Universidade Estadual de Londrina

JHENEPHAN MACEDO DA SILVA

COMPORTAMENTO SEDENTÁRIO, ATIVIDADE FÍSICA E TREINAMENTO RESISTIDO EM PACIENTES COM DOENÇA RENAL CRÔNICA EM TRATAMENTO HEMODIÁLITICO

Londrina
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Dissertação de Mestrado apresentada ao Programa de Pós-graduação associado em Educação Física UEL/UEM, como requisito à obtenção do título de Mestre em Educação Física.

Orientador: Prof. Dr. Crivaldo Cardoso Gomes Junior
Coorientadora: Prof[a]. Dr. Solange de Paula Ramos

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Londrina, 24 de outubro de 2019.

Dedico este trabalho à minha família que sempre me apoiou e me deu força.

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SILVA, Jhenephan Macedo. **Comportamento sedentário, atividade física e treinamento resistido em pacientes com doença renal crônica em tratamento hemodiálitico.** 2019. 29. Dissertação de Mestrado (Programa de Pós-Graduação stricto sensu em Educação Física UEL/UEM) – Universidade Estadual de Londrina, Londrina, 2019.

RESUMO

A doença renal crônica (DRC) caracteriza-se pela perda da função dos rins. O tratamento de hemodíalise é o mais indicado para esses pacientes. Apesar de indispensável para a sobrevida do paciente, o tratamento crônico associado com a DRC pode também ter efeitos colaterais, mesmo havendo muitas evidências negativas do efeito crônico da hemodíalise sobre a condição física do paciente, o efeito de uma única sessão de hemodíalise ainda não foi investigado. A inatividade física associada à DRC tem maior impacto na função física normal e está associada ao aumento do risco de mortalidade em pacientes em hemodíalise. O treinamento resistido em circuito (RCT) pré-dialítico apresenta vários resultados positivos para a saúde, indicando melhora na autonomia desses pacientes, entretanto, ainda não não se sabe se melhorando os indicadores de aptidão física e funcionalidade, pode-se modificar o padrão de comportamento sedentário ou atividade física de pacientes com DRC. Esta dissertação foi descrita em modelo escandinavo, com a produção de dois artigos. O objetivo do primeiro artigo foi avaliar o efeito de uma sessão de hemodíalise na função física de pacientes com DRC, para tal, foi realizado teste de caminhada de seis minutos pré e pós sessão de hemodíalise em dias aleatórizados em 10 pacientes com com tempo de HD de 7,4 ± 3,8 anos e perda de peso de -2,8 ± 0,5 kg por sessão, os resultados foram PRE-HD: FCinicial = 81bpm and FCfinal = 112 bpm *vs.* PÓS-HD: FCinicial = 80bpm and FCfinal = 97bpm , p = 0,774. No entanto, houve um aumento significativo na distância de caminhada após a hemodiálise PRE-HD *vs.* PÓS-HD = 20m, p = 0.004.O objetivo do segundo artigo foi avaliar e o efeito do RCT pré-dialitico no nível de atividade física, comportamento sedentário pacientes com DRC, para este, foi empregado um protocolo de 16 semanas de treinamento resistido em circuito e a utilização do acelerometro por 7 dias em 25 pacientes (CO = 12 e CTG = 13), adesão ao RCT foi de 64 ± 19% e obteve aumento na sobrecarga de 58,4% (p <0,040), não houve diferença significante NAF e CS após RCT (p>0,05). Conclui-se que uma sessão de HD melhora o desempenho físico ao 6MWT e RCT não foi capaz de modificar o comportamento dos pacientes.

Palavras-chave: Hemodiálise. Exercício Físico. Doença Renal Crônica. Funcionalidade.

SILVA, Jhenephan Macedo. **Hemodialysis and physical exercise: effects on chronic renal patients**. 2019. 29. Master's Dissertation (stricto sensu Post-Graduation Program in Physical Education UEL / UEM) - Londrina State University, Londrina, 2019.

ABSTRACT

Chronic Kidney Disease (CKD)is characterized by loss of renal function. Hemodialysis treatment is best suited for these patients. Although essential for patient survival, chronic treatment associated with CKD can also have side effects, although there is much negative evidence of the chronic effect of hemodialysis on the patient's physical condition, the effect of a single hemodialysis session is not being studied. CKD-associated physical inactivity has a greater impact on normal physical function and is associated with an increased risk of mortality in hemodialysis patients. Pre-dialytic resistance circuit training (RCT) has several positive health outcomes, indicating improved autonomy of these patients; however, it is not yet known whether improving physical fitness and functionality indicators can modify the pattern of sedentary behavior or physical activity of patients. CKD patients. This dissertation was described in a Scandinavian model, with the production of two articles. The aim of the first article was to evaluate the effect of a hemodialysis session on the physical function of patients with CKD. Therefore, a six-minute walk test was performed before and after the hemodialysis session on randomized days in 10 patients with HD time. of 7.4 ± 3.8 years and weight loss of -2.8 ± 0.5 kg per session, the results were PRE-HD: HR_{REST} = 81bpm and HR_{PEAK} = 112 bpm *vs.* POST-HD: HR_{REST} = 80bpm and HR_{PEAK} = 97bpm, p = 0,774. However, there was a significant increase in walking distance after hemodialysis PRE-HD *vs.* POST-HD = 20m, p = 0.004. *The objective of the second article was to evaluate and the effect of pre-dialytic RCT on the level of physical activity and sedentary behavior of patients with CKD. For this, a protocol of 16 weeks of resistance circuit training and the use of accelerometer for 7 days were used. In 25 patients (CO = 12 and CTG = 13), adherence to RCT was 64 ± 19% and increased overload of 58.4% (p <0.040), there was no significant difference in NAF and SC after RCT (p> 0.05). It was concluded that a HD session improves the physical performance in the 6MWT and the CRT was not able to modify the patients behavior.*

Keywords: *Hemodialysis. Physical Exercise. Chronic Kidney Disease. Functionality.*

LISTA DE ABREVIATURAS E SIGLAS

6MWT	6 Minute Walk Test (teste de caminhada de 6 minutos)
BMI	Body Mass Index (índice de massa corporal)
CaxP	Calcium Phosphorus Product (produto cálcio fósforo)
CEP-UEL	Comitê de Ética em Pesquisa Envolvendo Seres Humanos da Universidade Estadual de Londrina
CKD	Chronic Kidney Disease (doença renal crônica)
CO	Control Group (Grupo Controle)
CS	Comportamento Sedentário
CTG	Circuit Training Group (grupo de treinamento em circuito)
DRC	Doença Renal Crônica
ESRD	End-stage Renal Disease (doença renal em estágio final)
FC	Frequência Cardíaca
HD	Hemodialysis (hemodiálise)
HR	Heart Rate (frequência cardíaca)
KT/V	Dialysis Efficiency Index (índice de eficiência da diálise)
NAF	Nível de Atividade Física
PA	Physical Activity (atividade física)
PRU	Urea Withdrawal Product (produto de retirada de ureia)
RDC	Resolution of the Collegiate Board of Directors (resolução da diretoria colegiada)
RM	Maximum Repetition (repetição máxima)
SD	Standard Deviation (desvio padrão)
SPE	Subjective Perception of Physical Exertion (percepção subjetiva de esforço)
SUS	Sistema Único De Saúde
TFG	Taxa de filtração glomerular
RCT	Resistance Circuit Training (treinamento de resistência em circuito)
TGP	Glutamic Transaminase Pyruvic (transaminase glutâmica pirúvica)

SUMÁRIO

1 INTRODUÇÃO

A doença renal crônica (DRC) é caracterizada pela gradual e irreversível perda da função dos rins, que em estágio avançado não tem mais capacidade de manter a normalidade do meio interno do paciente[1]. A condição de função renal diminuída é constatada quando a taxa de filtração glomerular (TFG) é inferior a 60 mL/min por 1.73 m^2, marcadores de dano renal (albuminuria) ou ambos, perdurando por mínimo de 3 meses, independentemente da causa subjacente[2].

Esta doença se caracteriza como um problema de saúde pública, visto que o Censo da Sociedade Brasileira de Nefrologia (2019), estimou que em 2018 a prevalência da doença de 640 pmp (por milhão de pessoas) e incidência de 42.546 casos neste ano, apresentando alto nível de mortalidade, cerca de 19,5%. A DRC gera alto ônus econômico ao Estado, visto que o Sistema Único de Saúde (SUS) responsável por 80% dessa despesa, sendo 92,2% do custo somente com a hemodiálise.

A díalise é indicada para pacientes em fase terminal de insuficiência renal aguda ou crônica grave, com sintomas avançados de anemia, hipertensão arterial, edema, fraqueza, mal-estar e os sintomas digestivos[3]. A hemodiálise (HD) é uma terapia substitutiva para a função dos rins. O paciente é ligado a uma maquina que recebe o sangue do paciente através de um acesso vascular (fístula arteriovenosa ou cateter) e o sangue é bombeado para o dialisador (filtro de diálise) onde é exposto ao dialisato (solução de diálise) e através de uma membrana semipermeável, exerce a função renal, retirando o excesso de líquido e produtos finais de catabolismo, e devolve o sangue filtrado ao paciente pelo mesmo acesso. Precisa ser realizada de duas a quatro vezes por semana, e chega a durar de 3 até 5 horas[4].

