Acute affective and perceptual responses to resistance training with imposed and self-selected load in chronic kidney disease patients

Respostas afetivas e perceptuais agudas ao treino resistido com carga imposta e autoselecionada em pacientes renais

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Abstract

Introduction: Resistance training (RT) has shown several benefits for chronic kidney disease (CKD) patients. The affective and perceptual responses to training may influence the initial adherence to the program. **Objective:** To compare the acute affective and perceptual responses to RT protocols with imposed or self-selected loads in patients undergoing conservative treatment for CKD. **Methods:** Fourteen elderly (66.7 ± 3.0 years old) with CKD stage 3 or 4 completed two different protocols in a randomized crossover approach: with load at 70% of one maximum repetition (70% 1RM) and self-selected load. The affective valence and rating of perceived exertion (RPE) scales were used between each exercise (total of 10 exercises), and session RPE (sRPE) was measured 30 minutes after the training session. **Results:** The results demonstrated that when patients self-selected loads, the relative load was lower (~50% 1RM) compared to the protocol with imposed loads. More positive affective responses were found in the session with a self-selected load, as well as lower values of RPE and sRPE. **Conclusion:** The results of the present work suggest that self-selected loads may be an interesting strategy to improve the affective response to RT, and that this is probably mediated by a lower RPE in elderly CDK patients undergoing conservative treatment.

Keywords: Chronic kidney disease. Resistance training. Elderly. Affect.

Resumo

Introdução: *O treinamento resistido tem mostrado diversos benefícios aos pacientes com doença renal crônica (DRC). Fatores como respostas afetivas e perceptuais da própria sessão de treino podem afetar a aderência inicial aos programas.* ***Objetivo:*** *Comparar as respostas afetivas e perceptuais agudas a dois diferentes protocolos de treino resistido em pacientes renais em tratamento conservador com cargas impostas ou autoselecionadas.* ***Métodos:*** *Quatorze idosas com idade de 66,7 ± 3,0 anos, diagnosticadas com DRC no estágio 3 e 4, foram submetidas a dois diferentes protocolos em uma abordagem aleatorizada cruzada: com carga imposta, utilizando 70% de uma repetição máxima (70% 1RM), e autoselecionada. Foram utilizadas as escalas de Valência Afetiva e a Percepção Subjetiva de Esforço (PSE) entre cada exercício (total de 10 exercícios), e a escala de percepção subjetiva de esforço da sessão (PSE-S) após 30 minutos da sessão aplicada.* ***Resultados:*** *Os resultados demostraram que quando as pacientes autoselecionavam as cargas, a carga relativa era inferior (~50% 1RM) comparada ao protocolo com cargas impostas. As melhores respostas afetivas positivas foram encontradas nas sessões com carga autoselecionada, bem como menores valores referentes à PSE e PSE-S.* ***Conclusão:*** *Os resultados do presente trabalho sugerem que a autoseleção de cargas pode ser uma estratégia interessante para melhorar a resposta afetiva ao treino resistido e que esta provavelmente é mediada pela menor percepção do esforço em pacientes renais idosas em tratamento conservador.*

Palavras-chave: *Doença renal crônica. Treinamento de força. Idoso. Afeto.*

Introduction

Chronic kidney disease (CKD) consists of progressive and irreversible loss of kidney function (glomerular, tubular, and endocrine). The main causes of CDK are highly prevalent diseases, such as hypertension and diabetes mellitus.[1]

The disease is considered to be long-term, irreversible and asymptomatic for most of its course, contributing to delayed diagnosis and reduced opportunities for improving its prognosis.[2] In the most advanced stage, known as end-stage CKD, the kidneys are unable to maintain control of the patient's internal environment, and the patient becomes dependent of renal replacement therapy, whether dialysis (hemodialysis or peritoneal dialysis) or kidney transplantation.[2]

Kidney disease is a global problem, affecting 10% of the population, approximately 843.6 million individuals.[3] Estimates indicate a prevalence of 3-6 million Brazilians with CKD,[4] with the elderly being the most affected.[5] This constitutes a serious public health problem and leads to one of the highest costs for the healthcare system resulting from treatment and its complications.[2,5,6]

The therapeutic approach for CKD patients in stages 1-4, called conservative treatment, includes drug therapy and nutritional measures such as protein, sodium, and fluid restriction, and aims to slow the progression of CKD by delaying renal replacement therapy.[1,2]

