discussion on this topic.

Face these results, we perceive that there is a possibility of physiotherapeutic action in guiding, prescribing, and intervening on physical exercises that help the improvement of LPA and, mainly, the FC of patients with CKD.

We can list two major limiting factors in this study. The application of the questionnaire Ipaq may have limited the reliable verification of LPA because it may have occurred a great variability due to different factors, such as age, education, and capacity of the individuals to quantify daily activities. Another limiting factor was the recruitment of healthy and sedentary individuals for pairing with the HD group, isolating the real identification of LAP in this population.

CONCLUSION

Through this study, it was possible to observe that individuals with CKD featured reduced FC regardless of disease staging. Therefore, when the individuals with CKD who undergo HD were compared with healthy people, a smaller FC was observed. Regarding LPA, there was no different between the individuals studied.

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