O paciente não pode faltar as sessões, o tratamento é indispensável para a sobrevida do paciente, sem ele o acúmulo de fluídos e catabólitos provoca danos aos tecidos e sistemas. Por outro lado, o tratamento associado com a DRC pode também ter efeitos colaterais aos pacientes, prejudicando as atividades da vida diária, condição física e qualidade de vida de modo geral[5].

Os pacientes renais crônicos podem apresentar limitação funcional por diversos fatores decorrentes da própria doença e tratamento. Podem apresentar perda de massa magra progressiva por conta dos altos níveis de inflamação, dieta restritiva, comorbidades associadas que levam há um quadro de sarcopenia[6-7]. O quadro avançado de sarcopenia induzida pela DRC é conhecido com caquexia urêmica[7]. está associada com aumento da taxa de mortalidade e perda de desempenho físico[8] deste modo preservar a massa magra por meio de exercícios físicos é essencial para manutenção da qualidade de vida e preservação da sobrevida destes pacientes[7,9].Entretanto, os efeitos da hemodialise também estão associados com as limitações destes pacientes à prática de exercício, que ocorre em 75% dos pacientes em diálise peritoneal e hemodiálise, e está associada a sensação de cansaço, falta de folego e fraqueza crônica, hipo e hipertensão arterial, vômito e cefaléia[8,10].

Todavia, não somente as complicações da do tratamento e as limitações físicas causadas pela doença impedem o paciente de realizar exercícios ou atividades físicas, geralmente o paciente renal apresenta comportamento sedentário antes mesmo do desenvolvimento da doença e este fator pode ter sido inclusive um agravante ao desenvolvimento de suas comorbidades[11].O comportamento sedentário é um fator de mortalidade importante na população em geral e ainda mais grave nestes pacientes, agravando inclusive a caquexia urêmica, e aumentando ainda mais a mortalidade.

O comportamento sedentário e a inatividade física muitas vezes são confundidas e entendidas como uma única condição, entretanto, não são sinónimos, pois ambos apresentam respostas fisiológicas diferentes em relação à saúde, portanto, devem ser avaliados e interpretados de formas distintas[15]. O comportamento sedentário é definido por referir-se à atividades com baixo dispêndio energético, menor que 1.5 equivalentes metabólicos (METs)[15-16]. A inatividade é definida por não atingir as recomendações das diretrizes de saúde pública para os níveis de atividade física de intensidade moderada a vigorosa (AFMV)[17].

O exercício físico traz diversos benefícios à saúde, o treinamento resistidos de baixa intensidade e grande volume tem sido prescritos para esses pacientes afim de prevenir o avanço da atrofia muscular[9,12-13]. O treinamento em circuito é uma modalidade do treinamento resistido que consiste em levantar as cargas com o mínimo de descanso, podendo aumentar o consumo de oxigênio, ventilação pulmonar, força e capacidade funcional e ainda melhor a composição corporal por trabalhar capacidades condicionantes como resistência aeróbia[14]. Marcos-Pardo[18] concluiu em seu estudo que treinamento resistido em circuito está associado a um aumento significativo na força muscular e a capacidade funcional e melhora significante da composição corporal de idosos, porém, ainda não há evidências deste treinamento para pacientes com doença renal crônica em tratamento hemodialítico.

Apesar do exercício e a atividade física serem importantes para a sobrevida desses pacientes, encontrar o melhor horário para a prática ainda pode ser um desafio, visto que esses pacientes necessitam se submeter a várias sessões de hemodiálise semanais, e os horários de treinamento físico necessitam ser conciliados com o estado físico dos pacientes,[13] pois diversos efeitos são reportados pelos pacientes após sessões de hemodiálise, sendo os mais recorrentes a hipotensão arterial, vômito, tontura, cefaleia, sensação de fadiga e caimbras[10], sugerindo que o melhor horário para treinamento seja no período interdialítico, porém, não são conhecidos os efeitos agudos produzidos pelas sessões de hemodiálise sobre a capacidade do sujeito realizar exercício ou atividade física.

Considerando as lacunas do efeito agudo da hemodiálise e que os pacientes com DRC necessitam realizar exercícios físicos e deve ser conciliada com o tratamento de hemodiálise, esta dissertação tem como objetivo avaliar o efeito agudo da hemodiálise e o efeito crônico do treinamento em circuito sobre a capacidade física, nível de atividade física e comportamento sedentário de pacientes com DRC.

2 OBJETIVOS

Avaliar o efeito agudo da hemodíalise no desempenho funcional no teste de caminhada de seis minutos, e avaliar o efeito do treinamento resistido em circuito no nível de atividade física, comportamento sedentário de pacientes renais crônicos.

3 METODOLOGIA

A dissertação foi desenvolvida em modelo escandinavo, na qual foi produzida dois artigos.

A pesquisa foi realizada no Instituto do rim (HISTOCOM), na cidade de Londrina, Paraná, Brasil. Todos os voluntários a participar do estudo estavam em tratamento hemodialítico no local em questão. O estudo foi submetido à aprovação do Comitê de Ética em Pesquisa Envolvendo Seres Humanos da Universidade Estadual de Londrina (CEP-UEL), obteve sua aprovação mediante o parecer de número 1.863.432 e CAAE 61824916.0.0000.5231 (ANEXO A), todos participantes assinaram o Termo de Consentimento Livre e Esclarecido (APÊNDICE A).

4 RESULTADOS

4.1 Artigo 1

THE EFFECT OF A SESSION HEMODIALYSIS ON FROM 6-MIN WALK TEST.

ABSTRACT

Chronic kidney disease (*CKD) is characterized by loss of function of washes. Hemodialysis treatment is best suited for these patients. Although essential for patient survival, chronic CKD treatment can also have effects, even if it has negative effects on the chronic effect of hemodialysis on the patient's physical condition or the effect of a single hemodialysis session has not been investigated. Therefore, the aim of the study was to evaluate the effect of a hemodialysis session on the physical function of patients with CKD. To this end, a six-minute walk test was performed before and after the hemodialysis session on random days in 10 patients with a temporal course. 7.4 ± 3.8 years and weight loss of -2.8 ± 0.5 kg per session, the results were* PRE-HD: HR_{REST} = 81bpm and HR_{PEAK} = 112 bpm *vs.* POST-HD: HR_{REST} = 80bpm and HR_{PEAK} = 97bpm, p = 0,774. However, there was a significant increase in walking distance after hemodialysis PRE-HD *vs.* POST-HD = 20m, p = 0.004, *and a significant correlation was identified between PRU (R = 0.790, p <0.05) and KT / V (R = 0.790, p <0.05) In conclusion, this study demonstrates that a hemodialysis session increases walking distance and improves cardiac efficiency in the 6-minute walk test in patients with ESRD and that improved physical function is related. mainly to hemodialysis PRU and Kt/V*.

Keywords: chronic kidney disease; physical activity; cardiorespiratory fitness; dialysis; physical test; physical exercise

1 INTRODUCTION

Substitute renal therapy is the last-line treatment choice to end-stage kidney disease (ESRD) in order to partially replace renal function, alleviate the symptoms and increases patient survival, but does not promote the definitive remission of the disease[1]. Among the options for renal replacement therapy, hemodialysis (HD) mimics renal function through dialysis / capillary-driven blood passage that will remove toxins and excess of electrolytes and fluids, based on diffusion transfer processes that involves blood, dialytic fluid and ultrafiltration. HD solution composition may vary according to each patient's clinical circumstances, but presents as common components potassium, sodium, calcium, magnesium, chlorine, acetate, bicarbonate, dextrose and carbon dioxide[2].

Strategies for improving physical function are an adjunctive therapy in treating ESRD patients and is a key component to oppose the decline of important clinical outcomes, increasing survival,[3] reducing morbidity and hospitalization rates, and enhanced quality of life in ESRD patients under hemodialysis treatment. Thus, investigation of physical function in ESRD patients is gaining a widespread interest and the 6-minute walk test (6MWT) is a major physical test employed in these patients. Its value lies in the fact that it is as elf-paced test of walking capacity and reflects the functional ability at daily physical activities, which are mostly performed at submaximal level of exertion[4].

Briefly, the 6MWT evaluates the global and integrated responses of the organ systems involved during exercise, especially the respiratory, cardiocirculatory and neuromuscular systems. Beside this, the self-paced 6MWT assesses the submaximal level of functional capacity, once that most patients do not achieve maximal exercise capacity during the 6MWT, but they choose their own intensity of exercise and are allowed to stop and rest during the test[5].

Then, because most activities of daily living are performed at submaximal levels of exertion, the 6MWD may better reflect the functional exercise level for daily physical activities.

The functional limitation of the ESRD patients stems from the disease itself and its comorbidities, aggravating lean mass loss, inflammatory milieu and acid-base balance. In addition, HD itself also overcome above conditions and together with ESRD, both promote muscle injury (sarcopenia and diapenia)[6], generate discomfort related to physical exertion intolerance and increased fatigue, result in tiredness, weakness, hypertension and hypotension, vomiting and diarrhea, limiting the quality of life of these patients. Thus, the unambiguous and pressing duality of HD makes it necessary for life maintenance, but in long term seems to compromise the physical functionality of the ESRD patient.