In addition to the aforementioned measures, one of the non-pharmacological therapeutic modalities that has been receiving considerable attention in CKD is resistance training (RT). A systematic review and meta-analysis[7,8] demonstrated favorable outcomes when nephropathy patients undergoing conservative treatment or hemodialysis underwent a RT program with improvements in health-related quality of life, functional capacity, and lower limb strength. Indeed, RT has received attention from the scientific community for its unique impact on preserving muscle mass and function, which are known to affect activities of daily living[9] and patient survival.[10]

In contrast to the accumulating evidence regarding the benefits of RT in CKD, most patients have low levels of physical activity and low adherence to exercise programs,[11] suggesting that few patients with CKD benefit from this therapeutic approach.

For kidney patients to truly benefit from the ef-fects of RT, adherence to the programs is essential. It is believed that high intensities prescribed at the be-ginning of a physical exercise program are perceived as an intense effort, producing unpleasant or negative affective responses, and contributing to program abandonment.[12] An interesting strategy to provide a lower perception of exertion and, consequently, a better pleasurable affective response is self-selection of intensity,[13,14] since this results in exercises performed at lower intensities than those observed with a prescribed load.[14]

Given the benefits of RT for CKD patients and considering perceived exertion and affectivity as important factors for initial adherence to exercise, this study seeks to elucidate the affective and perceptual responses to RT in elderly patients with CKD undergoing conservative treatment. The hypothesis is that when individuals self-select their RT load, these are lower and, consequently, result in a lower perception of effort and a better affective response, in contrast to the use of a session with imposed loads.

Methods

This was a convenience sampling study approved by the ethics committee of the Catholic University of Brasília (UCB) under the protocol number 50590615.7.0000.0029 and Plataforma Brasil, protocol number 1.410.070. The required number of participants was calculated as n = 12, considering a power of 80%, a decline of 0.2 for rating of perceived exertion (RPE), an approximate standard deviation of 1.5 for the first experimental session, and a significance level of 0.05. Therefore, elderly women aged ≥ 60 years, diagnosed with stage 3 or 4 CKD, and undergoing treatment at the Taguatinga Regional Hospital, a public institution located in Brasília, Brazil, were invited to participate in the study. Elderly women who did not participate in physical exercise programs or had health problems, and who were free from osteoarticular injuries or clinical conditions that prevented them from participating in the RT program (uncontrolled blood pressure, musculoskeletal problems, or cognitive impairment). Patients began participation only after being cleared by the local cardiologist, after performing a treadmill stress test with electrocardiography, and after signing the informed consent form.

Procedures

The research participants underwent five weeks of assessment and testing procedures. Initially, they underwent a medical history analysis and anamnesis questionnaires for physical exercise performance, in order to select participants for the experimental protocols. In a second meeting, they were familiarized with the OMNI scale (RPE-OMNI), session rating of perceived exertion (sRPE), affective valence (Feeling Scale) scales, and with the weight training equipments.[14,15] One-repetition maximum (1RM) tests were conducted with a retest in the third session, and experimental sessions in the fourth and fifth weeks, according to a randomized crossover design (Figure 1).

Using the Research Randomizer tool, the groups were randomly assigned, and seven patients were initially allocated to sessions with prescribed loads and seven to self-selected loads, with the groups being reversed after one week. The sessions were held at the Laboratory of Studies in Physics and Health at UCB.

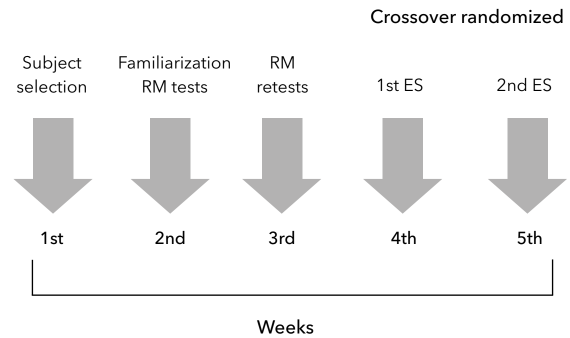

Figure 1 - Illustrative experimental design.

Note: RM = Repetition maximum test; ES = experimental session.