After a session HD, patients commonly report reduced levels of physical functioning and severe debilitating symptoms such as muscle and joint pain, muscle weakness and fatigability, breathlessness, tiredness, lack of energy, etc. In theory, HD could contribute to better physical performance during the 6-minute walk test, once that expected to provide a more metabolically favorable environment with less body fluid overload. Therefore, it is important to investigate the effect of a session of hemodialysis on the performance of the 6-minute walk test, as this could help in understanding the impact of HD and, above all, in better monitoring the physical functionality of ESRD patients[7]. Based on the above, this study was designed to test the effect of a session of HD on physical function from 6-min walking test in ESRD patients.

2. MATERIAL AND METHODS

Design

This crossover study was a feasibility to evaluate the effects of a session hemodialysis on 6-min walk test performance. After preliminary measurements, eligible participants were enrolled in two experimental sessions conducted in a random order - pre or post hemodialysis, as shown in Fig. 1

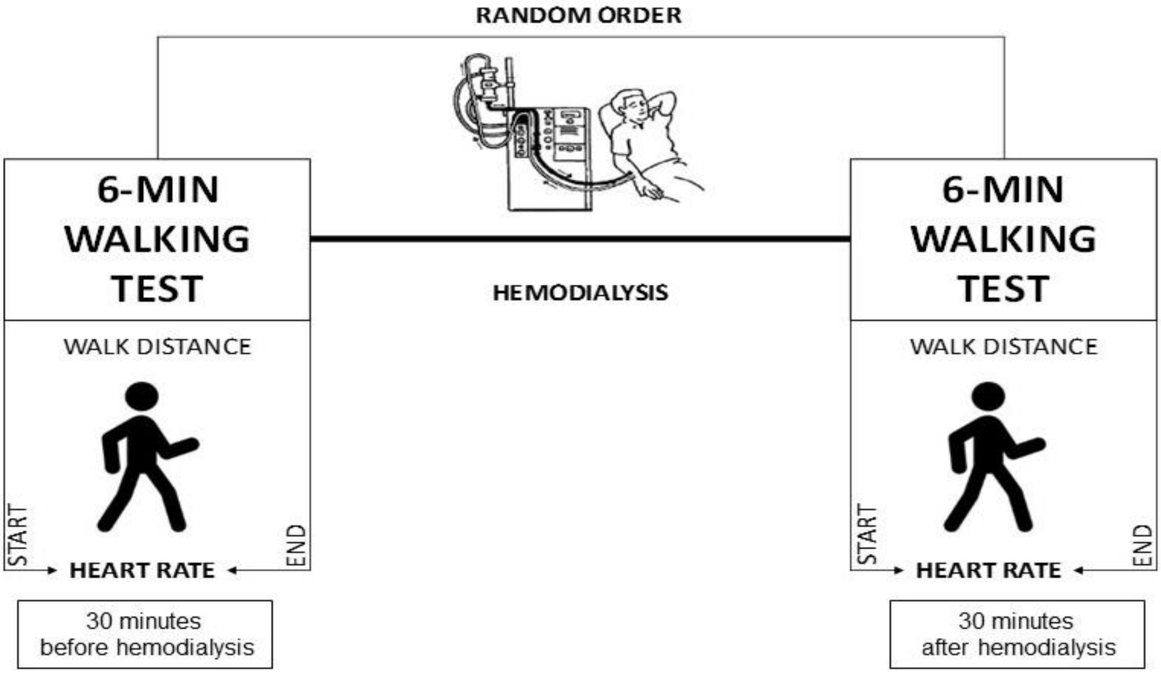

Figure 1. Experimental design of the study.

Participants

Participants were recruited from the hemodialysis (HD) unit at the Kidney Institute and HISTOCOM of Londrina (Brazil).

As ESRD affects different populations, including men and women, different age groups, individuals with several comorbidities and necessarily receiving drug therapies, this crossover study opted to enroll a comprehensive sample as a first approach to address the effect of a session of HD on walking distance, as well heart rate responses. Them, after screening and endorsement by the nephrologist, ESRD patients of both genders, aged from 18 years and hemodialysis by brachial arteriovenous fistula for at least one month preceding the study were invited to participate. Individuals who clinically decompensate, with inability to perform the functional tests or any health problem that precludes exercise were excluded.

The study followed the ethical standards of this journal and was approved by the local Ethics Committee (n °1.863.432 - CAAE 61824916.0.0000.5231). Each participant provided informed written consent before enrollment. The study protocol consisted of a preliminary evaluation followed by the experimental protocol.

Preliminary Evaluation

Firstly, we collect information about age, height and dry weight in medical records. Moreover, in the reference period of the functional test blood sample was collected from venous access for blood glucose, hematocrit, hemoglobin, iron, creatinine, calcium, pyruvic glutamic transaminase enzyme, parathyroid hormone, phosphorus and potassium. The calcium and phosphorus product (CaxP) was calculated.

After preliminary evaluation, participants were randomized to start into one of two experimental session (https://www.randomizer.org/). An external investigator generated the random numbers. The study was undertaken from October to Abril 2018.

6 Minutes Walk Test

The 6-minute walk test (6 MWT) was assessed 30 minutes before or after hemodialysis and it registered the maximal number of meters the participant was able to walk in a 20-m distance corridor, marked every 2 meters by adhesive tape. Heart rate (rest and peak) was recording by fistula palpation within 15 seconds. The cardiac efficiency index was calculated by the quotient between total distance traveled and HRpeak.

Hemodialysis

Patients were dialyzed on Fresenius Medical Care model 4008S or 4008B hemodialysis machines. The dialyzers used were Nipro Elisio-21M polypropylene hollow fiber synthetic, with pure water in the dialysate. Other characteristics such as (dialysis efficiency, treatment system, water quality and distribution, disinfection, re-use of capillaries, etc.) followed the norms contained in the Resolution of the Collegiate Board of Directors (RDC) No. 11, March 2014. The urea reduction percentage and Kt/V index were assessed to quantify hemodialysis efficiency.

Statistical Analysis

Considering an alpha error of 0.05 and a statistical power of 80%, a minimum of 10 participants were required. Paired T tests were used to compare the hemodialysis effects on the physical functional between the session. Pearson correlation was employed to related binary variables. The data are presented as mean (SD). Statistical analyses were performed using the excel for Windows. Statistical significance was set at $P < 0.05$.

3 RESULTS

The main etiological factors for CKD of the sample were arterial hypertension (n = 4, 30.8%), polycystic kidneys (n = 2, 15.4%), focal segmental glomerulosclerosis, glomerulonephite, bilateral hydronephrosis, systemic lupus erythematosus, diabetic nephropathy, primary membranous nephropathy and nephrotic syndrome (n = 1, 7.7%). Additional clinical information from anthropometric and metabolic data are shown in Table 1.

Table 1. Anthropometric and laboratorials data of the patients.

	Values
n, male/woman	10, 5/5
Age (y)	57.4 (11.6)
Heigth (m)	1.68 (0.10)
Dry Weigth	67.7 (12.1)
Dry body mass index (kg/m²)	23.8 (4.1)
Glycemia (mg/dL)	112 (18)
Hematocrit (%)	38.2 (5,3)
Hemoglobin (g/dL)	12.5 (1.6)
Iron	55.0 (12.3)
Calcium	8.4 (1.3)
Phosphate	5.9 (2.2)
Phosphate calcium product	49.4 (21.4)
Piruvic Glutaminic Transaminase	9.8 (3.4)
Parathyroid hormone	648 (785)
Creatinine	11.4 (2.3)
Potassium	6.7 (1.3)

Data are present as mean and standard deviation.

The mean hemodialysis time preceding the study was 7.4 ± 3.8 years. Hemodialysis lasted 3.5 ± 0.3 hours and promoted a weight loss of -2.8 ± 0.5 kg. The pre and post-hemodialysis urea concentration, as well the percentage of urea clearance were 158 ± 34, 51 ± 13 and 67.5 ± 4.7%, respectively. The KT/V index was 1.34 ± 0.18. The individual values of weight loss, percentage of uremic clearance and KT/V index of are shown in Figure 2.

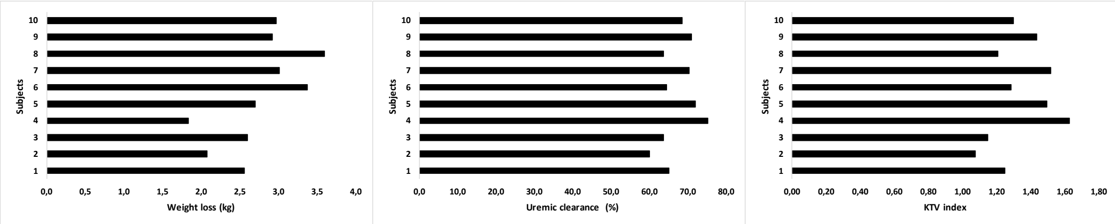

Figure 2 - Individual values of weight loss, percentage of uremic clearance and KT/V index during hemodialysis.

No statistically significant differences were found in the comparison of rest and peak heart rate values of the 6-minute walk test between pre- and post-hemodialysis experimental sessions PRE-HD: HR_{REST} = 81bpm and HR_{PEAK} = 112 bpm *vs.* POST-HD: HR_{REST} = 80bpm and HR_{PEAK} = 97bpm, p = 0,774. However, there was a significant increase in walking distance after hemodialysis PRE-HD *vs.* POST-HD = 20m, p = 0.004. The individual variation in walking distance, as well as in the cardiac efficiency index during the 6-minute walk test, both obtained by the difference between post and pre-hemodialysis values, are shown in Figure 4.

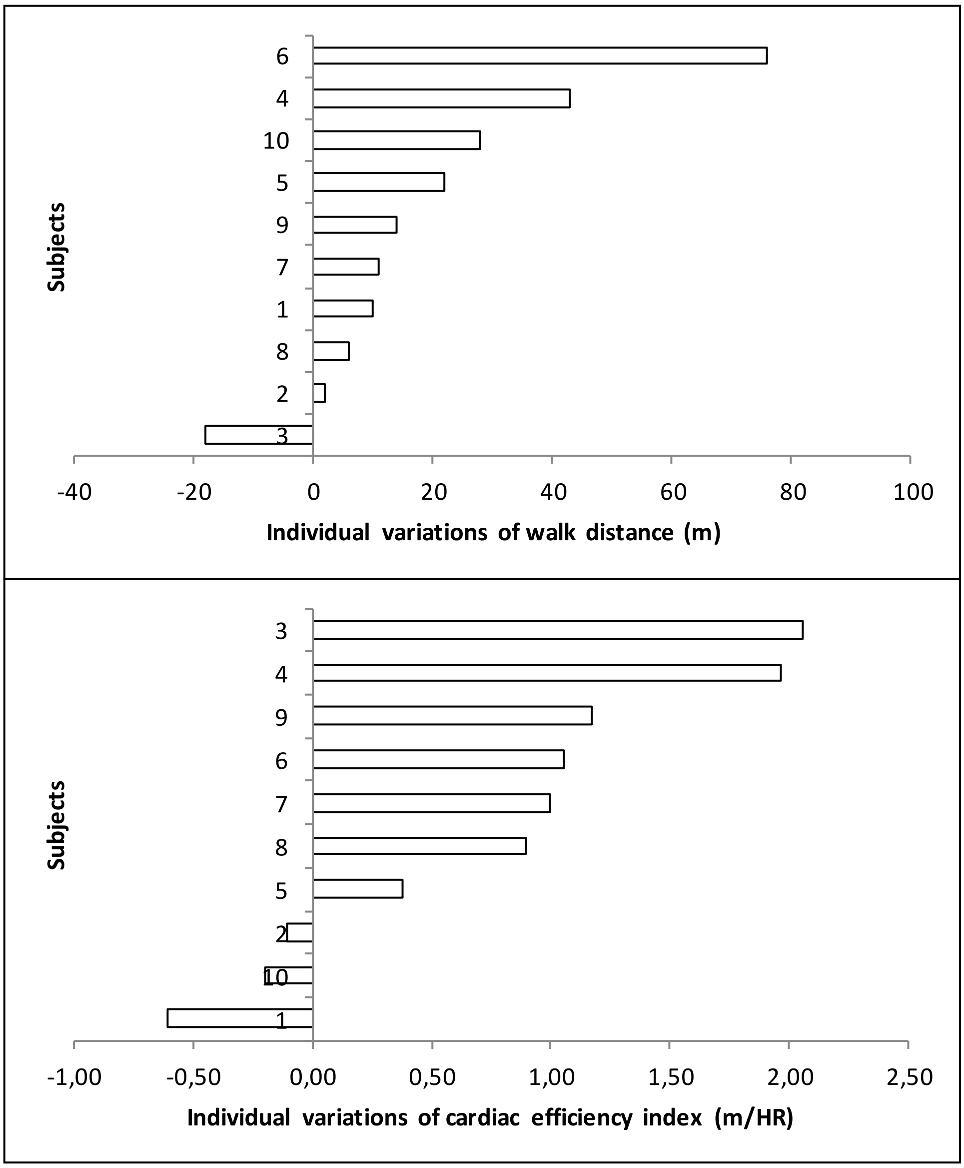

Figure 4. Individual difference between post and pre-hemodialysis values in walking distance and cardiac efficiency index of 6-minute walk test.

No statistically significant correlation was found between walk distance and clinical, and with weight loss or metabolic parameters. However, a correlation was found with PRU 0.790, $p < 0.05$) and KT/V ($R = 0.790$, $p < 0.05$).

4 DISCUSSION

The main findings of this study indicate that an hemodialysis session increases walking distance and improves cardiac efficiency in the 6-minute walk test.

The six-minute walk test (6MWT) is a submaximal test that assesses the functional exercise capacities of healthy subjects or those with a chronic disease, as well as the effects of interventions, such as pulmonary rehabilitation or drug therapies. It can predict prognosis, mortality and morbidity in adults with chronic diseases[8]. It is noteworthy that a significant relationship between 6MWT indicators in chronic renal individuals and VO2max, suggesting that the 6-min walk test is a trustworthy, safe and reliable submaximal cardiopulmonary assessment modality for assessing the functional capacity of ESRD patients[9]. Several studies show that ESRD patients under hemodialysis treatment present reduction in functional capacity, which may increase sedentary behavior and impair the development of basic activities, besides leisure, work and social life, deteriorating the quality of life[18-19] .

The prevalence of atrial fibrillation in ESRD patients is higher than in general population and associated with increased mortality, the hemodialysis procedure may be a trigger for atrial fibrillation and thus AF preventive measures should be introduced in dialysis patients[10]. In the present study there were no complications with the 6-min walk test that was reliable and well tolerated in both experimental situations (before and after hemodialysis), which favors its application as a low-cost tool to monitor functional exercise capacity in ESRD patients.

The functional exercise capacity depends on a perfect interaction between the respiratory and cardiovascular systems and peripheral muscles. ESRD patients have reduced exercise tolerance, which appears to be caused by a multifactorial condition such as anemia, metabolic acidosis, electrolyte disturbances, osteopathies, malnutrition, inactivity, uremic muscle dysfunction, and comorbidities related to CKD worsening[11]. Thus, hematocrit directly influences the active transport of oxygen and carbon dioxide in peripheral muscles and can affect the walked distance. However, our results demonstrate that there was no statistically significant correlation between the variations of walking distance with hematocrit or hemoglobin levels, in agreement with Canadian Erythropoietin Study Group[12] that appoint that exogenous erythropoietin increases the hemoglobin and hematocrit levels but does not affect the 6MWT walked distance. Therefore, it is possible that hemoglobin and hematocrit levels do not collaborate in predicting the 6MWT walking distance for non-anemic ESRD patients. Even anemia and pre-existing cardiovascular disease can also interfere with test performance[13]. On the other hand, a significant correlation was identified between PRU ($R = 0.790$, $p < 0.05$) and KT/V ($R = 0.790$, $p < 0.05$) with the variation in walking distance, this may be associated with the metabolic acidosis clearance mediated by hemodialysis contributes to an eventual increase in the arteriovenous oxygen difference and thus, at least in part, justifying the improvement in functional capacity after hemodialysis[14].

Matsuo[15] found that ESRD patients on chronic HD have a high prevalence of cardiac structural and functional abnormalities including calcified aortic sclerosis and highlighted that high age and PTH were associated with aortic valve narrowing in these patients. It is noteworthy that after the hemodialysis session, a reduction in LV diastolic diameter and an increase in wall thickness are common. Similarly, before hemodialysis there is LV dilation with eccentric hypertrophy, which will be "converted" to concentric after the hemodialysis session. This acute cardiac phenomenon triggered by hemodialysis refers to the effect of volume depletion triggered by ultrafiltration and as the main outcome an improvement in the contractile function of the heart. In fact, Nixon[16] verified a ventricular function curves plotted from altered cardiac filling volume before and after three dialysis maneuvers that ultrafiltration produced a pure Frank-Starling effect, while hemodialysis with or without volume loss produced a shift in the ventricular function curves, which results on improvement of the contractile state of the left ventricle. Thus, the changes in left ventricular function produced by regular hemodialysis are the combined effects of a decrease in end-diastolic volume and an increase in the contractile state of the left ventricle. In the present study, we found that the cardiac efficiency index improves after hemodialysis, which means that for the same distance covered there is a lower chronotropic requirement during the test. These findings corroborate the studies of Wallin[17] suggests that chronotropic incompetence may be the most important factor influencing exercise capacity in ESRD patients.

Although there are no data on the positive or negative effects of interventions on the 6MWT walked distances of CKD patients, the present study has demonstrated that the smallest detectable change is 19.4 ± 25.6 m. This suggests that interventions leading to a ~ 20 m gain in walking distance may result in an important outcome for this population.