One-repetition maximum test

Following familiarization procedures for the strength exercises, which were performed in a single session, RM tests were performed in the same day. For this session, after a general warm-up (10 minutes on a treadmill at a light intensity), individuals performed five repetitions with 50% of their estimated 1RM; after a one-minute rest, three repetitions were performed with 70% of their estimated 1RM. After three minutes, subsequent attempts were performed for one repetition with progressively heavier loads until the 1RM was determined in three attempts, with 3–5 minutes of rest between attempts. The load was chosen from the last two attempts and used as the initial measurement. A test-retest correlation (≥ 0.8) was established between the second and third days of 1RM testing.

Experimental sessions

The experimental sessions consisted of alternating upper and lower limb exercises (peck deck, leg extension, front pull, seated leg curl, grip row, lateral raise, hip adductor, elbow curl, horizontal leg press, and triceps pulley). Most exercises were performed on machines because they offer convenient adjustment of resistance (load) and positioning. Each exercise session was developed according to the American College of Sports Medicine (ACSM) guidelines.[16] This guideline recommends elderly women to perform single-joint and multijoint exercises, based on three sets of 8 to 10 repetitions each, with a load of 70% of 1RM, moderate execution speed, and a 2-minute recovery interval between sets, aiming to improve strength and muscle hypertrophy. For the self-selected load session, participants were instructed to choose a load with which they could perform three sets of 10 repetitions, using the prompt proposed by Ratamess et al.[17]: "How much weight would you select for this exercise to perform one set of 10 repetitions?"

The speed of muscle movements was controlled by the evaluator through verbal communication, with a cadence in the concentric and eccentric phases of 2:2 seconds according to the procedures of Kraemer and Ratamess.[18]

Pleasure/displeasure scale

Pleasure/displeasure responses were assessed using affective valence, presented in an 11-point bipolar measure ranging from +5 to -5, with the following verbal descriptors: +5 = very good, 3 = good, 0 = neutral, -1 = reasonably bad, -3 = bad, and -5 = very bad.[15]

Subjective perception of effort

To measure subjective perception of effort, the OMNI scale was used.[19] This Likert-type scale consists of 10 points, with anchors ranging from 0 ("extremely easy") to 10 ("extremely difficult"), and is used in any type of training. To interpret the scale and to obtain this measurement correctly, participants were instructed to cognitively establish a perceived effort intensity that was consistent with the visualization of the descriptor 0 ("extremely easy") at the beginning of the scale and 10 ("extremely difficult") at the end of the scale.

To better understand the scale, participants were instructed to use the memory of the last and greatest effort they experienced while performing the activity to establish a visual-cognitive link. To measure the sRPE, participants rested on the training facility for 30 minutes after completing the training session.

The scale was then presented to them and they were instructed to answer the following question: “How much effort did you feel throughout this training session?”

In this procedure adopted for memory anchoring, the subject recalls their routine, in accordance with the protocol used in a pre-viously conducted study.[20]

Statistical analysis

The data were subjected to the Shapiro-Wilk normality test and then to one-way analysis of variance (ANOVA) to compare dependent variables obtained between different intensities. Tukey's post-hoc test was used as a multiple comparison procedure to locate the differences found (p ≤ 0.05). The effect size estimate was calculated by Cohen's d, with the following formula: post-exercise mean in the self-selected load condition – post-exercise mean imposed load/standard deviation imposed load. The effect sizes (d) were interpreted as trivial (< 0.50), small (0.50-1.25), moderate (1.25-1.90), and large (>2.00).[21]

Results

Fourteen elderly women participated in the study, aged 66.7 ± 3.0 years, the majority of them had low income (1.4 ± 0.7 minimum wage) and low level of education (Table 1). With a self-reported diagnosis time of 2.7 ± 1.8 years, most participants had hypertension and diabetes as the underlying disease for CKD, justifying the fact that the majority used antihypertensive and hypoglycemic agents (Table 2).

Table 1 - Patients' education and income (n = 14)

Education	n (%)
Complete elementary education	3 (21.4)
Incomplete elementary education	2 (14.3)
Complete high school	3 (21.4)
Incomplete high school	1 (7.1)
Complete higher education	3 (21.4)
Incomplete higher education	2 (14.3)
Income (minimum wage)*	
< 1	3 (23.1)
1 - 2	7 (53.8)
< 3	3 (23.1)
≥ 3	-

Note: Fourteen elderly woman took part in the study, however one chose not to report her income (n = 13).