A limitation of our study is the lack of a control condition or group, but we understand that the existence of a control condition (hemodialysis sham, for example) can be a matter of ethical incompatibility. Another important limitation concerns the absence of more precise techniques to evaluate the mechanisms that may explain the effect of a session on walking performance. Thus, we suggest a future studies in focus on the mechanisms behind the effect of a session on performance during 6 min walk test.

In conclusion, this study demonstrates that an the a session hemodialysis increases the walking distance and improves cardiac efficiency at the 6-minute walk test in ESRD patients and that physical function improvement is related mainly with the PRU and KT/V from hemodialysis. Furthermore, our recognized there is a possible change in left ventricular function as results of combined effects of a decrease in end-diastolic volume and an increase in the contractile state from hemodialysis.

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4.2 Artigo 2

PRE-DIALYSIS CIRCUIT-RESISTANCE TRAINING INCREASE STRENGTH, BUT DID NOT CHANGE SEDENTARY BEHAVIOR OR HABITUAL PHYSICAL ACTIVITY OF ESRD PATIENS

ABSTRACT

Chronic kidney disease (CKD) is characterized by loss of renal function. Hemodialysis treatment is best suited for these patients. CKD-associated physical inactivity has a greater impact on normal physical function and is associated with an increased risk of mortality in hemodialysis patients. Resistant circuit predialysis training (RCT) has several positive health outcomes, indicating greater autonomy of these patients. However, it is not known whether improving physical fitness and functionality indicators can modify the pattern of sedentary behavior or physical activity of patients with CKD. The aim of this study was to evaluate the effect of pre-dialytic RCT on the level of physical activity, sedentary behavior in patients with CKD. For this, a protocol of 16 weeks of resistance circuit training and the use of accelerometer for 7 days were used. In 25 patients (CO = 12 and CTG = 13), adherence to RCT was 64 ± 19% and increased overload of 58.4% (p <0.040), there was no significant difference in NAF and SC after RCT (p> 0.05). We conclude that 16 weeks of predialysis circuit endurance training increases strength but does not alter the sedentary behavior or habitual physical activity of patients with ESRD.

Keywords: physical exercise, resistance training, accelerometry, chronic kidney disease, hemodialysis

1 INTRODUCTION

The chronic kidney disease affects 11% to 13% in the worldwide[1]. In Brazil, 21 million inhabitants are affected[2] and 840,000 patients are in the final stages of this disease. Among them, 100,000 need renal replacement therapy and hemodialysis is the most recurring therapy[2]. The costs with the disease are very high and compromise 1.8% of the total health budget in Brazil[2-3]. In addition, the social burden of hemodialysis patients as well as their families is also high, as they need to reorganize their lives based on the days of hemodialysis sessions[4].

Physical activity is known to be protective against CKD risk factors such as diabetes, hypertension and cardiovascular disease[5] and exercise is recommended in management strategies for people diagnosed with CKD[6-7]. However, there are several factors promoting a sedentary lifestyle in patients on regular hemodialysis, such as anemia, functional and structural muscle abnormalities, uremia, inflammation, hyperparathyroidism, reduced secretion of testosterone, and malnutrition[8-12]. Indeed, these patients have a reduced aerobic fitness with a decreased peak oxygen uptake and skeletal muscle wasting. This wasting occurs due to factors such as aging, dietary intake, sedentary behavior, and comorbid illnesses[13-14]. Hemodialysis also induces significant metabolic changes such as hypovolemia due to ultrafiltration, rapid changes in electrolyte concentrations, and systemic inflammation, all of which can adversely affect physical function[15]. Moreover, the time spent in dialysis sessions makes these subjects less active in their daily lives than healthy individuals[16-17].

It is well-known that deconditioning associated with end-stage renal disease[18] arises from inactivity which has a major impact on normal physical function and will result in disability associated with an increased mortality risk in people undergoing hemodialysis[19-22]. However, in a previous study, we and others[16,23-24] confirm that pre-dialysis circuit-resistance training increases strenght and functionality, in regardless of any body composition modification[25], as well as self-esteem, quality of life and indicators of physical functionality of daily life for housework, self-care, work activities and mobility. Indeed, pre-dialisys circuit-resistance training increase cardiac autonomic modulation, reduce the casual systolic and diastolic blood pressure during hemodialysis and mitigate the rise of blood pressure during the sympathetic excitatory maneuver[26]. All toghether, our results suggest a positive effect of pre-dialysis circuit-resistance training on autonomy indicators of ESRD patients.

In a view of the promising effects of pre-dialysis circuit-resistance training on several positive health outcomes, it remains to be seen whether this training, especially by improving indicators of physical fitness and functionality, could contribute to modifying the pattern of sedentary behavior or physical activity of ESRD patients. Therefore, the aim of the present study was to test the effect of pre-dialisys circuit-resistance training on sedentary behavior and physical activity of ESRD patients.

2 MATERIALS AND METHODS

Subjects

Figure 1 shown the flowchart of the study participation. As ESRD affects different populations, including men and women, different age groups, individuals with several comorbidities and necessarily receiving drug therapies, the present study opted to enroll a comprehensive sample of patients on hemodialysis treatment at the HISTOCOM / Londrina Kidney Institute, PR - Brazil. As primary outcome, this non-randomized feasibility study was design to evaluate the effect of 16 weeks of pre-dialysis circuit-resistance training on sedentary behavior and physical activity in ESRD patients. Then, after screening and endorsement by the nephrologist, ESRD patients of both genders without health problem that precludes exercise, aged from 18 years and hemodialysis by brachial arteriovenous fistula for at least three month preceding the study were invited to participate and after preliminary measurements, eligible participants were enrolled in two groups (CO – control group and CTG – resistance circuit-training group). Exclusion criteria included dropout, clinical decompensation endorsement by medical team or change renal replacement therapy, such as peritoneal dialysis or kidney transplant.

The study followed the ethical standards of this journal and was approved by the local Ethics Committee (n °1.863.432 - CAAE 61824916.0.0000.5231). Each participant provided informed written consent before enrollment. The study protocol consisted of a preliminary evaluation followed by the experimental protocol.

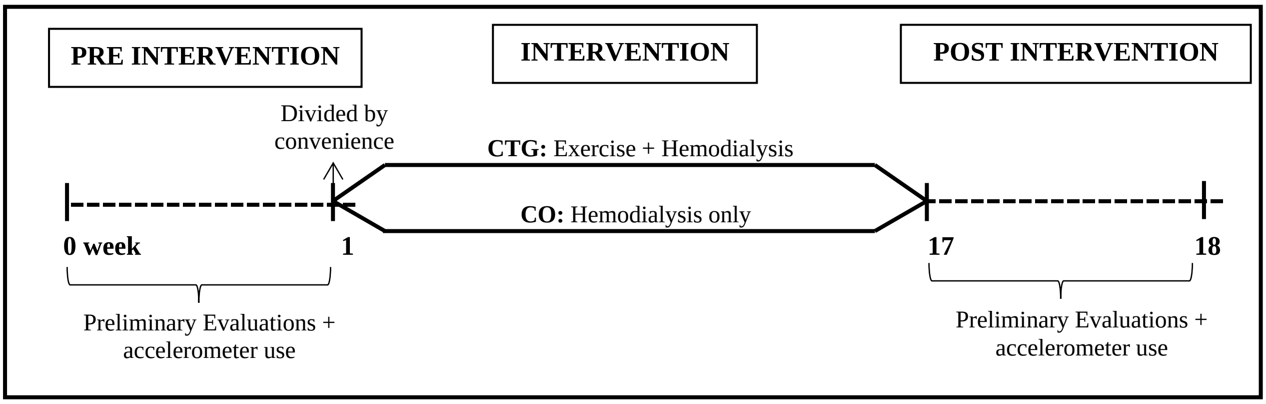

Figure 2. Overall Study Design.
Note: CO = control group; CTG = circuit training group.

Preliminary evaluation

Height was determined by a wall-mounted stadiometer (up to 2.5 m and 1 cm gradation) and body mass was measured by digital floor scale (Digi-Tron model DG-N display until 300 kg). Body mass index (BMI) was calculated by the quotient between body mass (kg) and the square of height (m). Blood samples were collected for hematocrit measurement, hemoglobin dosage, urea before and after the hemodialysis session, potassium, calcium, phosphorus, glutamic transaminase pyruvic (TGP) and creatinine.

Physical Activity and Sedentary Behavior

Habitual physical activity was measured using a GT3X accelerometer (Actigraph, Pensacola, Florida) over the right hip for 7 days, removing it for swimming or bathing. The device obtains objective information on physical activity patterns because it can continuously measure the intensity, duration, and frequency of activities. The accuracy and reliability of the instrument have been reported in previous studies[27-28]. The download and analysis process of the recorded data was performed by Actlife software version 5.0. Volunteers who had 8 hours of daily monitoring were included in the analyzes. Consecutive time of zero count (accelerometer raw data) was considered as the non-use period. Counts values were translated to PA minutes. The intensity of PA was categorized by the Freedson et al criteria (sedentary: 0 - 99, mild: 100 - 759, lifestyle: 760 - 1951, moderate: 1952 - 5724, vigorous: 5725 - 9498 and very vigorous: > 9499 counts / minute, respectively). Accelerometry recordings were performed one week prior to the interventions and replicated one week after the completion of the interventions.

Hemodialysis

Patients were dialyzed on Fresenius Medical Care model 4008S or 4008B hemodialysis machines. The dialyzers used were Nipro Elisio-21M polypropylene hollow fiber synthetic, with pure water in the dialysate. Other characteristics such as (dialysis efficiency, treatment system, water quality and distribution, disinfection, re-use of capillaries, etc.) followed the norms contained in the Resolution of the Collegiate Board of Directors (RDC), March 2014. The urea reduction percentage and Kt/V index were assessed to quantify hemodialysis efficiency. All participants attended hemodialysis by arteriovenous fistula with sessions 3x / wk, lasting 210 to 240 minutes, with a blood flow of 300 to 450 ml / min, dialyzed at 500 ml / min and dialysis temperature at 36ºC. However, those engaged in the control group underwent hemodialysis on Tuesdays, Thursdays, and Saturdays, while CTG participants on Mondays, Wednesdays, and Fridays.

Resistance Exercise Circuit Training

Resistance exercise circuit training was carried out within the facilities of the HISTOCOM / Londrina Kidney Institute, PR - Brazil, where there was a permanent presence of nurses and physicians, who provided all necessary clinical support and all exercise sessions were supervised by physical education professionals. Each PT session was split between warm-up, main part and back to calm. The warm-up lasted from three to five minutes and involved diversified exercise strategies to provide general (whole body) and specific warm-up (limbs that would be exercised on the day), favoring psychological, physiological and performance training during the session. In the main part, 10 exercises were prioritized in the following order: 1- fly with rubber bands, 2- leg extension using canle, 3 - row dumbbells, 4 - squat, 5 - french triceps, 6 - knee flexion, 7 - shoulder side lift, 8 - going up and down steps, 9 - biceps curl dumbbells, 10 – calf raise. These exercises were performed in circuit form. All exercises were performed using the subject's own body as resistance or with the help of free weights (dumbbells and anklets with load variations). Each patient went through the circuit three times performing a target zone of 12 to 15 repetitions (RM), always being asked to perform 15 repetitions when possible. The only exception was for calf exercise, where patients were encouraged to perform as many repetitions as possible within 30 seconds. The recovery interval between exercises and passages was 1 minute. After the 3 passes through the circuit, 3 sets of 30 seconds of adbominal exercises. Finally, in the return to calm, stretching exercises were used for neuromuscular and cardiorespiratory restoration.

Subjective perception of physical exertion (RPE) was used in the patients by applying the OMNI-RES scale[29] to ensure that loads were within the established range of 8 to 10. Whenever patients reported that the load was getting easy, and the SPE was below 8, load adjustments were made so that the overload remain within the SPE range of 8-10. If someday a patient reports some sort of tiredness (common in this population) and does not support the load normally worked, the load would be decreased for that day, and it would return to normality in the next session. The control group was advised the maintenance of daily living physical activities.

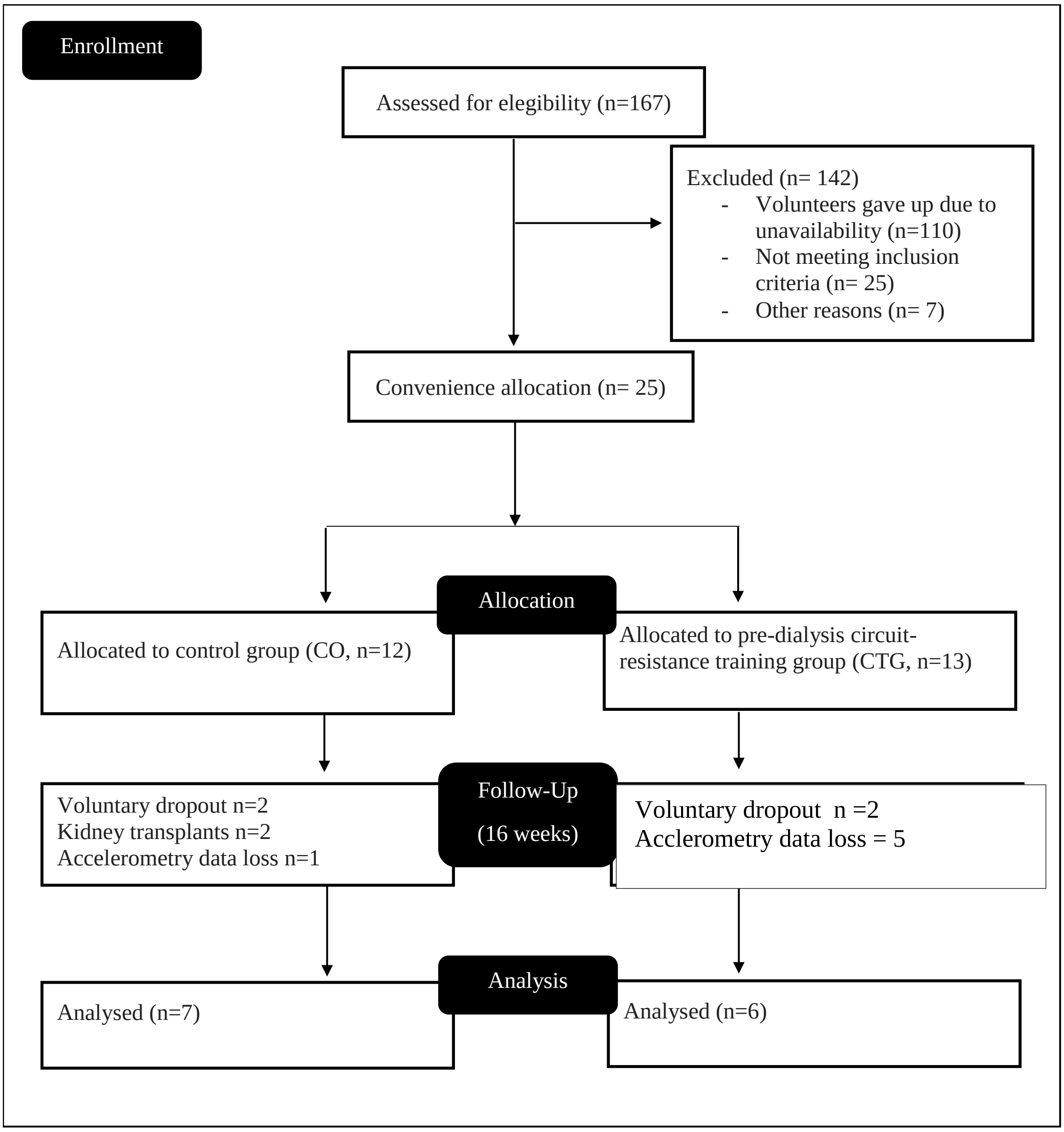

Figure 1. Study flowchart

Data analysis

After analyzing the assumptions of each statistical test the differences between groups at the pre-intervention time was employed paired bi-caudal T test. For any differences between groups and moments (pre and post intervention) a repeated measurement of 2-way ANOVA was used. For sedentary behavior and physical activity data analysis pre and post-intervention between groups and moments (pre and post intervention) a repeated measurements of 3-way ANOVA were employed.

3 RESULTS

The main etiological factors for CKD of the sample were arterial hypertension (n = 11, 44%), polycystic kidneys (n = 4, 16%), glomerulonephite (n = 4, 16%), diabetic nephropathy (n = 5, 20%), primary membranous nephropathy (n = 1, 4%), pyelonephritis (n = 1, 4%) and lithiase (n = 1, 4%). Additional clinical information from anthropometric and metabolic data are shown in Table 1.

Table 1. Initial Characterization of Subjects

	ALL (N=25)	CO (N=12)	CTG (N=13)	p - value
Age(years)	57 ± 11	55 ± 8	59 ± 6	0.345
Men	12 (48%)	6 (24%)	8 (32%)	
Women	13 (52%)	6 (24%)	7 (28%)	
Weigth (kg)	72 ± 18	71.8 ±17.3	72.2 ± 26.6	0.619
BMI (kg/m²)	27.5 ± 5.2	27.9 ± 5.9	27.2 ± 5.9	0.330
Laboratory Testes				
Hemoglobin (g/dL)	10.5 ± 1.2	10.2 ± 1.2	10.8 ± 1.8	0,564
Hematocrit (%)	31.2 ± 4.4	30.3 ± 3.8	32.1 ± 6.6	0,574
Calcium (mg/dL)	18.6 ± 1.2	8.5 ± 0.9	8.8 ± 2.4	0,819
Phosphor (mg/dL)	5.7 ± 1.6	5.2 ± 1.5	6.2 ±2.3	0,303
Calcium phosphor product (mg/dL)	49.9 ± 15.1	44.6 ± 15.5	55.2 ± 25.2	0,402
Pyruvic glutamic transaminase (U/L)	9.8 ± 3.1	9.0 ± 2.9	10.5 ±6.0	0,591
Interleukin-6 (pg.mL-1)	0.1216 ± 0.542	0.1201 ± 0.504	0.1321 ± 0.666	0.330

A significant differences were observed in the hemodialysis time preceding the intervention period between the groups (CO = 5 ± 2 *vs.* CTG = 8 ± 3 years, p= 0.019).