Table 2 - Comorbidities and pharmacological treatment of patients (n = 14)

Comorbidades	n (%)
Diabetes	10 (71.4)
Hypertension	9 (64.3)
Obesity (body mass index ≥ 27m²/kg)	11 (78.6)
Osteoporosis	4 (28.6)
High cholesterol	6 (42.9)
Eye diseases	5 (35.7)
Depression	7 (50.0)
Lower back pain	7 (50.0)
Hypothyroidism	4 (28.6)
Gastritis	5 (35.7)
Pharmacological treatment	
Angiotensin-converting enzyme inhibitors	6 (42.9)
Angiotensin 1 blocker	8 (57.1)
Beta blocker	7 (50.0)
Diuretics	9 (64.3)
Statins	6 (42.9)
Oral hypoglycemic agents	8 (57.1)
Serotonin reuptake inhibitors	7 (50.0)

As shown in Table 3, positive affectivity was higher in all exercises, except for the machine fly. The same was true for RPE, resulting in a lower sRPE for the self-selected load session. Furthermore, most effect sizes were moderate and large for the effective respon-se and RPE. Figure 2 shows that participants used a lower load when selecting their own loads compared to the im-posed load of 70% of 1RM, with the exception of the elbow flexion exercise.

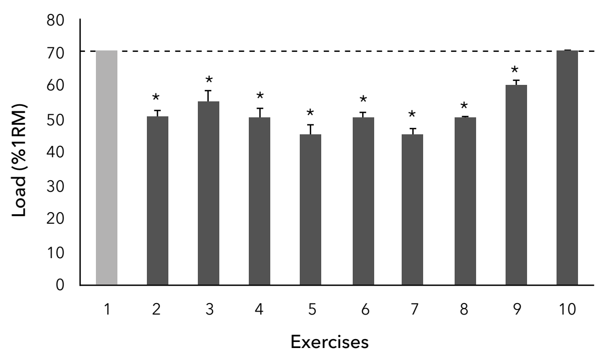

Figure 2 - Loads used in sessions with imposed and self-selected loads.

Note: 1 = imposed load; 2 = peck deck; 3 = horizontal leg press; 4 = front pull; 5 = seated leg curl; 6 = neutral rowing; 7 = leg extension; 8 = lateral raise; 9 = hip adduction; 10 = elbow flexion. 1RM = one-repetition maximum.

Table 3 - Affectivity and rating of perceived exertion used in sessions with imposed load (IL) (70%1RM) and self-selected load (SSL)

Exercises	Affectivity				Rating of perceived exertion			
	IL	SSL	p-value	Cohen´s d	IL	SSL	p-value	Cohen´s d
Peck deck	2.1 ± 1.5	2.3 ± 2.7	0.1997	0.90	4.3 ± 1.2	3.2 ± 1.5	0.9693	-0.38
Horizontal leg press	0.3 ± 1.7	2.2 ± 1.8	0.0500*	2.02	5.7 ± 2.5	4.1 ± 2.5	0.0496*	1.82
Front pull	1.1 ± 1.1	3.2 ± 1.0	0.0136*	2.20	5.6 ± 1.7	4.2 ± 1.3	0.0504	0.91
Seated leg curl	1.6 ± 1.8	1.8 ± 2.5	0.0549	0.91	6.0 ± 1.8	4.9 ± 1.6	0.0152*	1.14
Neutral rowing	0.6 ± 1.3	2.0 ± 2.2	0.0265*	1.54	6.1 ± 1.8	4.3 ± 1.9	0.0080*	0.91
Leg extension	0.0 ± 2.0	1.1 ± 3.3	<0.0001*	1.10	6.0 ± 2.2	5.3 ± 1.8	0.0415*	2.57
Lateral raise	0.0 ± 2.0	1.8 ± 2.2	0.0016*	1.80	5.9 ± 2.0	4.6 ± 1.8	0.0500*	1.65
Hip adduction	0.1 ± 0.9	2.0 ± 2.1	0.3911	1.89	5.8 ± 2.2	3.8 ± 1.6	0.0427*	1.16
Elbow flexion	0.1 ± 2.4	2.3 ± 1.7	0.0500*	2.26	6.8 ± 1.6	4.5 ± 2.4	0.0491*	0.25
Triceps pulley	0.9 ± 1.1	2.1 ± 1.5	0.6448	1.28	6.2 ± 1.4	4.7 ± 2.1	0.0999	0.27
Mean	0.7 ± 0.5	2.1 ± 0.6	0.1413	-	5.8 ± 0.3	4.4 ± 0.4	0.0315*	-
sRPE	-	-	-	-	5.5 ± 1.1	4.1 ± 0.5	0.0020	-0.95

Note: 1RM = one-repetition maximum; sRPE = session rating of perceived exertion. *ANOVA with Tukey post-hoc (p ≤ 0.05).