Throughout the intervention period, hemodialysis was fully performed on all participants who completed the study and no statistically significant differences were found for dialysis efficiency indicators Kt/V (COpre = 1.36 ± 0.13 *vs.* COpos = 1.34 ± 0.15 and CTGpre = 1.41 ± 0.26 *vs.* CTGpos = 1.41 ± 0.31, $p < 0.05$) and PRU (COpre = 68.5 ± 4.4 *vs.* COpos = 67.8 ± 4.5 and CTGpre = 68.9 ± 6.8 *vs.* CTGpos = 68.2 ± 7.0, $p < 0.05$).

Adherence to exercise sessions was 64 ± 19%. Over the 16 weeks of circuit resistance training the total overload increased 58,4% ($p< 0.040$) and creatinine levels were maintained (COpre = 10 ± 3.2 *vs.* COpos = 10.9 ± 4.6 and CTGpre = 11.9 ± 3.2 *vs.* CTGpos = 10.5 ± 1.9, $p=0.864$).

Table 2 present an average minutes of hour and respective percentages (Table 2) of sedentary behavior and physical activity at baseline.

Table 2. Sedentary behavior and physical activity at baseline (n= 25).

		All days	**Interdialytic days**	**Intradialytic days**	**Intradialytic days excluding hemodialysis**
Sedentary behavior	Min.	34 ± 5	32 ± 6	38 ± 5*	33 ± 6
	%	57.0 ± 8.7	53.1 ± 10.0	63.5 ± 8.2*	56.1 ± 9.6
PA light	Min.	20 ± 5	22 ± 6	14 ± 4*	19 ± 5
	%	32.7 ± 8.0	36.5 ± 10.1	26.0 ± 7.5*	31.4 ± 9.0
PA moderate	Min.	1 ± 1	1 ± 1	2 ± 1	1 ± 1
	%	1.5 ± 1.2	1.9 ± 1.6	0.9 ± 0.7	1.1 ± 0.9
PA vigorous	Min.	-	-	-	-
	%	-	-	-	-

* Statistically significant difference from interdialytic day, $p< 0.05$. PA – Physical Activity

No statistically significant differences were found for the effect of pre-dialysis circuit-resistance training on sedentary behavior and physical activity level during interdialytic days of ESRD patients, as present in Table 3.

Table 3. Effect of pre-dialysis circuit-resistance training on sedentary behavior and physical activity level during interdialytic days of ESRD patients.

		CO		**CTG**	
		PRE	**POST**	**PRE**	**POST**
Sedentary behavior	Min.	28 ± 7	29 ± 7	31 ± 5	30 ± 8
	%	47.5 ± 11.9	48.1 ± 11.8	51 ± 8.8	50.0 ± 12.6
PA light	Min.	24 ± 7	25 ± 8	24 ± 5	24 ± 6
	%	40.8 ± 10.9	40.9 ± 12.9	39.5 ± 7.7	40.6 ± 10.6
PA moderate	Min.	1 ± 1	1 ± 1	1 ± 1	1 ± 1

	%	2.2 ± 1.3	2.5 ± 1.5	1.8 ± 1.6	2.1 ± 1.7
PA vigorous	Min.	-	-	-	-
	%	-	-	-	-

PA – physical activity; CO – control group; CTG – pre-dialysis circuit-resistance training group

The effect of pre-dialysis circuit-resistance training on sedentary behavior and physical activity level during **i**ntradialytic days of ESRD patients are present in Table 4.

Table 4. Effect of pre-dialysis circuit-resistance training on sedentary behavior and physical activity level during intradialytic days of ESRD patients.

		CO		**CTG**	
		PRE	**POST**	**PRE**	**POST**
Sedentary behavior	Min.	37 ± 5	35 ± 4	37 ± 6	38 ± 4
	%	62.8 ± 6.5	57.6 ± 7.5	61.3 ± 9.7	63.3 ± 7
PA light	Min.	16 ± 3	19 ± 4	18 ± 5	16 ± 2†
	%	27.0 ± 6.4	31.0 ± 6.5	30.8 ± 8.8	27.0 ± 3.8
PA moderate	Min.	1 ± 1	1 ± 1	1 ± 1	1 ± 1
	%	1.2 ± 0.9	1.4 ± 0.9	1.1 ± 0.7	1.0 ± 0.5
PA vigorous	Min.	-	-	-	-
	%	-	-	-	-

PA – physical activity; CO – control group; CTG – pre-dialysis circuit-resistance training group
† Statistically significant difference from control group, $p < 0.05$.

The effect of pre-dialysis circuit-resistance training on sedentary behavior and physical activity level during intradialytic days of ESRD patients, with the hemodialysis period discarded, are present in Table 5.

Table 5. Effect of pre-dialysis circuit-resistance training on sedentary behavior and physical activity level during intradialytic days of ESRD patients, excluding hemodialysis time.

		CO		**CTG**	
		PRE	**POST**	**PRE**	**POST**
Sedentary behavior	Min.	32 ± 5	29 ± 5	33 ± 6	35 ± 4
	%	55.1 ± 7.8	48.2 ± 8.5	55.6 ± 10.5	57.5 ± 6.5
PA light	Min.	19 ± 4	23 ± 4	21 ± 6	19 ± 3†
	%	32.4 ± 8.3	38. 2 ± 7.3	35.4 ± 9.8	31.2 ± 4.4
PA moderate	Min.	1 ± 1	1 ± 1	1 ± 0	1 ± 0
	%	1.3 ± 1.0	1.8 ± 1.2	1.3 ± 0.7	1.2 ± 0.6
PA vigorous	Min.	-	-	-	-
	%	-	-	-	-

PA – physical activity; CO – control group; CTG – pre-dialysis circuit-resistance training group
† Statistically significant difference from control group, $p < 0.05$.

4 DISCUSSION

The main results of this study demonstrate that pre-dialysis circuit-resistance training: i) increase strength; ii) did not change sedentary behavior; and iii) decreases exposure time for light physical activity of ESRD patients.

Since Morris et al. (1980) it has been reported that physical inactivity exerts significantly related to mortality, particularly cardiovascular mortality[30] and that ESRD patients, especially undergoing in hemodialysis, have a cardiovascular condition mortality 10 to 30 times higher when compared to the general population[31-34]. Indeed, ESRD patients undergoing in hemodialysis are significantly less active than healthy sedentary adults[35-36].

In the present study, sedentary behavior took up 57.0 ± 8.7% of all activity logging time. Furthermore, our results and others[37] showed that ESRD patients to be significantly less active on dialysis days when compared with nondialysis days. However, whereas human behavior can represent a set of physical actions and emotions that are associated with an individual or even a social group, resulting from our responses to the most varied stimuli of daily life, both intrinsic and extrinsic origin. In front of this, it is not possible to admit that the movement limitation imposed by the hemodialysis session is regarded as a "behavior". Therefore, the present study was concerned with assessing sedentary behavior as well as physical activity, and comparing both inter and intradialytic days with and without the interference of hemodialysis time. Thus, our results contradict the statement that sedentary behavior is higher on the intradialytic day, since after repair the behavior by the hemodialysis time we verified a similar behavior among inter and intradialytic days.

In a previous study[38], we demonstrated that a session hemodialysis increases the walking distance and improves cardiac efficiency at the 6-minute walk test, arising the conjecture that clearance of uremic toxins would give patients a sense of well-being and potentially allow them to be more active. In addition, it has also been found that 16 weeks of pre-dialysis circuit-resistance training promotes increased muscle strength and functionality[25], reduces BP during hemodialysis without causing hypotension, mitigates BP increase using metabolic stress, and alters muscle variability[26] of the ESRD patients. For all these reasons, there are cases where the expected volume of physical activity may increase. Yet, the "feeling of accomplishment" from the engaged in pre-dialysis circuit-resistance training practitioners may be interfered in the decreasing of light physical activity, as this behavior often attaches to self-indulgence from the perspective that it has done enough.

5 CONCLUSION

We conclude that 16 weeks of pre-dialysis circuit-resistance training increase strength, but did not change sedentary behavior or habitual physical activity of ESRD patients. So, promising effects of circuit resistance exercise motivate the recommendation and structuring for this type of practice to be effective in dialysis clinics, safeguarding other behavioral strategies to be investigated the possible trigger for sensitization of ESRD patients in relation to decreased sedentary behavior and increased daily physical activity volume.

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5 CONSIDERAÇÕES FINAIS

O objetivo deste estudo foi avaliar o efeito agudo da hemodíalise no desempenho funcional no teste de caminhada de seis minutos, e avaliar o efeito do treinamento resistido em circuito no nível de atividade física, comportamento sedentário de pacientes renais crônicos.

Teve como principais achados que a hemodiálise aguda aumenta a distância de caminhada e melhora a eficiência cardíaca no teste de caminhada de 6 minutos em pacientes com DRC e que a melhora da função física está relacionada principalmente à PRU e KT/V da hemodiálise. Além disso, reconhecemos que há uma possível alteração na função ventricular esquerda como resultado de efeitos combinados de uma diminuição no volume diastólico final e um aumento no estado contrátil da hemodiálise. Encontrou-se também que o treinamento de resistência em circuito na pré-diálise não alteram o comportamento sedentário ou a atividade física habitual dos pacientes com DRC.