Discussion

This study aimed to compare the acute affective and perceptual responses to two different RT protocols in CKD patients undergoing conservative treatment, using prescribed (imposed) and self-selected loads. The results showed that when the patients selected the loads, they exercised with lower loads (~50% 1RM) and lower than the protocol with imposed loads (70% 1RM), resulting in a better affective response to the exercises and a lower RPE during the session and at the end (sRPE). Studies have demonstrated positive outcomes when kidney patients undergo training protocols, such as reduced symptoms of uremia and systemic inflammation, optimized biochemical, structural, and functional adaptations in skeletal muscle, and improved tolerance to physical exertion and quality of life.[7,8] Conversely, these patients have low initial adherence to exercise programs, so many do not reap the benefits of training.[11]

This low adherence may be related to the intensity initially prescribed for this modality, which, due to the greater perceived exertion, would produce an unpleasant sensation.[12,13] In this sense, Ekkekakis et al.[12] propose the "hedonic" model to present an inverse relationship between exercise intensity and adherence mediated by affective responses. According to these authors, this model applies to the population as a whole, and a series of psychological, metabolic, and physiological factors present in some individuals could broaden the scope and intensify the severity of the somatic symptoms that cause initial aversion to exercise. In fact, CKD patients present mood and metabolic changes, and early fatigue during efforts considered "minimal" for most healthy individuals[9] and, from this perspective, they could be included in the proposed model.

It is possible that the effects of load selection may be due to a lower %1RM used in the session, due to greater discomfort in patients with more severe conditions. In this regard, one study[22] demonstrated that after[24] weeks of intervention, the use of the cluster-set method resulted in greater adherence compared to traditional RT, likely because it is a method that notably generates less discomfort and metabolic stress in the participants,[23] suggesting that RPE and discomfort during and after exercise may be factors that impact adherence.

Day et al.[25] conducted a study with nine men and six women, in which exercises were performed at different intensities: high (one set of 4-5 repetitions at 90% of 1RM), moderate (one set of 10 repetitions at 70% of 1RM), and light (one set of 15 repetitions at 50% of 1RM). The authors observed that the RPE of the session was greater for high-intensity exercises than for moderate and light intensities, in agreement with our findings. In the present study, SRPE displayed higher values for the intensity of 70% of 1RM as compared with self-selected loads. Similarly, it was found that the patients did not have an increased positive affective response with imposed loads. In summary, our results reinforce those previously found[14,17,26] and suggest the possibility of using resistance exercises with self-selected loads, and even lower intensities relative to those recommended by the ACSM[16] as more appropriate, if the initial goal is to achieve better affective responses and, possibly, initial adherence to training programs.

The present study had limitations, such as the convenience sample and the inclusion of only elderly women, consequently limiting the extrapolation of the results to populations with other characteristics. Given the importance of intrinsic session factors in adherence to training programs, future studies could investigate the relationship between adherence and affective and perceptual responses throughout an exercise program for renal replacement therapy patients with male participants, since the beneficial effects of exercise can culminate in improved quality of life[7,8] and perhaps contribute to slowing the progression of CKD. Furthermore, the participants' physical activity level could provide relevant information in future studies.

Conclusion

The results suggest that self-selection of loads may be an interesting strategy for improving the affective response to RT, and this is likely mediated by the reduced perception of exertion in elderly CDK patients undergoing conservative treatment. Therefore, we suggest further studies to compare different intensities to better understand the responses to load adjustments in patients with CKD, as well as in kidney patients in more advanced stages of CKD, since discomfort during exercise may be greater.

Authors' contributions

WMAMM was responsible for the main idea; LCSS

and WMAMM, for data collection; WMAMM and BMC, for manuscript preparation; and JP, for final review of the text. All authors analyzed the data and approved the final version of the manuscript.

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