Os resultados sugerem que a apesar do que tem se visto na literatura sobre o mal estar do paciente no pós-dialise, ele tem sim uma melhor desempenho no teste de caminhada no período após hemodíalise, sugerindo uma melhor função física, deste modo, este momento seria o mais recomendado para aplicar treinamentos e atividades físicas.

Apesar do treinamento resistido em circuito não ter sido capaz de alterar o nível de atividade física e comportamento sedentário, podemos identificar que a hemodiálise não torna o paciente mais sedentário como seria o esperado, visto que não é opcional a ele ficar de 3 à 5 horas em tratamento 3 vezes na semana. Independente do tratamento, o paciente tem um comportamento sedentário predominante e baixo nível de atividade física habitual. Isto pode ser explicado, pelo fato que durante toda a vida, esse tipo de população foi predominantimente sedentário e a mudança de comportamento fora de um ambiente que propicie isto, se torna mais dificil, visto que isso tem que partir do próprio paciente. Além dos beneficios de se realizar o treinamento dentro do local de tratamento, como a segurança dos pacientes, equipe médica disponível, é que também é um ambiente favoravél a prática do exercício ao paciente, visto que ele é obrigado a ir ao local regularmente, e deste modo, realiza o treinamento enquanto espera sua vez para hemodialise.

Contudo, conclui-se que a uma sessão de hemodialise melhora o desempenho no teste de caminhada de 6 minutos, e que o treinamento resistido em circuito não modifica nível de atividade física e comportamento sedentário, entretanto, é importante para sobrevida dos pacientes essa intervenção nos centros de tratamentos dialíticos.

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ANEXOS

ANEXO A

Parecer do CEP-UEL

Comitê de Ética em Pesquisa Envolvendo Seres Humanos

UNIVERSIDADE ESTADUAL DE LONDRINA - UEL

Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: EFEITO DO TREINAMENTO DE RESISTÊNCIA MUSCULAR NA APTIDÃO NEUROMUSCULAR DE PACIENTES COM DOENÇA RENAL CRÔNICA EM HEMODIÁLISE

Pesquisador: Crivaldo Gomes Cardoso Junior

Área Temática:

Versão: 2

CAAE: 61824916.0.0000.5231

Instituição Proponente: CEFE - Departamento de Educação Física

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.863.432

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

LONDRINA, 13 de Dezembro de 2016

Assinado por:
Alexandrina Aparecida Maciel Cardelli
(Coordenador)

Endereço: LABESC - Sala 14
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APÊNDICES

APENDICE A

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Titulo da pesquisa:

“EFEITO DO TREINAMENTO DE RESISTENCIA MUSCULAR NA APTIDÃO NEUROMUSCULAR DE PACIENTES COM DOENCA RENAL CRONICA EM HEMODIALISE**”**

Prezado (a) Senhor (a):
Gostariamos de convida-lo (a) a participar da pesquisa **“**EFEITO DO TREINAMENTO DE RESISTENCIA MUSCULAR NA APTIDAO NEUROMUSCULAR DE PACIENTES COM DOENCA RENAL CRONICA EM HEMODIALISE**”**, realizada no Instituto do Rim de Londrina, no Histocom e no Centro de Educação Física e Esporte (CEFE) da Universidade Estadual de Londrina**.** O objetivo da pesquisa e “Analisar o efeito do treinamento de resistência muscular sobre parâmetros da aptidão neuromuscular de pacientes com doença renal crônica em hemodiálise”. A sua participação e muito importante e ela se dará da seguinte forma: O (a) senhor (a) poderá ser sorteado (a) para compor um grupo que fara treinamento físico supervisionado, adicionalmente ao tratamento hemodialitico ou compor o grupo que seguira com o tratamento medico convencional, seja este, tratamento na modalidade hemodialitica (para aqueles que já fazem hemodiálise) ou tratamento conservador, isto e, sem hemodiálise (para aqueles que ainda não fazem hemodiálise). Ressaltamos que para aqueles sorteados para compor o grupo controle em hemodiálise, será oportunizado ao termino do estudo a participarem do mesmo programa de treinamento oferecido ao grupo intervenção com exercícios, desde que, o mesmo demonstre ser benéfico ou nao-malefico. Antes de iniciar qualquer participação nestes grupos que farão treinamento físico ou não, o (a) senhor (a) passara por uma bateria de exames onde serão obtidas medidas corporais, avaliada sua forca muscular, determinada a quantidade de fluidos corporais e coletado na clinica de hemodiálise 18 ml amostras de sangue para realização de exames bioquímicos, para avaliar a sua condição de saúde. Todos esses exames serão repetidos, novamente, no final do estudo. Com exceção das avaliações de força muscular, as quais serão realizadas no Centro de Educação Física - CEFE da Universidade Estadual de Londrina - UEL, todas as demais avaliações e intervenções, inclusive as sessões de treinamento físico, serão realizadas no próprio Instituto do Rim de Londrina/Histocom. E importante mencionar que o seu deslocamento ate o CEFE da Universidade Estadual de Londrina será viabilizado por carros particulares dos próprios pesquisadores que transportarão ate quatro voluntários por veiculo, sem nenhum ônus ao (a) senhor (a). Gostaríamos de esclarecer que sua participação e totalmente voluntaria, podendo você: recusar-se a participar, ou mesmo desistir a qualquer momento sem que isto acarrete qualquer ônus ou prejuízo a sua pessoa. Informamos ainda que as informações serão utilizadas somente para os fins desta pesquisa e serão tratadas com o mais absoluto sigilo e confidencialidade, de modo a preservar a sua identidade. **Para tanto, nos nos comprometemos** armazenar todo o material biológico a ser coletado com único fim de eventuais confirmações de resultados. Apos o termino do projeto e

disseminação de seus resultados, o respectivo material armazenado e não utilizado, será descartado dentro das normas de biossegurança do Instituto do Rim de Londrina/Histocom.

Benefícios esperados: O (a) senhor (a) poderá beneficiar-se diretamente desta pesquisa, visto que o programa de treinamento de resistência muscular proposto poderá ajuda-lo (a) na preservação e/ou aprimoramento da sua força e massa muscular, melhorando suas atividades cotidianas. Além disso, o treinamento físico poderá torna-lo mais ativo fisicamente fora do ambiente da hemodiálise. Outros benefícios que podem ser advindos do treinamento são: i) a interrupção do comportamento sedentário; ii) a interação social com os demais participantes; e iii) a publicação cientifica decorrente dos resultados do estudo. Considerando a gravidade da doença renal crônica, **os riscos envolvidos** com a presente proposição cientifica são diversos. Contudo, e importante mencionar que a prudência de se realizar as intervenções dentro de uma clinica de hemodiálise, com todo o suporte de socorro de urgência, no caso de uma necessidade, esta garantida. Em menor escala, e possível que o (a) senhor (a) sinta dores nos segmentos corporais exercitados. Todavia, isto será atenuado com a evolução do programa de exercícios a medida que as adaptações musculares ocorram, respeitando sua individualidade. Em síntese, e importante mencionar que: i) O estudo ser desenvolvido dentro da clinica de hemodiálise e esta dispõe de uma equipe medica permanente, pronta para intervir em qualquer eventualidade; ii) A intensidade dos esforços e o volume de treinamento serão elaborados para sujeitos iniciantes; e iii) Não ha evidencias cientificas que esta modalidade de treinamento seja prejudicial a pacientes com DRC. Diante disto, acredita-se que não haverá riscos adicionais além daqueles inerentes a doença para os voluntários desta pesquisa.

Caso você tenha duvidas ou necessite de maiores esclarecimentos pode nos contatar **(CRIVALDO GOMES CARDOSO JUNIOR,** Rod. Celso Garcia Cid, km 380 - Campus Universitário - Cg Postal 6001 – Londrina/PR CEP 86051-990, TELEFONE (43) 9 9678.4527, (43) 33715840**),** ou procurar o **Comitê de Ética em Pesquisa Envolvendo Seres Humanos da Universidade Estadual de Londrina** (LABESC - Laboratório Escola "Comitê de Ética em Pesquisa Envolvendo Seres Humanos - CEP/UEL - Rodovia Celso Garcia Cid, Km 380 (PR 445) Campus Universitário – ao lado do Banco Itaú – Londrina/PR - CEP: 86057-970) TELEFONE (43) 3371-5455.

Este termo devera ser preenchido em duas vias de igual teor, sendo uma delas, devidamente preenchida, assinada e entregue a você.

Londrina, ____ de _______________de 20___.
Pesquisador Responsável:
Crivaldo Gomes Cardoso Junior
RG: 23.241.199-2

____
(**nome por extenso do sujeito de pesquisa**), tendo sido devidamente esclarecido sobre os procedimentos desta pesquisa, concordo em participar **voluntariamente** da mesma.
Assinatura (ou impressão dactiloscópica):
____
Data:_____/______/________
Obs.: Caso o participante da pesquisa seja menor de idade, deve ser incluído o campo para assinatura do menor e do responsável.